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From Archives to Participatory Recordkeeping:
Transforming recordkeeping design for interoperability

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Abstract

This research project investigates the transformative design of recordkeeping[1] systems to support participatory approaches to records and archives.

While archives are now recognised as an interlinked network of record-holders, records, and individual and community stakeholders (PACG, 2011), recordkeeping infrastructure remains institution-oriented and preoccupied with the custody of collections of records. Record-holding organisations still deploy stand-alone information systems that lack the nuanced interoperability expected in the contemporary on-line environment. Such a paradigm privileges institutional perspectives and needs over those of other community stakeholders (J. Evans, McKemmish, Daniels, & McCarthy, 2015). An emergent paradigm of *participatory recordkeeping* has begun to articulate responses to these issues, however there is little consensus on how this should be achieved (Huvila, 2015).

The main shortcoming of contemporary recordkeeping service delivery is its focus on the administration of records within isolated collections, rather than on enabling participants to exercise agency in their recordkeeping at arbitrary levels of granularity, across multiple-systems. Additionally, participants in records are required to understand the intricacies of institutional recordkeeping practice and documentation — rather than archives being designed to meet participant needs by reflecting stakeholder contexts (Bearman, 1992). While these issues are appreciated at a theoretical level, little research has been performed to understand how to design and build recordkeeping systems that address them in concrete terms.

The goal of this research project is to explore the design of infrastructure for participatory recordkeeping; aiming for the capability to interconnect recordkeeping systems and enable appropriate access to records by all participants. It demonstrates that a networked and interoperable approach to participatory recordkeeping system design is both feasible and appropriate; and can support a plurality of stakeholder rights in records across multiple-systems. This research takes a design-science approach that involves the development and evaluation of: (i) a statement of system requirements for participatory recordkeeping; (ii) theoretical models; and (iii) a proof-of-concept network-based recordkeeping system.

The statement of requirements was elicited from high-level interviews with European domain

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[1] The (single word) term *recordkeeping* is used here as all-encompassing description of activities germane to the conceiving, creating, managing, and deriving utility from records in a continuum of use (Upward, Reed, Oliver, & Evans, 2013). In contrast, the term *archive* is used here to refer to any jurisdictionally bounded recordkeeping system that deals with records or record metadata — whether historical or current.

experts together with detailed requirements from literature warrant. From these requirements, a functional model — published as 'Agency in the Archive: a model for participatory record-keeping' in *Archival Science* in July 2016 — and a conceptual model — published as 'Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata' in the *Records Management Journal* in June 2017 — were developed[2]. Finally, a distributed and interoperable implementation of the conceptual model was created as a proof-of-concept instantiation. The models and the proof-of-concept system were evaluated, both in the lab and via domain expert focus groups and individual interviews in the U.S. and Australia.

This research demonstrates that the meta-requirements for participatory recordkeeping can be articulated and that the consolidation of these requirements into a coherent framework leads to a functional model that explicates the "...different degrees of participation in archival contexts." (Huvila, 2011, p. 1). These, in turn, support a new recordkeeping conceptual model that directly facilitates and embraces multiple perspectives on records. Finally the proof-of-concept instantiation demonstrates that disparate recordkeeping systems — even those that embody incommensurable ontologies — can interoperate in order to support a plurality of participant perspectives. These findings, in turn, inform the theoretical understandings and practical considerations of records and recordkeeping.

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[2]These articles, together with additional commentary, form two chapters in the thesis.

Publications During Enrolment

Battley, B., Daniels, E., & Rolan, G. (2014). Archives as multifaceted narratives: linking the "touchstones" of community memory. *Archives and Manuscripts*, 42(2), 155-157. doi: 10.1080/01576895.2014.911675

Evans, J., McKemmish, S., & Rolan, G. (2017). Critical Approaches to Archiving and Record-keeping in the Continuum. *Journal of Critical Library and Information Studies*, 1(2).

Rolan, G. (2015a). Archival Systems Interoperability. Research Themes and Opportunities. In R. J. Cox, A. Langmead, & E. Mattern (Eds.), *Archival Research and Education. Selected Papers from the 2014 AERI Conference* (pp. 85-108). Litwin Books.

Rolan, G. (2015b). Towards Archive 2.0: issues in archival systems interoperability. *Archives and Manuscripts*, 43(1), 42-60. doi: 10.1080/01576895.2014.959535

Rolan, G. (2016). Agency in the archive: a model for participatory recordkeeping. *Archival Science*, 1-31. doi: 10.1007/s10502-016-9267-7

Rolan, G. (2017). Towards interoperable recordkeeping systems: a meta-model for recordkeeping metadata. *Records Management Journal*, 27(2). doi 10.1108/RMJ-09-2016-0027

Declaration

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.
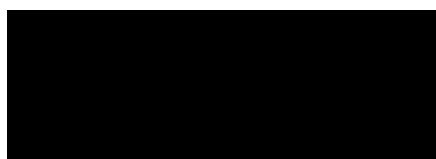
This thesis includes two original papers published in peer reviewed journals and one chapter based on a published conference paper. The core theme of the thesis is recordkeeping systems design. The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself, the student, working within the Faculty of Information Technology under the supervision of Dr Joanne Evans, Professor Sue McKemmish, and Associate Professor Gavan McCarthy.

In the case of chapters three, four, and five, my contribution to the work involved the following:

Thesis Chapter	Publication Title	Status	% Contrib.
2	Archival Systems Interoperability. Research Themes and Opportunities. (*Archival Research and Education. Selected Papers from the 2014 AERI Conference*)	Published	100%
4	Agency in the Archive: a model for participatory recordkeeping (*Archival Science*)	Published	100%
5	Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata (*Records Management Journal*)	Published	100%

I have renumbered sections of submitted or published papers in order to generate a consistent presentation within the thesis.

Student signature: ▮▮▮▮▮▮▮▮▮▮   Date: 11/8/2017

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student's contributions to this work.

Main Supervisor signature: ▮▮▮▮▮▮▮▮▮▮   Date: 11/8/2017

Acknowledgements

And I could not find any better or clearer way towards the goal than my own crooked one.

Erwin Schrödinger; *What is Life?*

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Preface

Story is our only boat for sailing on the river of time, but in the great rapids and the winding shallows, no boat is safe.
Ursula K. Le Guin; *Another story or A fisherman of the inland sea*

This thesis is about a journey of transformation. Yes, I realise that doctoral candidates in their thousands have probably used the term 'journey' somewhere in their opening remarks. It is such a fearful cliche. However, rather than, perhaps disingenuously, hitting up the thesaurus for alternatives, I think I will stick with the term for a moment. You see I really identify as a journeyman academic. Not only for having spent the best part of four years as an apprentice researcher, but also literally, having travelled internationally, plying my trade (in this case both gathering information and espousing my ideas to whomever would listen).

And a figurative journey as well. Travel so well describes the process of research: setting off with a fuzzy destination in mind; experiencing setbacks and breakthroughs, cul-de-sacs and detours, frustrations and satisfactions. Like all good journeys, I started off with a rough plan and a vision of what the destination may hold, but didn't know where exactly I was going to end up. It is this serendipity of discovery that often pleasantly surprises and encourages the next step, and the ones following.

Layers within layers. The transformational journey is also a metaphor for my learning and personal development. I returned to study after thirty or so years as an IT professional, looking for a sea-change and new challenges that didn't involve 3:00am telephone calls about broken software that I hadn't written. Sitting in the lectures and workshops after so long, I quickly realised that I had spent the bulk of my career rather more concerned about the 'how' of building systems than the 'why'. At the same time, I found myself increasingly intrigued by the

informatics of records and archives. And thus this research journey was born. Along the way I shrugged off my technocratic coat and travelled the roads of interpretive research; of critical analysis; and of transformative change.

This thesis, then, is a record, a retrospective memoir, and the most complete account of my journey as it unfolded over the years. Although I did publish along the way, such publications are vignettes that afford little space for reflection and sense-making. The thesis-writing process, on the other hand, provides an opportunity for such reflection, sense-making, and contextualisation. In fact, the importance of the roads I travelled, the places I visited, and the destination I reached only became clear when I was able to step back and carve out the mental space needed to put the words down. The thesis is as much a means as it is an output.

I have tried to give a sense of these layers of meaning while presenting my research as a coherent whole. And I hope that what follows is as lucid and meaningful as my memory of this journey is to me.

Part I

Framing the Research

Chapter 1: Introduction

There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.

Machiavelli

Our recordkeeping systems are failing us.

In Australia, former ward of the state, Vlad Selakovic, speaks of his records: "It is not my file. [. . .] I hated it, I despise it, I loathe it – and I still want nothing to do with it. And I mean I want nothing to do with it, because it's not my story. It's someone else's interpretation of: where I was, and what was going on." (Selakovic, 2010, p. 3)

Another former ward, Frank Golding, was "staggered to find Departmental officials reluctant to give back all that was surely [his], the story of [his] life in their care. Having preserved the files of events going back fifty years, why continue to decide what [they] could and could not read? (Golding, 2005, p. 20)

In Canada, "the federal government kept secret thousands of documents that could have supported [one man's] claim that he was sexually abused by a priest when he was forced to attend St. Anne's as a child". (McMahon, 2016, p. 76)

In Britain, a 'Data Protection Officer', writing about case files, admitted that they were "usually ashamed about the lack of information and other items and nuggets" and "appalled by some of what has been written" as "a lot of data was not recorded with the intention that it would be viewed by the data subject." (Horrocks & Goddard, 2006, p. 268)

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In Australia, there is a crisis of distrust in the archive by Aboriginal communities: "...it was you bastards who done this to us. And now you're the protector and guardian of my information. How do I trust you?" (Russell, 2005)

In the Virgin Islands, the removal of colonial records by foreign powers meant that the community had no way "to construct meaningful interpretations of its history. The community, forced to rely on second-hand accounts, constructed memories forever vulnerable to inaccessible records and outside interpretation. (Bastian, 2002, p. 80)

In the USA, the immigrant experience of the archive was one of invisibility: "I too was part of a first wave; a wave of children born to . . . newly arrived immigrants who were at once entirely American, but who felt a sense of displacement by not seeing themselves reflected in the American story." (Caswell, Cifor, & Ramirez, 2016, p. 68)

In Britain, the role of archives in the marginalisation of the black experience manifests through " 'erasure' or 'censorship', creating an 'absence' of evidence of different groups within the heritage" as well as "through a misrepresentation or perception that the presence was 'ABOUT us rather than FOR us'." (original emphasis) (Hopkins, 2008, pp. 89-90)

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In Cambodia, the "Khmer Rouge records of prisoners are rife with the silences of the marginalized"; the Tuol Seng prison mug shots, for example, are "records of absence" that compel survivors to speak but without the words to do so. (Caswell, 2014a, p. 20, 59, 107)

In the USA, thousands of items collected by the Portland Police Bureau as part of its surveillance of 576 activist groups and individuals between 1965 and 1985, and scheduled for destruction due to the illegality of retaining such material, have nonetheless become part of the public record. (Carbone, 2015, p.28)

In Britain, a recent study of the non-consensual 2015-2016 transfer of patient records to private data-analysis firm DeepMind, found that "there are retrospective and grave concerns about the justifiability of DeepMind's continued holding of data on millions of citizens." (Powles & Hodson, 2017)

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From small to large; from moments of inconvenience to ongoing violence and trauma; from the personal to the societal; examples abound of the various ways in which people, families, organisations, and communities are disenfranchised from their records. Beyond their role as

collections of cultural heritage artefacts or repositories of transactional evidence, our record-keeping and archival systems — and I use the term 'systems' here in its broad, socio-technical sense — are patently not working for many. And while this may not be a planned outcome, it is certainly a manifestation of the way that such systems have developed. This is not due to happenstance. For better or worse, our recordkeeping and archival systems have been *built*, with aims, objectives, functionality, affordances, and constraints that have been purposefully designed. We may ask then, how can we design such systems so that they better serve all of the stakeholders in records?

This is the core theme of my research project. The title that I have given this research — *From Archives to Participatory Recordkeeping: Transforming recordkeeping design for interoperability* — is laden with contested terms, but quite specific in its intent. Unpacking these terms is a good place to start in order to explain my motivation for this work, and the aims and scope of the study.

1.1 Overview

First of all I need to define what I mean by the 'archive' and 'recordkeeping' perspectives. Throughout this thesis I will use the term *recordkeeping* as described by McKemmish (2017, p. 122) to mean the "pluralist concept [. . .] as theorised and practised in the continuum". In this sense, recordkeeping comprises all of the conceiving, creating, managing, and deriving utility from records in a continuum of use (Upward et al., 2013). This is in contrast to my use of the phrase *archive perspective* which I take to mean one that is concerned with "a particular custodial model of the archival process, [. . .] taking place after records have been transferred to a formal archival repository" (Eveleigh, 2015, p. 54). It is worth mentioning that, from an archive perspective, the hyphenated term *record-keeping* (or its two-word form, *record keeping*) refers to a different perspective: the narrow range of activities relating to "current or active records in corporate or other organisational contexts" McKemmish (2017, p. 123, Note. 1) prior to transfer to an archive, and should not be confused with the single-word term.

From these definitions, it can be seen that recordkeeping encompasses the activities of both the record-keeping and archive perspectives. However, it does so from a broader conceptual and pluralistic basis. I discuss this distinction in more detail in the literature analysis presented in Chapter 3.

Interestingly, and especially given the forgoing, the word 'systems' does not appear in the title of this research. This is deliberate[3] as I wished to (perhaps, provocatively) de-emphasis the

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[3]Although belatedly. I must admit, the word 'systems' had been part of the title since the beginning of the

IT aspects of modern-day recordkeeping, and to highlight the structures and agency of the various stakeholders in records. As I indicated above, I use the term *system* to mean a given configuration of human activities and social structures as well as technical artefacts; in other words a broader socio-technical (or, more precisely as explained in Chapter 3, sociomaterial) understanding. Recordkeeping systems then, encompass IT artefacts, societal structures, and human agency. Recordkeeping design necessarily involves all of these aspects in an attempt to explore 'what [it] ought to be' (Simon, 1996, p. 4).

1.1.1 Participatory Recordkeeping

In the myriad studies of recordkeeping systems, many have suggested ways of addressing or mitigating the issues that they have investigated. Some, recognising the barriers of institutional archives and the need for personal relevance and agency in recordkeeping (for example, in the postcolonial and diasporic cases above) advocate for, or at least, identify, the separate collections of material under community control as community archives (Caswell et al., 2016; T. Cook, 2013; Flinn, Stevens, & Shepherd, 2009; Ketelaar, 2005b). Some have explored the enhancement of recordkeeping systems with affordances that allow the extension of some archival 'work' to the community at large; for example, to give marginalised or silenced stakeholders, such as those described in the cases above, a voice in their record. Often termed 'Archive 2.0', such affordances facilitate the contribution of additional material such as records, description, discussions, comments, and/or tags that complement existing holdings (Eveleigh, 2015; Krause & Yakel, 2007; Trust and Technology Project, 2008). Some have called for a re-examination of the mission of recordkeepers or, at least, archivists, in terms of upholding human rights (Gilliland & McKemmish, 2014; Iacovino, 2015) or an ethic of care (Caswell, 2016). And some have called for a "radical user reorientation" (Huvila, 2008, p. 3) of recordkeeping itself (J. Evans et al., 2015) (for example, in relation to personal health or case files as described above).

Others have approached the problem from a theoretical perspective, questioning the uses of records themselves (T. Cook, 2013; McKemmish, 1996), the recordkeeping/archive dichotomy of perspectives (McKemmish, 1997; Upward, 2000), the necessity of custody for establishing the provenance of records (Cunningham, 2011; Ham, 1981), and, indeed, the nature of provenance itself (Hurley, 2005a). Given the diversity and entanglement of conceptual and practice perspectives, identified issues, and proposed solutions, it is not surprising that there has been no consensus on how recordkeeping could or should be designed to address multiple stakeholder

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project. Even though I had been working with a broad definition of 'system' for some time, it was only quite near the end of the project that I decided to drop it. My IT background runs deep indeed.

needs. In fact, these problems may be considered as being *wicked*[4] (Rittel & Webber, 1973) in the sense that, not only do they defy simple definition, but the entanglement of interacting structures, systems, and components means that candidate solutions cannot be comprehensibly identified, let alone tested in isolation. It is this indeterminacy of the recordkeeping problems that has led to a plurality of approaches for their analysis, as is usually the case with wicked problems (Buchanan, 1992). I discuss the origin and nature of wicked problems in more detail in Chapter 2.

Nonetheless, there have been two outcomes of this body of work that have shed particular light on this problem. One has been the identification of new postmodern (T. Cook, 1997; Upward, 2005b) and critical (J. Evans, McKemmish, & Rolan, 2017) accounts of contemporary records and recordkeeping, and the sorts of issues that they engender. These broader perspectives expose stakeholder issues as manifestations of the structures of recordkeeping and recordkeeping systems. In other words, various forms of stakeholder disenfranchisement are deeply embedded in our recordkeeping systems. And while many of the studies described in the introduction to this chapter identify and address surface manifestations of these deep issues, unless we attempt structural change, such issues will remain unresolved.

The second is the emergence of the term *participatory* in the context of recordkeeping; a term borrowed from community development discourses (Cornwall, 2008). It is used to describe stakeholder involvement in various aspects of recordkeeping — from the recording of comments on institutional archive portals, to the aforementioned "radical user reorientation" of recordkeeping involving, perhaps, the repatriation of records from institutional into individual or community control. While, again, there has been no consensus on the meaning of the term 'participatory' in recordkeeping (Huvila, 2015) — let alone "a model of different degrees of participation in archival contexts" (Huvila, 2011), there is a sense that, perhaps, it is a path to understanding the needs of stakeholders in recordkeeping.

And what of the *design* of our recordkeeping systems? Despite advances in postmodern, post-custodial, and continuum thinking described above, our recordkeeping systems have not changed much since the days of imperial or colonial administration. Of course there have been developments in technology or administrative processing, but the conceptual understandings and implementation of what records are created, who derives utility from them, how they should be managed, and so on, have not advanced. Technical considerations aside, Muller, Feith, and

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[4]This use of the term 'wicked', pre-dates it's British colloquial use to mean 'cool' 'effective' or 'excellent' (like the Australian Aboriginal use of the word 'deadly' to mean 'fantastic', 'great' or 'awesome'). In any case I take 'wicked' as meaning malevolent and (to attribute agency to wicked problems) almost wilfully intractable.

Fruin (1898) would probably feel at home with our recordkeeping systems — if anything, they would be dismayed that much of the discipline of paper-based registry systems has been abandoned over the last thirty years or so, as a result of the 'innovations' of electronic information management.

1.1.2 Transformative Design and Interoperability

Arguably, design — and, especially, re-design — has not been a priority in our field. Despite changes in societal expectations, and leaps in our theoretical understanding of the role of records in people's lives (T. Cook, 2013; Flinn, 2011; McKemmish, 1996), developments in practice and the tools we employ have been incremental; not revolutionary. And so our recordkeeping systems serve the needs and mores of a different time; their structures contributing to increasing dissonance with many stakeholders in records.

Nonetheless, this understanding of records and recordkeeping that embraces postmodern, post-custodial, continuum, and, in particular, participatory perspectives, has emerged over the last few decades and suggests that a re-think of the design of recordkeeping systems is in order. Such a design should embody such perspectives in order to better align with contemporary expectations and the needs of stakeholders. However, the manifest inhospitality of existing record-keeping systems to other perspectives means that the gap between existing systems and the sorts of recordkeeping structures that are actually needed cannot be healed through incremental improvements in design (J. Evans, 2017, p. 680). What is required is a *transformative* design that challenges the assumptions upon which recordkeeping should be built; and one which seeks to address participant needs as a first-class requirement.

Finally, why *interoperability*, the last word in my title? Why chose such a technical term, and one that is usually associated with IT systems? In fact, there are many qualities of interoperability that range from the purely technical means of interconnection, up to the semantic and social mechanisms of interaction and understanding (Miller, 2000). From a systems-thinking perspective, interoperability is applicable to all aspects of socio-material systems and, especially, the structures that underpin their operation.

Our understanding of the Archival Multiverse — as an entangled network of records, systems, practices, and participants (Gilliland & McKemmish, 2011) — is at odds with our recordkeeping systems, that exist as bounded and isolated collections of records and documentation. Interoperability of recordkeeping systems, if it has been considered at all, exists as the technical exchange of material amongst consortia of organisations (Europeana, 2017; Institute for Advanced Technology in the Humanities, 2016; National Library of Australia, 2015), or as the

exposure of public material for harvesting by others (LODLAM, 2017). In an increasingly net-worked world — and one in which emergent internet standards, systems, and protocols have prioritised security, privacy, heterogeneity, and hospitality — granular and participant-oriented interoperability of our recordkeeping systems is noticeably absent.

This absence can be expressed in terms of *infrastructure* for recordkeeping. Infrastructure may be considered an ecology of standardised interfaces and affordances in sociomaterial systems — noting that one person's affordance may also be another's barrier (Star, 2002). To paraphrase the Sun Microsystems slogan[5], the network *is* the archive. The nature of the Archival Multiverse means that interoperability is a fundamental quality of sociomaterial recordkeeping infrastructure capable of delivering participatory recordkeeping. An interoperable orientation is part of the necessary transformation in recordkeeping design; the incorporation of interoperability at technical, personal, institutional, community, and societal levels.

1.2 Aim and scope

My aim in this research project was to investigate participatory recordkeeping design and to understand whether a networked and interoperable approach is feasible and appropriate to support participant agency in records. My primary research questions are therefore concerned with an understanding of the problem domain, the possibility of transformative recordkeeping system design to address the problem, and the impact of the design on our understanding of recordkeeping.

To put it simply, I am asking: what is this interoperable participatory recordkeeping that am investigating? How can it address issues of disenfranchisement in recordkeeping? Can it be designed; is such a design useful; and what do we learn from such a design? The detail of my research questions evolved over the course of this project as expressed by my secondary research questions. At the beginning of this project, I was focussed on the nature of the design and its efficacy. However, as the project progressed and my understanding of the wickedness of the issues increased, my attention broadened to encompass recordkeeping as a whole and a reflection on the recordkeeping design process itself.

My first research question addresses the understanding of the problem/solution space.

1) **What emergent and theoretical approaches to recordkeeping address issues of disenfranchisement and participation?**

   This question seeks to establish a consistent framing of the problem domain and the the-

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[5]The Sun slogan was 'the network is the computer', a phrase attributed to employee John Gage in the mid 1980's.

oretical basis for pursuing a design solution. In particular, it prompts inquiry into the nature of recordkeeping structures and an understanding of participation, interoperability, and infrastructure as they apply to recordkeeping. At the back of my mind in asking this question, is Huvila's (2011) call for "a model of different degrees of participation in archival contexts". In this question I seek to discern how participatory recordkeeping is perceived from various participant perspectives and, to what extent, these can be reconciled as a common understanding.

The sub-questions necessarily unpack these aspects of the question.

    i. *Can a comprehensive and consistent understanding of participatory recordkeeping be articulated?*

    ii. *What forms of interoperability are necessary to support participatory recordkeeping?*

    iii. *How can an interoperable and participatory recordkeeping infrastructure address issues of disenfranchisement and participation?*

This question is largely addressed by the literary analysis of Chapter 3 and the requirements gathering exercises in Chapter 4.

My second research question concerns the capability of transformational design to address these issues.

2) **Can infrastructural and participatory approaches to recordkeeping be addressed through transformative design?**

This second question asks whether transformative design is possible as a means of tackling the wicked problem of participatory recordkeeping. It also seeks to determine whether such a design is broad and flexible enough to cater for different recordkeeping perspectives, and whether it is effective in addressing participants' needs in recordkeeping. Such a design is necessarily a 'meta' design in the sense that it is not intended for a particular context, but should be a blueprint for the creation of interoperable recordkeeping infrastructure. Note that, in this question, the word 'design' here plays two roles — both as the activity of design, and the resulting output from such an exercise.

This question gives rise to a number of sub-questions concerning the feasibility and efficacy of such a design.

    iv. *To what extent can the detailed requirements and goals for such a system design be articulated?*

    v. *Can conceptual and other models be developed that express the characteristics and affordances of a meta-solution?*

    vi. *Can such a design be implemented?*

    vii. *How well can such an implementation fit the requirements for participatory recordkeeping design?*

This question is addressed in the chapters directly concerned with the design exercise: Chapters 4, 5, 6 & 7.

The third question concerns the learning from the design, and its impact on contemporary recordkeeping.

3) **In what ways does my design impact:**

    viii. *mainstream theories of records, archives, and recordkeeping?*

    ix. *professional practice?*

    x. *transitioning to a participatory paradigm?*

This is an important question given the stagnant nature of recordkeeping system design and the gap between theoretical understanding and the way that recordkeeping plays out in the real world. Exercising the recent body of theoretical work with a tangible instantiation of its implications should prove to be a good test of its constructs. Similarly, if the technical affordances of the system are re-designed, then other aspects of recordkeeping, in terms of practice and agency, may also change. How will this manifest? And, even if the design proves to be feasible and efficacious, there is also the question of transition from legacy to new systems and the barriers to such change.

This question is mainly addressed in Chapter 8 which, in turn, is underpinned by the work in Chapters 4, 5 & 6.

Additionally, in the course of this project, another research question arose. This fourth emergent research question, regarding the methodological approach for tackling wicked problems, is discussed in the following section.

Note that in questioning the structures of recordkeeping, one area that I have not addressed are its juridical frameworks. For example, the basis in (domestic and international) law of a mandate for recordkeeping, role of recordkeeping provenance in evidence, and the embodiment of rights in records are all out of scope for my study. I do recognise that this is a limitation of my research in addressing the structures and systems of recordkeeping, and I return this topic in Chapter 9. Similarly, I am not concerned with the *authenticity* of records (see, for example, Reed

(2005c), p. 105) in terms of the internal integrity of particular inscriptions or performances, however I do touch upon issues of trust in Chapter 8.

1.3 Approach

As I explain in Chapter 2, Information Systems (IS) research is "fundamentally about human activity systems which are usually technologically enabled" (McKay, Marshall, & Knock, 2007). Similarly, because all "questions about design are both technical and social" (Callon, 1990), such design needs to explore the "complex relationship between IS and their social, political and organisational contexts" (Cecez-Kecmanovic, 2001). This *critical* perspective enables such research "to expose the inherent conflicts and contradictions, hidden structures and mechanisms accountable for these influences" that, in the recordkeeping context, manifest as inhospitality to participants. Mindful of the need to explore such structures of recordkeeping in addition to its tangible tools, I adopted such a critical approach for this study, while recognising the value of interpretive approaches in understanding the lived experience of participants in recordkeeping.

This critical perspective dovetails with interventionist approaches such as design science that seek "to create knowledge in the interest of change and improvement" with an "interest not only for what 'is', but also for what 'might be'" (Goldkuhl, 2012). It is for this reason that I elected to employ a design science approach for this study.

Design science involves the design of meta-artefacts in response to a set of meta-requirements — i.e. requirements and solutions that transcend a particular situated problem (Venable, 2006). By designing for an entire class or type of problem (i.e. the participatory recordkeeping meta-problem), greater understanding of the problem and solution domains may be attained. Design science is essentially "learning by building" (Vaishnavi & Kuechler, 2004). Moreover, the complexity of the participatory recordkeeping problem means that an iterative approach to the design is likely to be more successful as the reflection that takes place between iterations is likely to flush out previously obscure issues, stakeholders, and possible solution paths. This is similar reasoning that gave rise to the agile systems development techniques as a response to complex challenges in software development (Beck et al., 2001).

Thus I employed an iterative *systems development* method for the core of my design science research. This method involves the development of one or more software components in order to explore the design while, at the same time, demonstrating its implementability (Burstein, 2002; J. Evans & Rouche, 2006; Nunamaker & Chen, 1990; Nunamaker, Chen, & Purdin, 1991). As I explain in Chapter 2, Nunamaker and Chen (1990) suggests that the process of developing

a prototype always assists in improving the understanding of a problem domain. Similarly, Burstein (2002) argues that the systems development method bridges both the technical and socials aspects of IS research, linking such development to theory-building.

Within the systems development method, I employed a variety of techniques for the gathering and analysis of the data that both informed, and resulted from, my design. These included a broad literary analysis, semi-structured interviews, a focussed literary warrant analysis, an ontological analysis, agile software development, focus groups, personal reflection, and reflexive practice within the design process. These are explained in more detail in Chapter 2.

The literary analysis provided the basis for addressing the first of my research questions concerned with developing and understanding the problem and the avenues to be explored for solution design. The design exercise itself together with the design artefacts — an articulation of requirements for participatory recordkeeping as well as functional and conceptual models — addressed the second of the questions concerned with the feasibility and nature of design. These design artefacts were expressed in a proof-of-concept instantiation which I then subjected to a variety of evaluation activities in order to demonstrate the veracity of the design. The design artefacts and instantiation as well as reflection of the design process itself provided the data that addressed the third research question regarding the impact of this study on contemporary recordkeeping.

It was through my reflective practice of design science that a fourth research question emerged. The nature of transformative design and the constraints of working on one part of a wicked problem at a time were at odds with the way that canonical design science has thus far been articulated. I Therefore found myself addressing an unexpected question:

4) **How should design science be conducted when addressing a slice of a wicked problem?**

I introduce this issue in the evaluation Chapter 7, and consider it further in my discussion Chapter 8.

1.4 Structure of this thesis

This thesis is structured in three parts as shown in Figure 1.1. The remainder of this first part, *Framing the Research*, comprises Chapters 2 and 3. In Chapter 2, I describe in detail my approach for conducting this research, including a discussion of my epistemological stance as well as the design science methodology I employed to develop a new design for recordkeeping systems. I also introduce the systems development method and various techniques I used in
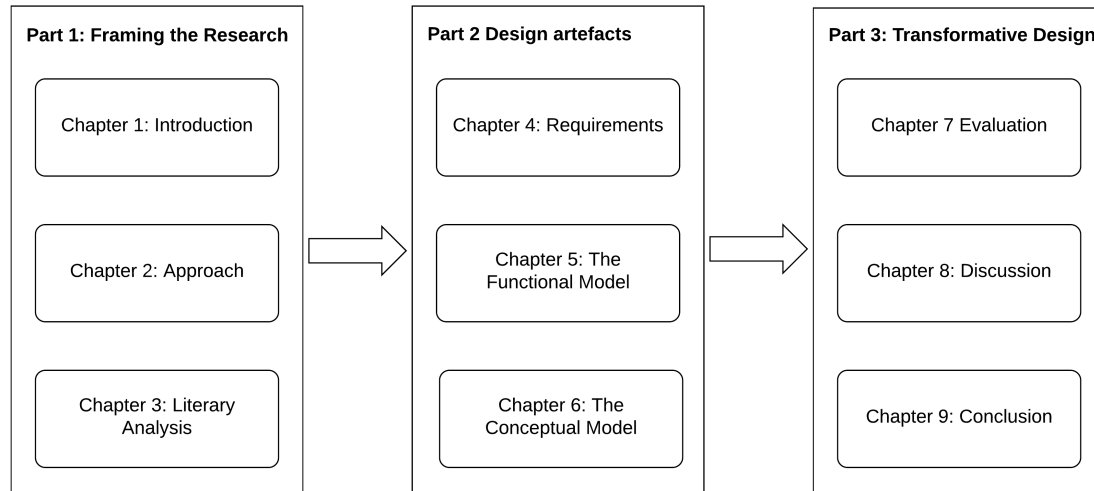
Figure 1.1: Thesis structure

collecting and analysing my data, indicating the locations throughout this thesis where I discuss each method in detail. Chapter 3 presents an analysis of recordkeeping literature that serves to frame the claims and issues raised in this introductory chapter and provide an understanding of the problem and solution domains.

Part 2, *Design Artefacts*, concerns the core elements of my design and comprises Chapters 4 to 6. Chapter 4 is a treatment of the requirements for interoperable recordkeeping systems design in general, and participatory recordkeeping in particular. The requirements are the result of a series of interviews conducted with domain experts from academia and practice, together with a warrant analysis of research literature concerned with participatory recordkeeping. Chapter 5 describes the consolidation of these requirements into my functional model, the *Participatory Recordkeeping Continuum Model*, and comprises an article published as 'Agency in the Archive: a model for participatory recordkeeping' in *Archival Science* in July 2016. Similarly, Chapter 6 presents an ontological analysis and the resulting conceptual model, the *Meta-model for Record-keeping Metadata*, published as 'Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata' in the *Records Management Journal* in June 2017.

The last part, Part 3, *Transformative Design*, provides the link from my design to the concrete implementation of transformed recordkeeping systems. Chapter 7 describes a proof-of-concept instantiation of my design — the Participatory Recordkeeping Infrastructure, or PaRIty system — and it's subsequent validation through a variety of laboratory and external evaluation methods. Chapter 8 discusses the implications of this design and the ramifications of my findings for recordkeeping theory, practice, and systems development. In particular, a transformative shift to distributed and participatory recordkeeping necessitates revisiting the nature, prove-

nance, and defence of records as well as an understanding of the perpetual and iterative nature of recordkeeping practice. In Chapter 8 I also reflect on my experience with the design science methodology for investigating transformational design. Finally, in Chapter 9, I conclude this thesis with a summary of how I have addressed my research questions and the contributions of this study. I also provide an overview of the remaining questions, including those that arose during my research, that are not only opportunities for future research, but issues that need resolution in order to achieve a complete transformation for participatory recordkeeping.

Conclusion

This research project was quite complex in that I attempted to tackle a fundamental re-design of recordkeeping systems at various levels of interoperability; from the technical to the social. Without giving too much away, it demonstrated the possibility of transformative design for participatory recordkeeping. Nonetheless, this study generated many questions along the way — at times adding to the complexity which it was, itself, meant to address. But I am getting ahead of myself. In order to understand how I arrived at the design, I must first describe the approach I took to investigate these issues.

Chapter 2: Approach

> *Every honest researcher I know admits he's just a professional amateur.*
> *He's doing whatever he's doing for the first time. That makes him an*
> *amateur. He has sense enough to know that he's going to have a lot of*
> *trouble, so that makes him a professional.*
>
> <div align="right">Charles Franklin Kettering</div>

Having introduced my study in Chapter 1, the purpose of this chapter is to describe the approach I took to address my research questions. I will describe the design of this research project in terms of its theoretical underpinnings as well as the methodological foundations of the research activities. In the main, this chapter contains a treatment of the design science research methodology and various methods and techniques I employed to investigate participatory recordkeeping. But first I will describe an epistemology of Information Systems research together with a critical perspective that I feel is necessary in order to study and address the needs of participants in records and recordkeeping.

2.1 Epistemology: from artefact to intervention

Over the past few decades, research concerning the nature of records, recordkeeping, and archives has been conducted in an attempt to understand the rich information ecology of the Archival Multiverse (McKemmish & Gilliland, 2013). I use the term 'Information Ecology' here in the sense described by Nardi and O'Day (1999) who explain that, "like a biological ecology, an information ecology is marked by strong interrelationships and dependencies among its different parts". As discussed in Chapter 1, it is these far-reaching interrelationships and dependencies, sometimes obscure or opaque, that give rise to the complexities of recordkeeping in society. For this reason, research in the Archival Multiverse has emerged as an Information Sci-

ence meta-discipline of the type that Bates (1999) argues intersects other research and practice spheres, the nature of which are "shaped and molded for a societal objective through different types of professional activities involving the manipulation and transmission of knowledge". This pervasiveness is also due, in part, to the way that Information Systems (IS) in general, and recordkeeping in particular, may be implicated in the causes, effects, and potential solutions to grand challenges of the current era (Gilliland & McKemmish, 2012).

A participatory approach to recordkeeping that strives for local, national and global perspectives on the meaning and use of records necessarily gives rise to multiple, shifting, and potentially incommensurate perspectives[6] that must be dealt with in a systemic manner. Consequently, a socially, politically, disciplinary, and technically heterogeneous, divided and contested information ecology means that the challenges of recordkeeping in society may not only be grand, but may be *wicked* as well. The term 'wicked', originally associated with seemingly intractable social planning dilemmas, refers to problems that are not amenable to reductionist approaches for definition, deconstruction and solution finding (Rittel & Webber, 1973). Wicked problems are ill-defined or un-definable, have no end to the causal chains that link interacting systems of their components, and may have no immediate or enumerable set of testable solutions. Arguably, to attempt to foster interoperability between recordkeeping systems with their divisive social and organisational politics, divergent archival practices, multiplicity of overlapping standards, and a plethora of technological approaches, is to tackle a wicked problem — even when addressing it in the simplest of technological levels.

However, it is doubtful that a simple 'technology' perspective exists, particularly in relation to IS. In contrast to an inward-looking or internal view that IS may be analysed independently of their setting of use (Wand & Weber, 1995), many researchers now understand that the investigation of IS only has meaning in the context of their social setting (Cecez-Kecmanovic, Galliers, Henfridsson, Newell, & Vidgen, 2014; Leonardi, 2013; Orlikowski & Scott, 2008; Svahn, Henfridsson, & Yoo, 2009). This indivisibility of material artefacts from their social embeddedness, termed *sociomateriality*, draws upon various philosophical schools of thought including Structuration theory (Giddens, 1984), Actor-Network theory (Latour, 1987), Agential Realism (Barad, 1996), and Critical Realism (Archer, Bhaskar, Collier, Lawson, & Norrie, 2013). Sociomateriality holds that what is actually observable are performed relations between actors and objects rather than pre-formed elements, as "entities have no inherent properties, but acquire their form and attributes only through relations with others" (Orlikowski & Scott,

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[6]I use the term 'incommensurate' here in the sense of being unable to be reconciled, for example as employed by Russell (2005) to compare indigenous and western knowledge systems.

2008). These relations associate material artefacts and social actors alike, with agency that entangles over time in a non-deterministic manner (Svahn et al., 2009). This is not to say that artefacts do not exist outside of a performative context. Rather, "materiality exists independent of people, but affordances and constraints do not. Because people come to materiality with diverse goals they perceive a technology as affording distinct possibilities for action" (Leonardi, 2012, p. 20).

The sociomateriality of IS not only provides an explanation for the complexities of information ecologies described above but demands a research perspective that goes beyond the hypothetic-deductive logic of enquiry (Cecez-Kecmanovic, 2013) that has long been associated with a *reductionist*, inward-facing view of IS. The agency of actors in sociomaterial systems means that "IS is fundamentally about human activity systems which are usually technologically enabled" and not centred on the internal nature of technical artefacts themselves (McKay et al., 2007). Investigations of IS therefore necessarily involve "an understanding of the *context* of the information system, and the *process* whereby the information system influences and is influenced by its context" (Original emphasis) (Walsham, 1993, p. 4). Researchers need to therefore take *interpretive* approaches that focus "on the complexity of human sense making as the situation emerges [and attempt] to understand phenomena through the meanings that people assign to them" (Klein & Myers, 1999) in order to apprehend such contexts.

Even so, what differentiates IS research from other forms of social research *is* the presence of the IT artefact. Significantly, such artefacts are purposefully created; they are the product of a design perspective "concerned with how things ought to be" and that involves "courses of actions aimed at changing existing situations into preferred ones" (Simon, 1988). Because all "questions about design are both technical and social" (Callon, 1990), IS design needs to interrogate the "complex relationship between IS and their social, political and organisational contexts" (Cecez-Kecmanovic, 2001). This *critical* perspective allows movement beyond the understanding of contexts and influences gained through interpretive inquiry "to expose the inherent conflicts and contradictions, hidden structures and mechanisms accountable for these influences" (Cecez-Kecmanovic, 2001). The structures of society are mutable, even ephemeral (Giddens, 1984). By transcending interpretive study of extant sociological constructs, a critical perspective introduces the possibility of inquiry across space and time towards an understanding of this mutability. Similarly, design is the other side of the critical enquiry coin. By moving beyond a passive understanding of such structures in order to actively seek alternatives, the process of design leads to greater understanding of the problem domain (Heusinger, 2013).

I therefore adopt a critical epistemology, necessary for investigating recordkeeping systems, while recognising the value of interpretive approaches to understanding the lived experience of sociomaterial IS. However it is this critical posture that underpins the design science methodology I used to approach the problem of participatory recordkeeping. To put my choice of methodology into context, in the following section I will give a brief overview of the methodological landscape before turning my attention to the detail of interventionist methodologies in general and design science in particular.

2.2 Methodology

As a sociomaterial meta-discipline that spans reductionist, interpretive, and critical ways of understanding IS, Bates (1999) argues that, "to solve the information science field's problems, a mix of methodologies are [sic] needed". Along similar lines, Gilliland and McKemmish (2012) catalogue a wide variety of research methods applicable to recordkeeping research. How then to discern which methodology and methods are applicable to my project?

2.2.1 Methodological landscape

Research in recordkeeping informatics spans the dimensions of the IS research framework described by (Braa & Vidgen, 1999) and depicted in Figure 2.1. This framework situates methodological approaches in respect to the three research dynamics — (post) positivism, interpretivism, and pragmatism — with a critical perspective stemming from an imperative for positive change. As such, it is focussed on research outcomes (albeit with the epistemological assumptions identified above): reductionist approaches that lead to prediction; interpretation that generates understanding; and interventions that facilitate change. It does not position these alternate research approaches as incommensurable opposites, rather it situates them as tendencies or directions in a two-dimensional research topography.

For example, along with experimentation and measurement as mechanisms for quantifying the understanding of records and recordkeeping, an appreciation of their sociomaterial interrelationships and dependencies requires interpretive research methods such as those described by Gilliland and McKemmish (2012) including ethnography, diplomatics, functional analysis, and literary warrant analysis. However, transformative change requires interventionist methods, such as design science and action-research. Furthermore, the sociomateriality of recordkeeping means that "only the participants of an information ecology can establish the identity and place of the technologies that are found there [. . .] integrating them into settings of use in such a way that they make sense" (Nardi & O'Day, 1999). Such sense-making is a hallmark of inter-
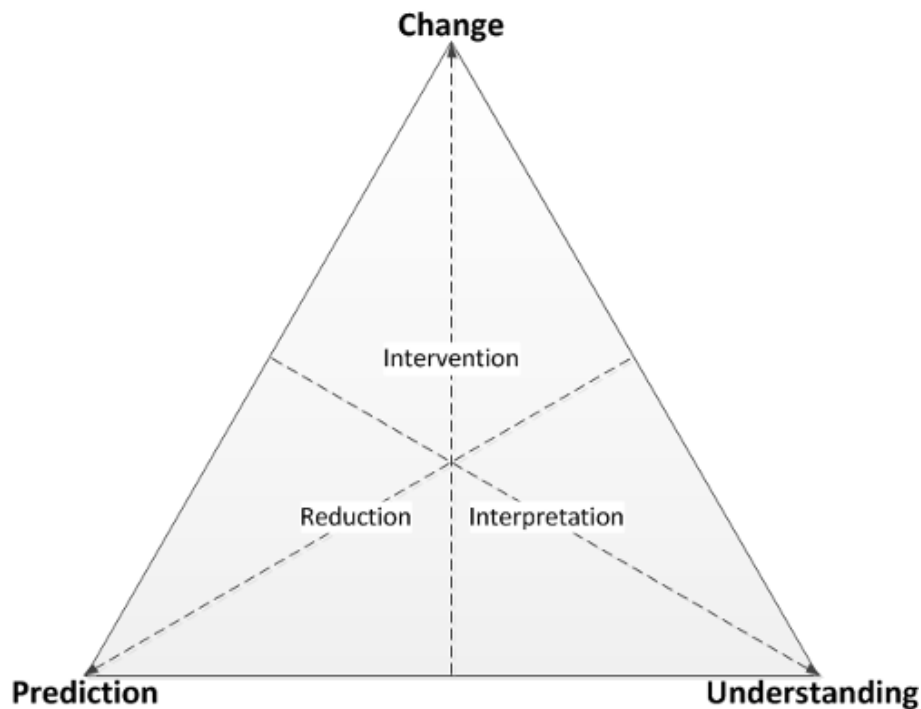
Figure 2.1: Information Systems research framework — after Braa and Vidgen (1999)

ventionist pragmatism that Goldkuhl (2012) argues seeks "to create knowledge in the interest of change and improvement" and possesses a critical orientation which arises from an "interest not only for what 'is', but also for what 'might be'."

There is an additional characteristic of this critical interventionist perspective that I should note here. Neither the hypothetic-deductive logic of reductionist approaches (Cecez-Kecmanovic, 2013), nor the inductive logic associated with interpretive understanding (Williamson, Burstein, & McKemmish, 2000, p. 31) are sufficient modes of reasoning to transcend the structures of the prevailing sociomaterial paradigms for emanciaptory change. In order to be able to explore what 'might be' or the nature of 'possible worlds' (Goldkuhl, 2012; Heusinger, 2013) we need an additional mode of reasoning. Realising that "in science, explanation involves the invention of new concepts, just as much as the positing of new statements (in some fixed conceptual framework)", *abductive* reasoning provides for a "context of discovery" that encourages novel approaches to problem solving (Aliseda, 2004).

While deductive logic may lead to inferences about extant recordkeeping systems based upon existing social or recordkeeping theory, and induction to the sorts of insights about the Archival Multiverse introduced in Chapter 1, abductive reasoning allows us to envision what a participatory recordkeeping infrastructure "might be", providing suggestions of a design path from here to there. Thus, abduction involves the accommodation of an anomalous observation or desired

condition in the context of an existing body of knowledge, resulting in a set of new, possible explanations. It is fundamentally a creative act (Davis, 2012, p. 22), an "epistemic process for belief change" that involves transition from the ideal to the concrete through subsequent verification of candidate explanations (Aliseda, 2007). Abductive reasoning, then, is the logic of design and the foundation of a critical interventionist perspective.

In terms of application, Rittel and Webber (1973) found that linear systems approaches were not suitable for tackling wicked problems and that an "[iterative] process in the course of which an image of a problem and of [a] solution emerges gradually" was more likely to yield useful results. Conklin, Basadur, and VanPatter (2007) also determined that, when investigating pervasive, sociomaterial systems, "you won't understand the problem until you've created a solution" and that "problem formulation emerges in parallel with solution formulation". They also argue that non-linear or iterative approaches "illuminate the hidden issues and flush out the hidden stakeholders". Similarly, the rise of agile systems development techniques over the past fifteen years (Beck et al., 2001) has been a response to challenges in software development that exhibit wicked characteristics. Moreover, because the sociomaterial affect and affordances of IS are temporally emergent, "no one knows in advance the shape of future machines" (Pickering, 1993). Thus the interventionist paradigm is well suited for iterative research in that the learning from one research cycle (i.e. activity followed by evaluation) can become the basis of understanding for the next.

The design, development, and evaluation of IS artefacts need to therefore progress in an iterative manner in order to identify and address emergent requirements, issues, and opportunities. Additionally, because design 'fit' should be "understood in terms of contingently formulated accommodations to temporally emergent resistance" (Pickering, 1993), iterative pragmatist approaches are more appropriate for tackling sociomaterial IS problems than the linear activities of reductionist or interpretive discovery and justification.

Such interventions usually involve the design and application of solutions to problems. Action-research in this context "involves a simultaneous preoccupation with both taking action to improve a problematic situation, and with researching into and learning from the attempt at problem resolution or improvement" (McKay et al., 2007). It involves and entangled multi-hermeneutic "aimed at solving an immediate problem situation while carefully informing theory" (Baskerville, 1999) and, at the same time, increasing understanding of the problem domain and the research process itself. Design science on the other hand, involves the design of meta-artefacts in response to a set of meta-requirements — i.e. requirements and solutions that

transcend a particular situated problem (Venable, 2006). By designing for an entire class or type of problem, greater understanding of the problem and solution domains may be attained. Design science is essentially "learning by building" (Vaishnavi & Kuechler, 2004). Setting design at the core of research "allows for emergent behaviour and knowledge to be incorporated into the designed artefact and its understanding" (J. Evans, 2017, p. 672) as well as making explicit the necessary "practitioner and researcher partnerships and collaborations with shared agendas for change". Transformative design is therefore made possible as such a design process directly tackles situated complexity aiming "for both integrated practical and theoretical outcomes".

Action-research is situated toward the topmost apex of the Braa and Vidgen research framework shown in Figure 2.1 because it is intrinsically interventionist. On the other hand, design science fits somewhere 'below' the apex — partly because of the unsituated nature of design science artefacts, and partly due to the common application of interpretivist or reductionist methods for artefact evaluation. For example, in addition to Gilliland and McKemmish (2012), Bearman (1989), in his "Archival Methods" essays, provides a number of avenues for reductionist evaluation of various recordkeeping systems initiatives. Of course, if design science artefacts are introduced into a real-life context in order to both affect change and to learn from the intervention, then that evaluation exercise may well be one of action-research that, in turn, informs the design. The point is that I considered a critical interventionist methodology necessary to make inroads into the complex, sociomaterial problem of participatory recordkeeping. For me, however, the breadth and interconnectedness of the Archival Multiverse and, consequently, the difficulty of effecting in-situ change meant that a design science approach would best yield the sort of understanding that I sought.

2.2.2 Design science

Note that the terminology here varies a bit, some mean 'design science research' to be the interventionist methodology while others use the term 'design science' to refer to investigations into the nature of design. I will use the term *design science* to mean the interventionist research methodology associated with IS, introduced and promulgated by Nunamaker et al. (1991), Walls, Widmeyer, and El Sawy (1992), March and Smith (1995), Hevner, March, Park, and Ram (2004), and Venable (2006) amongst others.

Although a consensus definition of design science is elusive (Iivari & Venable, 2009), it is usually considered to be a problem solving process, typically concerned with knowledge generation through the building and evaluating of design artefacts such as conceptual constructs and models, algorithmic methods, and/or technical instantiations (Hevner et al., 2004; March & Smith,

1995; Walls et al., 1992). Gregor and Hevner (2013) make the point that quality design science research is grounded in strong kernel theories or justificatory knowledge[7] that leads to the identification of IS meta-problems that require meta-solutions. Venable (2010) also highlights common characteristics of quality design science: the significance or depth of the problems addressed; the centrality of the development of design artefacts, whether methods, models, or instantiated IT components; and their subsequent rigorous evaluation. This extrapolation from kernel theories to design is the abductive 'leap' of creativity, often applied using a critical lens, to seek alternative "possible worlds" that may be evaluated in the IS context.

The seminal guidelines for ensuring rigour in design science research first promulgated by Hevner et al. (2004) have been subject to critical analysis and refinement within the reductionist tradition, for example by Gregor and Jones (2007) and Weber (2013). However, there has also been some critical analysis of these guidelines from an interpretivist perspective. Niehaves (2007), in particular, has demonstrated the applicability of hermeneutic principles, originally developed by Klein and Myers (1999), for reinforcing the rigour of design science and action-research practice. When applied to interventionist research methods, these hermeneutic principles ensure that iterative and incremental development of artefacts is carried out in a reflective and reflexive manner in order to enhance an understanding of the problem under consideration. Resolution of breakdowns in this understanding may result in insights regarding the viable transition paths or provisions that may inform a solution. Similarly, Carlsson (2010) uses a critical realist perspective to question the underlying positivist assumptions of the Hevner et. al. influenced (Venable, 2010) design science paradigm.

McKemmish and Gilliland (2013) also note that the incorporation of reflexive practice is sign of growing maturity in recordkeeping research. They highlight autoethnography as a mechanism for this reflexivity, and one that creates understanding through "the experience of designing and implementing research." In this way, interspersed among the building and evaluating activities is the conscious and rational activity of reflection that researchers can "bring to situations of uncertainty, instability, uniqueness, and value conflict" (Schön, 1983, p.49) that characterise the sociomaterial research problem space. Such empirical understanding is key to tackling wicked problems that require "a fundamentally different challenge to the design process. One that makes solution secondary and problem understanding central" (Conklin et al., 2007). In the case of sociomaterial IS, a design science approach should therefore include reflection on the

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[7]Part of the rigor of design science derives from its grounding in existing theory that informs the design — often from disciplines other than computer science; for example, sociology or cognitive science. Such a body of knowledge, that informs a design science study, is usually termed *kernel theories* (Hevner et al., 2004) or *justificatory knowledge* (Gregor & Jones, 2007).

design process as much as any resulting artefact. This may result in improved understanding of the meta-requirements under consideration (i.e. the problem definition) as well as insights into the possibilities of sociomaterial meta-solutions that may address these requirements.

2.2.3 The systems development method

Central to my design process was the systems development method for design science research (Burstein, 2002; J. Evans & Rouche, 2006; Nunamaker & Chen, 1990; Nunamaker et al., 1991). The systems development method involves the creation of one or more software artefacts as a means of iteratively exploring the design, and providing evidence of the implementability of the design. Nunamaker and Chen (1990, p.634) suggest that "building a prototype system always helps to study and to understand a research domain. Researchers may learn more about all aspects of a domain from observing the prototype behavior as well as from building it". Indeed Burstein (2002) argues that the systems development method spans "the technological and the social sides of IS research" providing a link between "theory building and applied IS research", while J. Evans and Rouche (2006) provide examples of its use in a recordkeeping informatics context.

Additionally this research project satisfies the criteria set out by Nunamaker and Chen (1990, p. 637) for its suitability for study via systems development. It is (1) a study of an important IS phenomenon with (2) potentially significant results; (3) it is testable; (4) it may provide a better solution for the problem domain; and (5) will result in a generalised design. Importantly, I supported the systems development method with a variety of research techniques for requirements elicitation, analysis, design, and development (Nunamaker et al., 1991) as described below.

2.3 Research design

The systems development method comprises the four central activities shown in Figure 2.2: concept building; design; development; and evaluation. Although this diagram depicts these activities as distinct and sequential, the reality is more complex. In general, systems development proceeds cyclically from concept building through evaluation in one or more macro iterations, however, the myriad smaller resistances and accommodations (Pickering, 1993) as well as conceptual insights and breakthroughs, mean that the designer actually moves backward and forward between activities in a continual series of micro iterations (Nunamaker & Chen, 1990).

This process is indicated in Figure 2.2 by the wider horizontal arrows that link back into the main iterative flow. For example, blockages or insights encountered while developing an in-
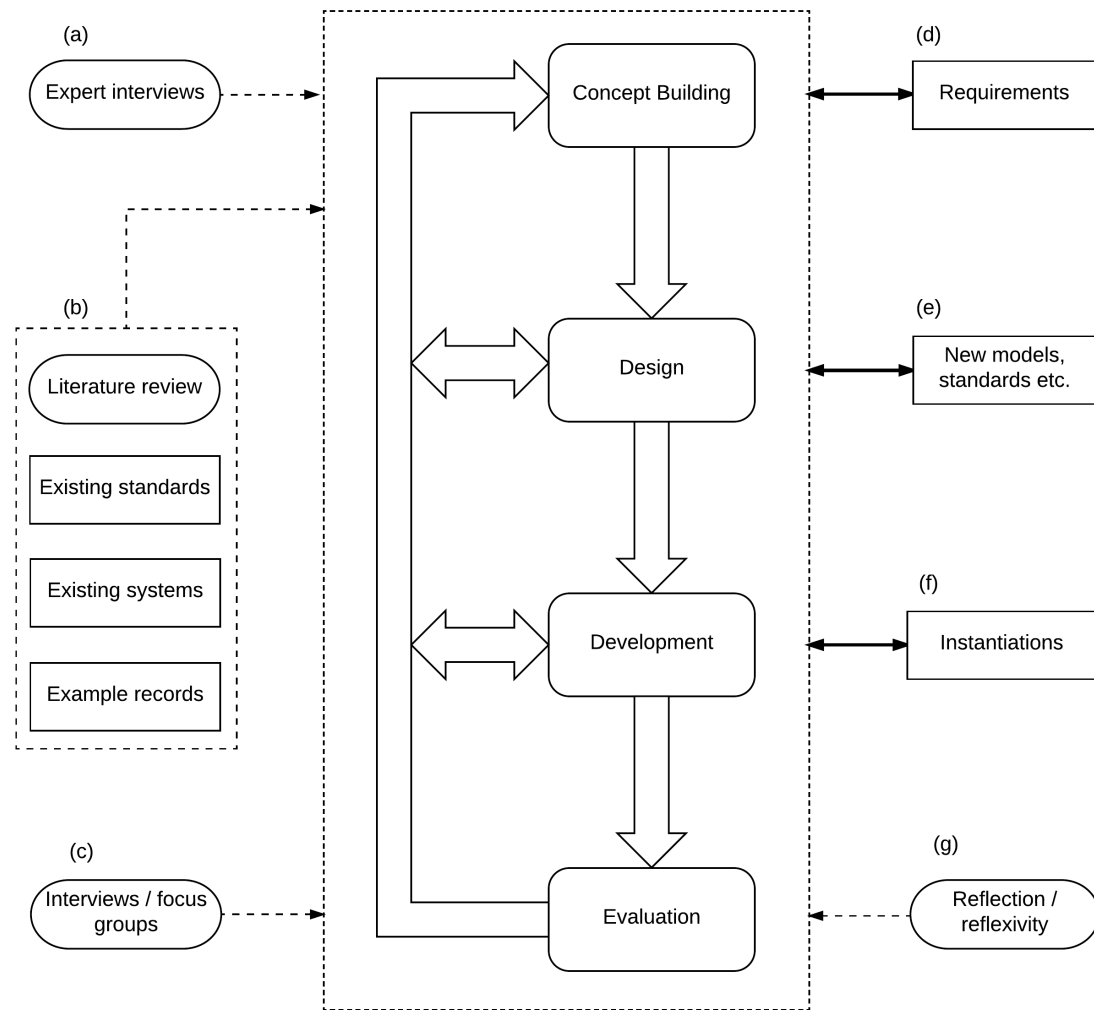
Figure 2.2: Design science methodology flow

stantiation may involve re-visiting concept building; which then may have downstream effects in subsequent design, development, or evaluation. These macro- and micro- iterations are necessary in order to make space for the emergent nature of sociomaterial IS in which the fit of a system to requirements "is not simply a matter of engineering; rather, it emerges from user interactions with the system" (Davern, 1996).

The process flow of my research design is shown in figure 2.2 and is a reworking of the generalised systems development method described by (Burstein, 2002) which, in turn, is based on that of Nunamaker and Chen (1990). This iterative flow is a conceptualise/design/develop/evaluate cycle that, while it encompasses the basic build and evaluate steps of design science (March & Smith, 1995), it makes explicit the core systems development method of my approach. The systems development method is described in more detail in the following section.

To clarify the application of this method to my project, Figure 2.3 shows a mapping between the research methods and techniques, the data that they produced, and the research questions that they addressed.

My approach drew on justificatory knowledge (Gregor & Jones, 2007) or kernel theories (Hevner et al., 2004) in the form of academic and practice literature as well as extant recordkeeping systems, standards, and records (Figure 2.2 b). I used this literature in two ways. Firstly as the source for a critical analysis of existing recordkeeping and archival paradigms so as to understand the nature of its structural problems as well as avenues of investigation. Secondly, I undertook a more detailed analysis of specific literature as warrant for the requirements for participatory recordkeeping

The literature analysis and the more focussed literary warrant analysis are described in more detail in Chapters 3 (Literary Analysis) and 4 (Requirements) respectively. This body of knowledge was enhanced by interviews that I conducted with domain experts as part of the concept building activity (Figure 2.2 a) and the feedback from interviews and focus groups conducted as part of the design evaluation (Figure 2.2 c). These interviews and focus groups are described in more detail in Chapters 4 (Requirements) and 7 (Evaluation) respectively.

Originally I had anticipated two macro-iterations through this design science cycle —- a major design effort followed by a smaller one involving the refactoring of the design artefacts based upon evaluation feedback and my own reflections. However, two cycles proved unattainable within the time I had available; the modelling, software development, and publication activities being more extensive than I had expected. Nonetheless, a single cycle that comprised the systems development micro-iterations proved successful in "generating new knowledge and improving social [utility] of the system" (Burstein & Gregor, 1999). Throughout the whole cycle, this reflexive design process was informed by personal reflection as described below (Figure 2.2 g). The design outputs from this process included a statement of meta-requirements for participatory recordkeeping (Figure 2.2 d), models (Figure 2.2 e), and a proof-of-concept instantiation (Figure 2.2 f).

I discuss these micro iterations in more detail in Chapter 7 but, for now, I will describe each of the systems development activities in turn.

2.3.1 Concept building

Although concept building has been described as "theory building, where the theory can be illustrated by a system" (Burstein, 2002), I feel that this is a too broad a definition that encroaches
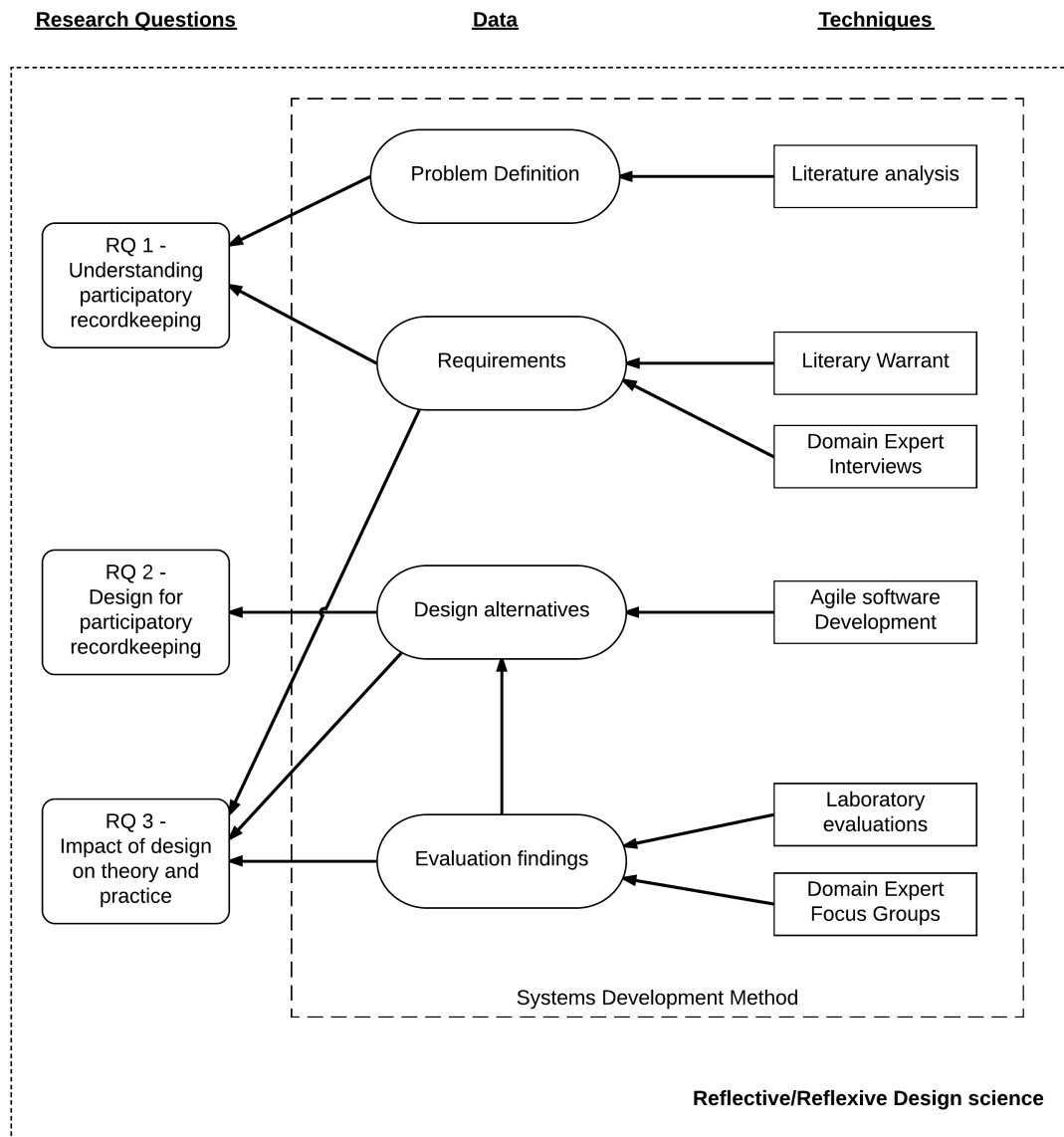
Figure 2.3: Methods and data mapped to research questions

on the design process. Instead, I would argue that concept building specifically refers to that activity that leads to the circumstances of performing design work. It is the core 'front-end' activity of design science that draws on the kernel theory (Hevner et al., 2004) or justificatory knowledge (Gregor & Jones, 2007) as well as a fledgling understanding of the problem domain to frame the possibility of intervention via design (Hevner et al., 2004). As described above, my "investigation of the system requirements and functionality, incorporating relevant ideas and approaches from other disciplines" (J. Evans & Rouche, 2006) involved the elicitation of requirements from domain experts together with detailed requirements derived from the body of recordkeeping literature.

The techniques I employed for concept building included the following:

- **Literature Analysis**

  Early on in the research I performed a literature analysis that served several purposes. Firstly, this analysis situated my study within the body of recordkeeping research; acting to "[close] areas where a plethora of research exists, and uncover areas where research is needed" (Webster & Watson, 2002, p.13). Secondly, it began the process of design in terms of critically identifying the systems and structures that underpinned the issues I was addressing, and suggesting avenues for intervention.

  I use the term literature here rather broadly because, in recordkeeping, as with other forms of IS, the "'literature universe' is comprised of diverse, interdisciplinary work" (Levy & Ellis, 2006, p. 183). Consequently I not only analysed recordkeeping literature, but that of related IS disciplines such as that relating to interoperability and infrastructure as well as specific internet-related technologies. Additionally, the analysis encompassed existing archival and recordkeeping systems and standards — both highly relevant to understanding contemporary frameworks and highlighting contradictions and other breakdowns.

  The literature analysis and its results are presented in detail in Chapter 3.

- **Domain expert interviews**

  Interviewing is a fundamental mode of human inquiry and is a major method of interpretive research. At the core, interviews provide "access to the context of people's behavior" (Seidman, 2013) in order to understand "the lived experience of other people and the meaning they make of that experience". Interviews may be more or less structured; highly structured formats being more aligned with the purposes of questionnaires

that are amenable to standardisation and/or quantitative techniques, while less structure opens up the possibility that the individual perspectives of participants[8] can be captured to a greater extent (Williamson, 2013b).

In general, I elected to hold semi-structured interviews, conducted in a flexible manner, that were based upon pre-established list of questions and/or prompts. This had the benefit of keeping the interviews 'on track' while allowing the discourse to range over topics that participants felt to be relevant, resulting in 'in depth' accounts that included both 'consensus' and 'dissonance' in the interview data (Williamson, 2013b).

I used a *purposeful sampling* approach to assemble the cohort of interview participants in order to "illuminate the questions under study" (Patton, 2002, p. 46). In my case, these were *domain experts* whose knowledge — beyond that of (mere) specialists in the field — would enable them "to identify and to account for problem causes as well as for solution principles" (Pfadenhauer & Menz, 2009) in recordkeeping systems design. Finally, the interviews were recorded, and then subsequently transcribed and analysed using category coding techniques (Williamson, Given, & Scifleet, 2013).

The arrangement and conduct of these semi-structured interviews, the analysis of the transcripts, and a discussion of my findings are described in more detail in Chapter 4.

- **Literary warrant**

  Beyond using the literature to position my research within the participatory recordkeeping discourses, I also used the literature in a more focussed way: as literary warrant (Duff, 1998) for the requirements for participatory recordkeeping. As I explain in Chapter 4, this was due to my limited scope for engaging with a broad cross-section of participant communities for requirements elicitation.

  The term 'literary warrant' comes from the world of bibliographic cataloguing and originally conveyed the meaning that classification systems should only be concerned with material that was actually under analysis and not some idealised universe of subject matter — i.e. that the literature itself provided the rationale for the classification terms. In recent times, this concept has been extended to mean a literature-based justification for a practice-based discourse or conceptualisation (McKemmish, 2001). For example, in the

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[8]Given that interviewees are active stakeholders in the interviews — i.e. electing to be interviewed and choosing what experiences or insights they share — I will use the term *participant* to also refer to those with whom I conduct interviews or focus groups. Note that I am not claiming that this makes my study participative research (Cornwall & Jewkes, 1995). Additionally I recognise that there is a risk of confusion with respect to statements about participatory recordkeeping, that I hope I avoid. Nonetheless, I am in agreement with Seidman (2013) in that the term 'participant' conveys a sense of active involvement and equity in the interviews.

recordkeeping space, such a justificatory literary warrant played a significant role in the Pittsburgh Project (Cox, 1994) where it formed the basis for an understanding of requirements for electronic recordkeeping (Duff, 1998). Similarly, such analysis was employed by Cumming (2007) to identify the roles and purposes of recordkeeping metadata

I describe my use of literary warrant for participatory recordkeeping in detail within Chapter 4. In that chapter I also discuss the limitations of this approach, as a consequence of data reported in the literature being some 'distance' from the sociomaterial phenomena under study.

2.3.2 Design

The design activity is the abstraction and generalisation from the conceptualisations above that provide possible paths from 'what is' to 'what ought to be' (Simon, 1996, p. 4). Design is arguably "the most important part of a system development process" involving "the understanding of the studied domain, the application of relevant scientific and technical knowledge, the creation of various alternatives, and the synthesis and evaluation of proposed alternative solutions" (Nunamaker & Chen, 1990).

In IS, such design frequently involves modelling, often in the form of functional or conceptual models (Hofman, 2017, p.635). In relation to design science, modelling may result in meta-models (van Gigch, 2014, p.258) that address a class of meta-problem by "establishing guidelines for the process of representation". In the case of design science, models (or meta-models) may form the foundation from which one or more concrete proof-of-concept instantiations may be constructed.

In my case, the design phase involved the creation and refinement of a functional model and a conceptual meta-model. The functional model was a direct articulation of the requirements determined in the concept building activities. The conceptual meta-model was based upon an ontological analysis (Lacasta, Nogueras-Iso, & Zarazaga-Soria, 2010) of recordkeeping, drawing on existing recordkeeping metadata models as well as the functional model and the underlying requirements.

The process of modelling, the models, and their implications are discussed in detail in Chapters 5 and 6.

2.3.3 Development

The development activity corresponds to the creation of an instantiation that is usually the focus of the 'build' stage of canonical design science (Hevner et al., 2004). Such an instantiation

"represents a concrete realization of a construct, model, or method. It demonstrates feasibility and enables researchers to actually test their concepts under real world conditions and learn more about the real world" (Cleven, Gubler, & Hüner, 2009). Where applicable, the creation of a concrete instantiation is invaluable for providing feedback that informs the design by serving to "expose and eliminate a number of ambiguities, inconsistencies, blind spots, and misunderstandings" (Boehm, 1984) in the conceptualisations and design outputs. However, as described above, instantiation can also form part of an iterative design process leading to new insights or other ways of considering conceptualisations (J. Evans & Rouche, 2006). Nonetheless, it should be remembered that the aim of an instantiation is to exercise the design — not to produce production-ready artefacts. Such a system is able to "resolve the feasibility issues, but lacks the extensive features, error-proofing, and documentation of the final product" (Boehm, 1984).

- **Agile software development**

  I employed agile software development techniques throughout development activities of the project. As described above, agile software development emerged in the 1990's in response to the growing complexity of software development challenges (Beck et al., 2001). There are a number of forms of agile development, but they all exhibit similar iterative and incremental approaches to the development of software components. Agile software development aligns well with the needed micro-iterations of the systems development method in design science. A key feature of agile development is a focus on iteratively delivering small pieces of functionality, prioritising adaptation over prediction — i.e. a focus on the next component to be delivered, rather than having a big-design-up-front. Another common thread is the prominence of automated testing; which is crucial given the highly iterative nature of development and the possibility of introducing bugs as the code-base gradually evolves (Fowler, 2005).

  I practised these agile techniques and tracked my progress using a research journal together with tools such as an automated testing framework and source code version control.

I planned to develop a networked and interoperable participatory recordkeeping system as an instantiation of my design. Not unexpectedly, the development micro iterations informed the design and led to refinements in the understanding of the requirements for participatory recordkeeping.

The development of the proof-of-concept instantiation as well as its relationships to the design artefacts is discussed in detail in Chapter 7. In that chapter I also explore the use of an instantiation as a pedagogical tool, useful for introducing my models and explicating their constructs.

2.3.4 Evaluation

The evaluation of design artefacts is a core activity of design science (Venable, Pries-Heje, & Baskerville, 2012) in which evidence is obtained to show that each design artefact "achieves the purpose for which it was designed". In keeping with the sociomaterial notions of 'fit' described earlier (Davern, 1996; Pickering, 1993), I evaluated my design artefacts with a range of activities; from laboratory techniques to human evaluation. Such a spread of evaluation methods was important in order to increase validity of my design as, "whilst empirical evaluation is an indispensable part of design science, the strong form of directional hypothesis testing would seems at odds with the inventive, creative spirit of design" (Wastell, Sauer, & Schmeink, 2009). Chief amongst the methods that I employed was the use of Focus Group walkthroughs of the design artefacts and instantiation.

- **Focus Groups**

  The focus group is a method borrowed from applied social science research that "involves organizing and conducting a series of group discussions with the objective of better understanding the attitudes, beliefs, practices, and values on a specific subject" (Bertrand, Brown, & Ward, 1992). Using focus groups as a vehicle for walkthroughs of designs and/or systems is a common method of evaluation of IS in general (Belanger, 2012; Nielsen, 1992) and design science in particular (Tremblay, Hevner, & Berndt, 2010). This approach has also been identified as being applicable to recordkeeping systems analysis and design research (McKemmish & Gilliland, 2013). Focus groups differ from interviews in that the interaction between participants can lead to the emergence of unforeseen sentiment and reflection and, therefore, insights and learning (Belanger, 2012). For this reason, focus groups are best conducted in a semi-structured manner to allow the group some leeway in providing feedback for the topic at hand.

  As with my design of the requirements elicitation interviews described in the concept building section above, I employed purposeful sampling to select domain experts from various recordkeeping disciplines (designers, practitioners, and researchers) for the evaluation focus groups. I conducted a number of focus group walkthroughs that used the proof-of-concept instantiation to explicate the design requirements and models that I had developed.

The evaluation of the design artefacts as well as the role of the proof-of-concept instantiation in their evaluation are discussed in detail in Chapter 7. In that chapter, I also describe in detail how I designed, conducted, and analysed these focus group walkthroughs.

2.3.5 Reflection/Reflexivity

Both reflection and reflexivity were core to my critical design process. As described in the sections above, this practice underpinned the macro- and, more importantly, the micro- iterations of the systems development method and contributed to both the rigour of the design science research and the quality of the design outputs. It is this reflection on the behaviour of the emergent design in the context of a current understanding of requirements, that lead to the "short iterative cycles [where] problem formulation evolves and emerges in parallel with the solution formulation" (Conklin et al., 2007, p. 19). Similarly, reflexivity in the research process itself is necessary to ensure that the research goals continue to be aligned with the emergent understanding of the problem domain. It is difficult to see how 'waterfall' processes (Royce, 1987) of design, and of the research itself, could lead to similar results.

The goal of such reflexive practice is to ensure that a 'systems approach' is employed at all stages that requires the continual assessment, from multiple perspectives, of what the design (and, indeed the research itself) is and is not doing (Ulrich & Reynolds, 2010, p. 247). In the first instance, the idea of the *hermeneutic circle* is key to this iterative and perpetual (re)alignment of context, problem, solution, and explanation. The hermeneutic circle achieves this by "iterating between considering the interdependent meaning of parts and the whole that they form" (Klein & Myers, 1999, p. 72). Practice informed by the hermeneutic circle involves constant (re)contextualisation of emergent understanding; exploration of meaning via ongoing abstraction and generalisation in order to test propositions; investigation of emergent contradictions between observations and current understanding; sensitivity to personal and paradigmatic biases; and awareness of the plurality of possible interpretations of contexts and findings. In the context of iterative design, there are "processes of reflection-in-action, not just reflection-on-action" (J. Evans, 2017, p. 669). It is through such reflection that a transformative design can emerge from the complexity of a wicked problem domain.

Additionally, there is a second level of hermeneutic; "a process of critical self reflection and associated self-transformation" (M. D. Myers & Klein, 2011, p. 27) in relation to the research process itself. Such reflection is fundamental to a critical stance in which we need to examine "the selectivity of whatever standpoint we assume for grasping and assessing a situation as comprehensively as possible" (Ulrich & Reynolds, 2010, p. 262). This selectivity necessarily changes over time and, as with the first hermeneutic circle, it is important to understand the engagement with the research in order to "identify sources of different/conflicting views and beliefs, and potentially change" them (Cecez-Kecmanovic, 2001, p. 148). It also enables "re-

searchers make explicit connections and comparisons with [other] relevant circumstances and experiences" that may only emerge along with growing understanding of the research problem. As Ulrich and Reynolds (2010, p. 262) argue, "the point is not that we should claim we have the answers but rather, that we should uncover the inevitable selectivity of all our claims".

Evidence of such reflection and reflexivity was recorded in a research journal and various development tools such as software version control logs. Examples of this reflective practice are introduced throughout this thesis, perhaps most explicitly in Chapter 7 where the systems development is discussed and in Chapter 8 where I reflect on the research as a whole.

Conclusion

In this chapter I demonstrated how the sociomateriality of recordkeeping demands an interpretive approach to understanding the complexities of recordkeeping in society. Additionally, I argued that a critical perspective is necessary to explain the need for, and barriers to, participatory recordkeeping. Beyond understanding, however, is the need for critical interventionist approaches that have the potential to reveal solutions that address the structural problems in recordkeeping and, perhaps, lay the foundation for structural change. Such interventionist approaches rely on abductive reasoning to perform the leaps of insight that are embodied in a "creative spirit of design" (Wastell et al., 2009).

Against this background I described one such interventionist research methodology, design science, and how it provided the framework for my study. Central to this framework was the systems development method that underpinned the iterative exploration of the design through the development of a concrete instantiation. Finally, I explained how evaluation of the design artefacts — primarily using the proof-of-concept instantiation — demonstrated the veracity of my design and its capacity to facilitate participatory recordkeeping. However, in support of the systems development method, I employed a number of research techniques in the gathering of research data to address my research questions.

My intention was to address my first research question regarding an understanding of participatory recordkeeping through the methods that made up the concept building activities. Similarly, I anticipated that I would address my second research question regarding the feasibility of an interoperable, participatory recordkeeping design through development of such design artefacts themselves — although evidence obtained through the evaluation activities would be needed to provide evidence of this support. Finally, the data obtained from each of the methods would inform my third research question regarding the impact of my findings on recordkeeping theory

and practice —- from a statement of requirements, through the designs, to evaluation findings that situated my design in contemporary recordkeeping.

Thus, having presented my research approach, in Chapter 2, I will present a literary analysis that frames the research by developing an understanding of the problem and possible solution domains.

Chapter 3: Literary Analysis

*Nothing is less reliable, nothing is less clear today than the word
'archive'.*

Jacques Derrida

In Chapter 1, I identified significant issues in recordkeeping and argued that they result from
the inherent structures of contemporary recordkeeping systems. I also suggested that issues
of disenfranchisement from records could therefore be addressed through the transformative
design of such systems. In Chapter 2 I then described the approach I would take to tackle such
a design. In this chapter I will back up a little and present the critical literature analysis that
justifies these claims and contextualises my research within the development of archival theory
and practice. In particular, this chapter begins to address my first research question; serving as
the first part of the design process in attempting to understand the problem domain.

1) *What emergent and theoretical approaches to recordkeeping address issues of disenfranchise-
ment and participation?*

This analysis is based on the literature at the time of the early stages of my project. Arguably
the field has moved on since I first began this study, and certainly there has been much writ-
ten in the intervening years; in particular, Huvila's (2015) discourse analysis of participatory
archiving, the emergence of Archival Activism (J. Evans et al., 2015), and a number of doctoral
theses including Eveleigh's (2015) work on Archive 2.0, Sexton's (2016) thesis on sharing pro-
duction and representation of an archive, and Soyka's (2015) work on continuum analysis of a
community archive. In my own jurisdiction, a significant recordkeeping discourse is one that
concerns the records of children displaced from their families into various forms of Out Of

Home Care[9]; a topic dominated by an ongoing *Royal Commission into Institutional Responses into Child Sexual Abuse* and the recommendations from earlier, similar inquiries (Swain, 2014). Nonetheless, while I do introduce broader (and more recent) literature in subsequent chapters, the point of this chapter is to describe my analysis of the pertinent literature in the early stages of this project.

Of particular importance to this contextualisation is the development of pluralistic conceptions of an Archival Multiverse and participatory recordkeeping. This review of background material will cover the development of recordkeeping theory as an explanation of the nature and purpose of records, recordkeeping practices, and archives; its manifestation in recordkeeping and archival standards and systems; and the theories of systems interoperability with particular reference to the impact of emergent web technologies on recordkeeping informatics.

But before I get to this detail, I will first present a very brief outline of the social theory that frames my assumptions about the structures of recordkeeping systems.

3.1 Systems, structures, infrastructure, and sociomateriality

From a social theory point of view, social systems present "as reproduced social practices" that are subject to structures which "make it possible for discernibly similar social practices to exist across varying spans of time and space and which lend them 'systemic' form" (Giddens, 1984, p. 17). This reproduction is at once, both the bearer and the outcome of such structures, and may be termed *structuration*. Social structures are "always both enabling and constraining" (p. 169) — "like the walls of a room from which an individual cannot escape but inside which he or she is able to move around at whim" (p. 174). The sociomateriality of systems means that "the physical world affects action and [...] social structure influences social practice" (Jones & Karsten, 2008, p. 132) which, in turn, continuously create social structures. This entanglement of the social and material is played out in terms of the *infrastructure* that supports such systems.

Infrastructure extends the social into the sociomaterial and is the embodiment of standards and practice in sociomaterial systems; "inscribed at the deepest levels of design" (Star, 1999, p. 389). It is complex, embedded, transparent (barring technical breakdown or social revolution), and entangled with norms of practice (Star, 1999; Timmermans & Epstein, 2010). Furthermore, as Winner (1980) observes, not only is infrastructure value-laden, it has politics. For example the definition or even the inclusion (or not) of a data element within an IS standard can

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[9]As explained in Wilson and Golding (2015), the capitalised term 'Care' is used to denote the ironic connotations of manifestly uncaring treatment, without the typographically heavy-handedness of continually enclosing the word in quotation marks.

be a negotiation of allowable actions or viewpoints within a sociomaterial context (Hanseth & Monteiro, 1997). Interestingly, Winner's contrasts of the social-political implications of distributed, citizen-deployed solar power versus centralised, industrialised power generation is a remarkably good analogue for the participative/institutional tensions in recordkeeping described above. This is why the nature of recordkeeping infrastructure is manifestly connected with the structures embodied within path-dependent recordkeeping practice. The structuration of the disenfranchisement of stakeholders within existing recordkeeping systems indicates a problems in the conceptualisation and design of recordkeeping infrastructure itself.

With this understanding about the role of recordkeeping and archival systems in the structuration of records and recordkeeping in society, and the entangled complexity that gives rise to the wickedness of issues in recordkeeping, I can now turn to the background of recordkeeping and archival theory that informed this research project.

3.2 Recordkeeping and archival theory

The practice of keeping records within an archive has been traced from as least as far back as the days of Sumerian clay tablets (for example: Cunningham, 2005), however modern archival thought arguably commenced in the late nineteenth century with the 'Dutch manual' of Muller, Feith, and Fruin (1898) as a milestone publication of the time (T. Cook, 1997; Ketelaar, 1996). Since then, archival discourses have largely been concerned with the nature, role, functions, management, and content of archives, and, in recent decades, about the nature of records, their role in society, and their relationship with various stakeholders beyond the creator, the archivist, and the user.

Over this period, the development of archival theory can be characterised by the consideration (and, perhaps, abandonment) of a number of dichotomies that have emerged since the early days of formal archival theorising. The first of these deals with the nature of records: should the Archive be concerned with primarily administrative records or should it also encompass other types of records such as personal papers; community records; natural, found, and constructed artefacts; or other inscriptions such as tattoos or scarification? And what about performative records including traditions of oral history, storytelling, song, dance, and ritual? The second is a distinction between records that are in active, current use (usually from an administrative, transactional perspective), and those that are not considered to be so and may, therefore, be destroyed or transferred to an archive. The third is the tension between custodial (i.e. concerned with the physical custody of collections of artefacts) and non-custodial control of records by an archive.

These dichotomies have played out as theoretical and praxis debates, and have had significant impact on archival research both within Australia and abroad. In recent years, a postmodern perspective in archival theory and research has resulted in critical analysis of the roles of records and archives, resulting in a conception of the Archival Multiverse and participatory recordkeeping that challenges traditional records management and archival theory and practice.

3.2.1 Records

A starting point is the explanation of what is meant by a 'record' and what constitutes notions of 'record-ness'. This is certainly a contested concept with whole book chapters (Reed, 2005c), series of articles (Hurley, 1998; Yeo, 2007), and significant conceptual modelling initiatives (Duranti, 1997; McKemmish, Upward, & Reed, 2010) dedicated to this topic.

If we look to the record management standards, the oft-quoted but now superseded Australian Standard AS 4390 provided the following definition, linking the value of records to an evidential role in human activity:

> "Recorded information, in any form, including data in computer systems, created or received and maintained by an organisation or person in the transaction of business or the conduct of affairs and kept as evidence of such activity" (Standards Association of Australia, 1996)

While appearing to be a suitably broad definition, it is problematic from several perspectives. The term 'recorded', in addition to being somewhat circular in a definition of a record, is vague. More difficult is the term 'conduct of affairs' that — despite serving to encompass personal as well as organisational records — appears to require some sort of purposeful activity that is being documented. This definition also emphasises preservation for solely evidential reasons. Surprisingly, the superseding international standard, ISO 15489, provides an even narrower definition:

> "Information created, received, and maintained as evidence and information by an organisation or person, in pursuance of legal obligations or in the transaction of business" (International Organization for Standardization, 2001b)

At the other end of end of the spectrum are McKemmish's suggestion that traces can form records that have a role "evidencing and memorialising a life" in the context of Giddens' 'narrative of self' (McKemmish, 1996), and Cook's observation that society's interests are served by "having expanded, vibrant, usable, and contextualized records for memory and identity" (T. Cook, 2013). The formal narrowing of the concept of the 'record' to solely business or ad-

ministrative contexts on the one hand, and pluralistic exploration of personal and community records on the other, has resulted in an intellectual debate that has raged, at least in Australia, for more than sixty years; manifesting as competing schools of practice and institutional 'turf wars' (McKemmish & Piggott, 2013).

Recognising that the ability to make, keep, and use records is an expression of societal power (Derrida, 1995; Harris, 2002; Ketelaar, 2005a, p. 10), the narrow definition articulated in our standards is one cause of the structural imbalance that leads to disenfranchisement from records. Those that are not directly 'transactors of business' may not see themselves in the records that are created and kept.

For this reason broader and unifying definitions of records have emerged; such as that given by Reed (2005c) who argues that records "stand as a representation of action", irrespective of whether this action takes place in a business, community or personal context, and that they are "a construct, always virtual, consisting of the physical object and its relationships, links and contextual information". This description like Upward's (1996, p.6) record as a "pseudo representation of [an] act" and Yeo's records as "persistent representations of activities" (Yeo, 2007), transcends the business/personal or archive/manuscript dichotomy and embraces the rich plurality of records, stakeholders and uses.

Reed is also not alone in emphasising the important point that metadata is part of the record — a stipulation that is conspicuously absent from the earlier standard. This metadata is core to the notion of 'record-ness' providing context for the trace-as-record. It embeds not only the "transactionality associated with the original creating intent[s]" (Reed, 2005a) but is key to "facilitating the life-long management, preservation, access and manipulability of the *bureaucratic record*, and in presenting and explicating the *societal record*" (original emphasis) (Gilliland & McKemmish, 2012). Recordkeeping metadata thus provides for a record's evidentiary nature — even if such notions of evidence turn out to be contingent, contested, and elusive (T. Cook, 1994; Hedstrom, 2002; Ketelaar, 2012; McKemmish & Upward, 1994; Yeo, 2007). This holds even for performative recordkeeping, where the situated recounting informs the context of the records being shared (Ross, McKemmish, & Faulkhead, 2006). Perhaps Chris Hurley articulated the relationship between trace and metadata most succinctly, arguing that records have "both content and context. The encapsulating metadata binds content to knowledge of circumstance" (Hurley, 1998).

3.2.2 From archives to recordkeeping

Historically, archival practice developed around a primary concern for the integrity of records over time, with archivists cast as "defenders of the [...] record of social and organisational activity" (McKemmish, 1994). As a result, archival institutions and the archival profession adopted a *custodial* approach, originally directed at ensuring the preservation and integrity of paper records (Muller et al., 1898, p. 14) but extended into other analogue and even digital records over the years. Interestingly, this focus is often couched in terms, originally described by Hilary Jenkinson, of ensuring the *moral and physical defence* of records. In fact, Jenkinson prioritised "defence against all kinds of dangers" ahead of "generally making [records] available for use by *students*" (My emphasis) (Jenkinson, 1922, p. 44). Physical defence is self-explanatory in the context of an archive — the preservation of physical artefacts[10] and their protection against tampering or loss to ensure their reliability and authenticity (Duranti, 1995). Moral defence, however, concerns the "defence of the sanctity of evidence" (T. Cook, 1997) for which Jenkinson cautions against the mishandling or negligence by an archivist in the intellectual treatment of records achieved through arrangement and description (Jenkinson, 1922, p. 84).

This custodial approach has led to the second dichotomy in the management of records introduced above, namely a distinction between records that are considered to be in active (often administrative) use and those that are no longer active, but retained for their historical value. The implications of such a *life-cycle* perspective are profound; one consequence being that the emphasis of archival theory and practice has become focussed on solely historical records, and the treatment of records as 'end products' (Acland, 1992; Upward, 2004). For example, Duranti (1996) traces the development of the concept of the 'archival threshold', a notional boundary over which records cross when passing from current records management to historical-oriented archiving, and the point at which "the officer of the public authority takes charge of the documents" (a process also known as *accession*). Note that this definition, while emphasising the custodial nature of the Archive, also implies an administrative purpose of records described above. Deeply embedded in this conceptualisation are the twin principles of provenance of records: that of *respect des fonds* (records that are produced or held together within the original, transactional context should remain together within an archive) and the principle of original order (that the ordering of documents as they are received across the threshold should be kept inviolate) (Duranti & Franks, 2015, pp. 288-293). Of course, such 'defence' by archivists is no absolute guarantee of authenticity and reliability; and only assures that the state of records as they are received across the archival threshold is maintained.

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[10]Even if this physicality now extends into the electronic realm and digital media.

The paradox with this approach is that, according to this paradigm, archivists (and, indeed, any stakeholder in the preservation of records) can only become involved with records after they cross this archival threshold. Such stakeholders therefore, have no role in determining what records should be created in the first place or which should be selected for transfer to an archive for preservation. Archival record-holders in this tradition are relegated to be "passive keepers of documentary detritus, Luc de Sante's 'caretakers in the boneyards of information'" (McKemmish, 1999). However, archivists can (and do) perform subsequent appraisal of accessioned records in order to further refine that set of records considered to have enduring value. This process, consolidated by Schellenberg (1956) in the mid-twentieth century, was a major departure from the Jenkinsonian emphasis on objectivity and non-interference with the record by archivists. Nonetheless, the life-cycle approach still presents the problem of how appraisal activities could or should be performed prior to records being accepted into archival custody.

The life-cycle model along with its custodial paradigm presents another mechanism by which people may be disenfranchised from their records. Stakeholders other than those directly involved in the transfer of records to an archive, have no input into how records are selected for preservation, nor any say in their intellectual treatment thereafter — save, perhaps, through the invited contribution of addenda to the formal documentation as described below.

In contrast to this life-cycle model, a *continuum* approach makes no such distinction between active and inactive records, or, at least, considers the distinction to have jurisdictional or administrative meaning, but not necessarily any conceptual value. For example McKemmish (2001) describes the continuum approach as one that can "assure the accessibility of meaningful records for as long as they are of value to people, organisations, and societies - whether that be for a nanosecond or millennia". Similarly, Bearman (1989) argues that institutional archive services could be reconstituted as the interface for both historical and current records. A major implication of the continuum approach is that all of the intellectual treatment of records, including the appraisal and documentation of records, occurs consistently and iteratively over the life of a record[11]. Ideally this intellectual treatment can commence before a record is created, involving the planning of what records should be created in the first place, with a view for their ongoing retention and management for as long as they are needed. As McKemmish stated elsewhere, "A record is always in a process of becoming" (McKemmish, 1994). The continuum perspective is obviously at odds with the life-cycle model; and together they form the second — and, perhaps,

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[11]In fact, successive episodes of intellectual control of records occurs in most life-cycle contexts anyway — albeit inconsistently and under disjoint jurisdictional control. Records are created under administrative regimes, managed through an 'active' phase through records management processes, and subsequently reviewed for destruction or preservation, in which case, they are transferred to an archive for another (usually single) round of intellectual control.

the most potent — of the three dichotomies described above; the idea of historical records as 'end product' artefacts serving to deny any ongoing 'active' value to stakeholders.

The continuum approach is clearly a *postcustodial* one — holding that the defence of the record can take place irrespective of the its physical location (if there is one) or custodial disposition (Acland, 1992; Cunningham, 2011; Ham, 1981; McKemmish & Upward, 1994). A postcustodial perspective questions the basic assumption of the life-cycle model: that possession of a record confers sole intellectual (or Jenkinsonian 'moral') authority for its interpretation and management, and gives rise to the third dichotomy introduced above. A postcustodial view is necessarily one informed by a postmodern perspective of records (T. Cook, 2001) and has been hailed as a "major transition in archival practice" (Upward, 1997). Through a postmodern lens, the principles of provenance described above are echoes of modernity's 'natural order' of things which, as Bauman (1987) argues, justify its hierarchical structures and rules of intellectual pursuit using a 'legislator' metaphor. In contrast, Bauman suggests that postmodern intellectual work is more aligned with an 'interpreter' metaphor, "aimed at facilitating communication between autonomous (sovereign) participants".

Moreover, as we transition from purely physical records to a mix of electronic and physical media, the arrangement and description of records based on physical ordering and access loses relevance (Upward, 1997). O'Shea and Roberts (1996) make the point more stridently: "in the digital world, the physical arrangement of records is meaningless", an argument that has also been expounded by Weinberger (2007) in relation to top-down-classification systems and Shirky (2005) in a critique of a-priori ontologies. This breakdown in custodial archival arrangement and description, when applied in the digital era, is another driver of the continuum understanding of records.

Continuum thinking has its roots in Australian archival practice of the late 1950's when Peter Scott, under the mentorship of Ian Maclean, developed the Australian Series System for archival description (Scott, 1966). Within this system, cross-referenced archival documentation of a record's contexts (i.e. as recordkeeping metadata) was identified as being distinct from its content, while remaining an intrinsic part of its 'record-ness'. This had the effect, in theory at any rate, of enabling the documentation of records outside of an institution's custody, with the logical conclusion that such an system could manage 'active' records as well (Hurley, 1994). Records Continuum theory was formalised several decades later; arguably maturing as a result of practice-informed theory and education at Monash University in the 1990's (Upward, 2000), and informed by Bearman's analysis of archival methods (1989), and others such as Cook's

work on postmodern conceptualisations of the archive (1994).

The Records Continuum Model is, perhaps, the most recognisable artefact of records continuum thinking. It is an attempt to address the complexities inherent in the intellectual treatment of records, and formalises continuum thinking as the intersection of postcustodial archival theory and broader sociology-based conceptions of memory and information processing. It was first articulated in its present form by Upward (1996; Upward, 1997) working closely with others such as Iacovino (2006), McKemmish (2001), and Reed (2005b) and has subsequently been published, referenced, critiqued and explored in many fora. A detailed description of the Records Continuum Model is provided in the Chapter 5 article.

3.2.3 Recordkeeping, the Archival paradigm, and structural dissonance

Thus far, I have outlined the core dichotomies that underpin some of the structural issues of records and archives, and introduced the theoretical basis upon which such issues may be understood. I can now more closely define the terminology that I introduced in Chapter 1, and that highlights the gap between existing systems and structures, and those required to address the issue of disenfranchisement from records.

Although I will refine these definitions later on in this thesis in light of my findings, for the moment I will use the (single word) term *recordkeeping* to mean all of the activity of the conceiving, creating, managing, and deriving utility from records in a continuum of use (Upward et al., 2013). The recordkeeping perspective is therefore one that is based on a continuum model of use and the postcustodial defence of records — which, in turn, may be understood as both inscriptions or performances and which may arise within personal, familiar, community, organisational, and societal contexts. Recordkeeping activities include appraisal (defining which records should be created or brought under control and identifying those that have enduring value — both as an initial decision and as a continual review as circumstances change); documentation of records and recordkeeping activities in the form of recordkeeping metadata; preservation of records for as long as they are needed; providing for the access to, and derivation of utility from, records; and performing disposal according to appraisal decisions.

The term *recordkeeping informatics* is a broad term that defines recordkeeping as an information science. It comprises both the social practices of recordkeeping and the material manifestation of archival infrastructure. It includes consideration of metadata and process modelling; standards and practice creation; and recordkeeping systems design, development, deployment, and integration (Upward et al., 2013).

In contrast, I define the *archive* perspective as one rooted in the traditional life-cycle model and custodial mechanisms of ensuring the defence of collections of records. In many jurisdictions, the archive perspective also limits holdings to those arising from administrative contexts — however with the emergence in recent times of various types of institutional and community archives, this is restriction now not as widespread.

Additionally, I occasionally use the term *archive* (*archives* pl.), to refer to any jurisdictionally bounded recordkeeping system that deals with records or recordkeeping metadata — whether historical or current — unless I am specifically discussing the archive perspective. Note that the (capitalised) term *Archive*, when used, refers to the gestalt of sociomaterial archival systems, recordkeeping practices and stakeholder behaviours. From a recordkeeping perspective, the Archive embraces the whole Archival Multiverse (see below), but it may have a narrower meaning and scope if considered from an archive perspective. Occasionally I will use the term *recordkeeping and archives* when referring to standards that employ either term in a distinguishing manner.

The variance between the archive and recordkeeping perspectives has been debated for decades now (T. Cook, 1997; Cunningham, 2011; Duranti, 1996; Flynn, 2001; McKemmish & Upward, 1994; Upward, 2000), and has confounded theory, practice, notions of professionalism, and even the language of discourse (Ketelaar, 1997). But perhaps the biggest impact of this divide has been on the design of systems for recordkeeping and archiving. The recordkeeping perspective necessarily recognises records as logical constructs — perhaps rooted in existing or anticipated artefacts (whether physical or digital) or performative acts — and a focus on the recordkeeping processes across space and through time (McKemmish, 2001). The archive perspective, on the other hand, is more concerned with the (inventory) management of collections of artefacts (again, whether physical or digital) under custodial control (Oliver, Evans, Reed, & Upward, 2010).

As can be imagined, these two perspectives inform the design of vastly different sorts of sociomaterial systems for dealing with records. I will cover the nature of such systems in the following section but, for now, it is important to recognise that, to date, the dominant (if not only) paradigm of sociomaterial recordkeeping systems design has been that of the archive perspective. In other words, despite theoretical advances and a growing recognition that the needs of stakeholders would be better served by a recordkeeping perspective, our systems continue to embody the custodial management of collections of artefacts (Reed, 2005a; McKemmish, 2017, p. 147; J. Evans, 2017, p. 661; International Council on Archives Experts Group on Archival

Description, 2016, p. 2). The ongoing problems of the disenfranchisement of stakeholders in their records are therefore directly attributable to the structuration of an entrenched archive perspective.

Now I turn to the aspects of the recordkeeping perspective that suggest an avenue for addressing such issues. Importantly, the recordkeeping perspective has been a significant input into concept of the Archival Multiverse and an imperative for participatory approaches to recordkeeping informatics.

3.2.4 The Archival Multiverse and participatory recordkeeping

The institutional approaches formalised by the time of Jenkinson and manifested in notions of 'archives as place' (Duranti, 1996) bring into sharp relief the boundaries of control, provenance, and authority that pervade the archival 'gatekeeper' role and mindset (Eveleigh, 2012). Such archival practice regards individuals primarily as record-seekers or, perhaps, in possession of knowledge that may be useful for augmenting 'official' records. Similarly, other stakeholders such as individuals, community groups, and other organisations are generally considered as potential donors of material with only other institutional archives recognised as evidentiary custodians of records.

Custodial archives are only able to accommodate a *hospitality* to 'otherness' "as long as it does not challenge inherited ways of knowing" (Harris, 2001), always remembering that "the minority is allowed to be a part of the majority, but this incursion is always controlled by that majority" (Hopkins, 2008). This institutional accommodation often manifests as attempts to engage the broader community by providing opportunities to contribute to institutional collections in various ways (Huvila, 2008). Sometimes termed 'participatory', this shallow engagement is often conceived in terms of addenda to the main collection (Theimer, 2011). Such initiatives allow the annotation or transcription of material, or the submission of additional material that complements existing holdings. For example, the 'Discovering ANZACS' web site[12] (National Archives of Australia, 2015b) enables community annotation of links into relevant parts of the national collection of World War I service and other related records. However, there is no linking back from the RecordSearch institutional portal interface to these annotations. These community contributions are not considered to be records in their own right or even part of the 'official' record and consequently are not preserved or intellectually treated in the same way as 'primary' material[13]. Such facilities have met with varied success as "simply building [such]

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[12]Originally called 'Mapping Our ANZACS' but renamed to 'Discovering ANZACS' since my research started.
[13]Often they are not held within the main recordkeeping system, as with the 'Discovering ANZACS' material. And what of ongoing management plans such as retention/disposal?

initiatives does not mean that users will come to use them" (Flinn, 2010), but, more impor-
tantly, they do not address the fundamental needs of other stakeholders with respect to their
records (Gilliland & McKemmish, 2014).

Thus, while there have been many calls for the democratisation of archives (Flinn, 2010; Harris,
2001; McKemmish, Faulkhead, & Russell, 2011), true hospitality may not be achievable within
a custodial archive. This intractability and inaccessibility of institutional archives have led some
communities to create or preserve their own records, providing services and narratives that
contrast with, and therefore complement, institutional accounts (Flinn, 2010; McKemmish,
Gilliland-Swetland, & Ketelaar, 2005). However, community archives are a replication of the
archival paradigm and custodial practice on a smaller scale; they comprise stand-alone, bounded
collections, albeit with community gatekeepers instead of institutional ones. Such an approach,
while placing some records in the possession of those, perhaps, with a greater interest in their
defence, leads to greater fragmentation of the Archive and does not address the tensions in-
herent in the archival paradigm. Similarly, in order to sidestep conflicting perspectives, some
jurisdictions simply exchange material between each other for local intellectual treatment —
i.e. an exchange of copies rather than a struggle to admit other perspectives (Institute of Na-
tional Remembrance, 2009).

More recently, the development of the postcustodial, postmodern, and continuum perspectives
of the Archive has resulted in the concept of an *Archival Multiverse* that challenges the custodial
view of " 'the one' and 'the other' [and leads] to a world of multiple ways of knowing and prac-
ticing, of multiple narratives co-existing in one space" (PACG, 2011). The Archival Multiverse
embraces the pluralities inherent in the Archive and encompasses "practices and institutions, bu-
reaucratic and personal motivations, community perspectives and needs, and cultural and legal
constructs" (PACG, 2011) as well as the physical and virtual aggregations of records themselves.

To address the plurality of stakeholder needs in records, a fundamental shift in recordkeeping is
needed to achieve a "radical user orientation" (Huvila, 2008) and a focus on how "communities
and communities of origin [can exercise] rights in terms of how they and their materials are
acquired, managed, represented and made accessible" (Gilliland & McKemmish, 2014) in pur-
suit of the re-enfranchisement of participants in their records. Such *participatory recordkeeping*
needs to be able to embody the rights in records and recordkeeping such as those declared by the
United Nations (Orentlicher & United Nations, 2005; United Nations Commission on Human
Rights, 2007), and delivery should be based on principles such as those suggested by Gilliland
and McKemmish. There is a manifest need for participatory approaches to recordkeeping across

all juristictions and demographics (Bastian, 2006; Caswell, 2009; Duff & Harris, 2002; Harris, 2002; Hopkins, 2008; Iacovino, 2011; McKemmish et al., 2011).

Unfortunately, use of the term "participatory" to describe approaches ranging from annotation of institutional collections to community archiving has resulted in the term becoming rather overloaded in the context of recordkeeping. To give another example that is distinct from the foregoing: the Find and Connect Web Resource Project (2013) can also be considered a participatory project, although it operates at arms-length from the holders of archival material. *Find & Connect* enjoys a high degree of involvement from individuals through to institutions in the creation and maintenance of a highly curated and deeply linked register of archival material.

The breadth of these examples demonstrates the necessity to map the terrain of participatory recordkeeping in order to reach agreement on nomenclature and features of such approaches. The emergence of postcustodial, postmodern, and continuum perspectives on recordkeeping, together with this broad range of ostensibly disparate viewpoints on the meaning of 'participatory', frames my first research sub-question posed in Chapter 1:

  i. *Can a comprehensive and consistent understanding of participatory recordkeeping be articulated?*

As explained above, the structures of the dominant archival paradigm do not provide space for an examination of the full implications of the participatory recordkeeping approach. Notwithstanding research that has identified issues in recordkeeping, systems and standards have not been designed to support the sort of pluralistic approach that is required. This question seeks to determine whether there is a substantive and concrete way in which participatory recordkeeping can be defined in terms of the requirements for a sociomaterial system that will reorient the structuration of records and recordkeeping.

In the following section I present an overview of recordkeeping and archival systems and standards and the way they may need to change in order to support participatory recordkeeping.

3.3 Interoperability: from systems to infrastructure

With the development of formal archival theory in the nineteenth century, archival systems employed simple descriptions of individual groupings of records. Text-based *Finding Aids* were developed to assist researchers to locate records of interest (Hurley, 1998). By the mid-twentieth century, acknowledgement of the multiple contexts of records led to the breakthrough in archival systems modelling known as the Australian Series System described above. As paper-based archival control regimes progressively transitioned into electronic implementations, Se-

ries System metadata (where it was employed) was used to document increasingly complex relationships between the contexts of provenance and collections of records[14] (Hurley, 1994). Over the last few decades, Series System modelling has been formalised through efforts such as the SPIRT project (McKemmish, Acland, Cumming, Reed, & Ward, 2000) and international standards such as ISO 23081 (International Organization for Standardization, 2006b). Many archival systems now provide web-based user interfaces structured around formalised contextual metadata schemas and full-text search of metadata elements.

Even so, contemporary archives continue to be oriented towards the custody of individual collections of records without regard to the manifest relationships between records (and documentation) that exist across the Archival Multiverse (International Council on Archives Experts Group on Archival Description, 2016; Reed, 2005a; Rolan, 2015; Upward et al., 2013). On the other hand, a recordkeeping perspective — with its postcustodial and continuum underpinnings — implies a fundamentally different systems design; one that embraces *interoperability* between individual instances in the network and encourages the interconnection of a plurality of perspectives. This interoperability between recordkeeping instances — the ability for "information that originates in one context to be used in another in ways that are as highly automated as possible" (Rust & Bide, 2000) — is a fundamental concern of participatory recordkeeping design that allows multiple voices to be heard and a plurality of rights to be exercised. How could such interoperability manifest itself in recordkeeping systems?

3.3.1 Interoperability

There are many models of systems interoperability, all of which posit a layered structure exemplified by the Open Systems Interconnection (OSI) networking model. In such a model, complex functionality is decomposed into layers, each one being serviced by the layer below and serving, in turn, the next higher layer (International Organization for Standardization & International Electrotechnical Commission, 1994). In all such models of interoperability, the layers represent increasing levels of sophistication from simple technical conventions, through complex semantic mapping, to potentially labyrinthine inter-organisational negotiation of meaning.

For example, one such model of interoperability is that proposed by Ouksel and Sheth (1999) with four such layers: *systemic* (being able to comprehend transmissions), *syntactical* (understanding the exchange of information), *structural* (understanding collections of information), and *semantic* (understanding the face meaning of information) aspects of interoperability. In

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[14]In this case, the *Series* which, as Scott argued, is an "independent element not bound to the administrative context" (Scott, 1966). This is in contrast to prior conceptualisations of record sets such as the *Record Group* and *Fonds* which were intrinsically linked to a creating context.

order to interoperate successfully, heterogeneous entities require agreement at each model layer in much the same way networked entities support the OSI functions at each layer.

Archival systems today manifest as monolithic systems that are used to describe incoming records, arrange for their preservation, and provide for orderly access by records seekers (Hurley, 2008). I use the term monolithic in this context to refer to systems conceived and executed as stand-alone repositories; an approach that is at odds with the needs of participants in records dealing with the plurality of heterogeneous systems in the Archival Multiverse. In other words, designers of these systems have not considered participant-oriented interoperability (J. Evans, McKemmish, & Bhoday, 2006; Rolan, 2015).

To give an Australian example, a number of government inquiries over the last fifteen years has addressed the trauma and ongoing affect of Out Of Home Care[15] on children and their families (Australia Parliament Senate Community Affairs References Committee, Hutchins, & McLucas, 2004; Australia Parliament Senate Community Affairs References Committee & Rosemary Crowley, 2001; Australia Parliament Senate Community Affairs References Committee & Siewert, 2009). These inquiries consistently highlighted fundamental problems in the conception and execution of recordkeeping services in Australia in relation to access to records by those impacted (O'Neill, Selakovic, & Tropea, 2012). Such issues can be attributed to a failure of archives to contextualise their role within the Archival Multiverse (O'Neill, 2012). This broader context comprises a plurality of participants in records: the subjects, creators, custodians, transactional users, and seekers of records, that encompasses individuals, families, community and advocacy groups, commercial organisations, and government agencies as well as state, religious, and charitable institutions. This continua of users and uses — from individuals to institutions, and from record creation to discovery, access, and ongoing utility — spans multiple recordkeeping systems. The failures in the delivery of services are due (in part) to the lack of participant-oriented interoperability between recordkeeping systems. In contrast, systemic interoperability within the Archival Multiverse has been identified as a core principle that needs to be upheld by public domain archival information services (McCarthy & Evans, 2012).

From this example (and, indeed, from those given in Chapter 1) it can be seen that archival institutions, in general, do not see interoperability in terms of such continua; and they have thus far attempted to address the issues of interoperability and participant support in two dis-

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[15]Some of the types of displacement, such as the deportation from the UK to Australia, or the forced adoption of children have since been discontinued. However other forms such as the removal of children from Aboriginal families, as well as various forms of kinship, foster, and residential care still continue today.

tinct ways. The first involves the exchange of recordkeeping metadata between cooperating institutions. These batch-oriented transfer mechanisms have their roots in library automation systems (Pitti, 1999) and provide for the aggregation of metadata and consolidation of finding aids among archival consortia. Examples of such arrangements include: the Trove service and HuNI project in Australia (*HuNI | Humanities Networked Infrastructure*, 2014; National Library of Australia, 2015), Europeana and the Archives Portal Europe in Europe (Archival Portal Europe Foundation, 2016; Europeana, 2017), the SNAC (Social Networks and Archive Context) and ArchivesSpace projects in the United States (Institute for Advanced Technology in the Humanities, 2016; Matienzo, 2010), and the Archives Canada network (Canadian Archival Information Network, 2011). A more modern form of this is the conversion of finding aids into linked-data documents for simple linking and querying (Niu, 2016).

The second mechanism is the use of shallow 'participatory archive' techniques described above whereby the individuals or community representatives are given selected access to tag, annotate, or provide additional material for metadata or records (Krause & Yakel, 2007; Lehane, 2006; Palmer, 2009). While some institutions are adopting such facilities (Theimer, 2011), the archive perspective does not admit interoperability in terms of the primary creation, appraisal, or documentation of material (Miller, 2000; Upward, McKemmish, & Reed, 2011), nor in regards to networked discovery and access, save for the sharing of catalogue metadata with other institutions or via linked open data as described above. What is required is interoperability that accommodates and supports the rich diversity of the Archival Multiverse and not a homogenisation of record-holding organisations.

This reticence is despite significant research in recent years that has investigated recordkeeping systems interoperability from several perspectives. For example, the Clever Recordkeeping Metadata Project took a continuum approach of 'create once – use many times' to examine the "capabilities of existing processes, standards and tools in supporting metadata interoperability" (J. Evans, McKemmish, & Reed, 2009). This project found such capacity wanting, noting the need to incorporate interoperability into systems design and standards development. In particular, the project found "that existing [metadata] schemas cannot easily be used to realise the interoperability that they advocate", citing a plethora of barriers to such interoperability (J. Evans, 2007, pp. 242-287). Similarly, one goal of the second International research on Permanent Authentic Records in Electronic Systems project (InterPARES 2) was the development of automated tools to help archivists manage, and end-users to access, trustworthy records and metadata (Gilliland, Rouche, Lindberg, & Evans, 2006). In one instance, the design and implementation of a cross-domain metadata schema registry was investigated to assist records creators

and archivists to develop and assess their own and others' metadata infrastructures. As with the Clever Recordkeeping Metadata Project, this initiative also found deficiencies in metadata standards and implementation, observing that "comprehensive and rigorously delineated metadata infrastructure (including archival description) is integral to [...] developing archival roles and services of the future". Additionally, the InterPARES 2 project determined that continuum approaches to recordkeeping informatics increase the complexity of metadata and archival description beyond that which is required for a life-cycle model.

However, there is evidence that designing interoperable recordkeeping systems is possible. The evolution of a generalised Australian Series System implementation described by J. Evans (2014) has resulted in a reusable, dynamic and customisable, hypertext-enabled, recordkeeping system based on "appropriate archival, scholarly, design, accessibility and usability principles". While this system (currently known as the Online Heritage Resource Manager or OHRM) features batch-mode interoperability in the form of OAI-PMH interchange of standardised encoded metadata, it also has been used to investigate requirements for participant-oriented interoperability and usability design. A key finding of the OHRM projects (and related projects, the Archival Data System (ADS) and Heritage Documentation Management System (HDMS) projects) was the necessity for flexible implementer-developed ontologies and, in particular, rigorous definition of metadata schema relationships.

Similarly, in my previous masters work, I demonstrated that a meta-model approach to schema design could facilitate interoperability between Australian Series System schemas (Rolan, 2015). This project suggested that formal adherence to such a meta-model could be a viable mechanism of achieving interoperability between disparate metadata schemas. In both cases, these projects determined that an understanding of information interoperability is the core to delivery of participatory recordkeeping networks.

Each of these research projects have delivered insights into archival systems interoperability, yet due to their path-dependency on legacy approaches — be it vertically integrated metadata regimes (Clever Recordkeeping Metadata Project), monolithic systems with metadata brokerage (InterPARES 2), or curated, series-system instances (ADS/HDNS/OHRM) — they fall short of directly addressing participant-oriented, networked interoperability. The reasons for this are bound up in the nature and role of the recordkeeping and archival standards that inform the design of such systems.

3.3.2 Standards

Standards attempt to establish uniformities that persist across space and through time (Timmermans & Epstein, 2010) and have far-reaching economic, technical, and social implications (Hanseth, Monteiro, & Hatling, 1996). Throughout much of Europe and the North America, archival description and metadata are tightly linked to the International Council on Archives (ICA) family of standards (International Council on Archives, 2016). These ICA standards address archival description (ISAD(G)), authority record(s) for corporate bodies, persons and families (ISAAR(CPF)), functions (ISDF), and institutions with archival holdings (ISDIAH). Matching encoding standards for metadata exchange have also been developed including the Encoded Archival Description (EAD) for ISAD-G metadata (Pitti, 1999) and Encoded Archival Context — Corporations, Persons, and Families (EAC-CPF) for ISAAR-CPF metadata (Pitti, 2004). The Encoded Archival Function (EAF) is still under development.

While ISAD-G was conceived as a formal way of specifying finding aids, the subsequent standards beyond ISAD-G were influenced by contributions by Australian practitioners with experience of Australian Series System modelling and the identification of context documentation as distinct from artefact description. Again, the structuration of the archive perspective has seen these standards largely interpreted in the context of life-cycle and custodial practice. Consequently such use of these standards have been criticised for not directly supporting the documentation of the plurality of contexts under which records may have been created (Hurley, 2005a; McKemmish, 1994).

In contrast, the Australian Series System itself requires metadata documentation in the form of schemas that explicitly declare all contextual entities and their relationships with each other as well as records (Australian Society of Archivists Committee on Descriptive Standards, 2007). Much work has been performed in the Australian context to develop suitable standards and have them adopted in broader recordkeeping practice. For example archival practice at national, state, and local levels in Australia and New Zealand has led to the development of the International Standards Organisation (ISO) standard 23081 and Australia/New Zealand standard (AS/NZS) 5478 standards for recordkeeping metadata (International Organization for Standardization, 2006b; Joint Standards Australia/Standards new Zealand committee IT-021, Records and Document Management Systems, 2013). These standards have also influenced Australian domestic jurisdictional standards, as well as international archival metadata initiatives mentioned above such as the InterPARES 2 metadata registry project, and regional archives in several Canadian jurisdictions (Billinton, 2008).

While the InterPARES 2 project found conflicts between the metadata requirements of the ISO standards and those associated with the ICA and North American practice, both Gilliland et al. (2006) and J. Evans, McKemmish, and Reed (2009) identified fundamental problems with recordkeeping and archival standards in general. I also found that current recordkeeping and archival standards (including ISO, ICA, and individual jurisdictional standards) appear to be insufficiently prescriptive to ensure interoperability (Rolan, 2015). Such standards do not prescribe the modelling of elements that are required for interoperable discovery and access by the members of the wider community.

This raises questions regarding the nature of current recordkeeping and archival standards. Are they backward-looking — designed for compliance by systems that have already been implemented? Are they able to support the development of optimal contemporary practices subsequent to their publication? Or are they aspirational, guiding the next generation of systems and process design? Arguably, while intending to be aspirational, much of standards-setting actually is of this first empirical type whereby the establishment of standards is informed by extant systems (Rolan, 2015). Such standards, by their very nature, must be accommodating of the diversity in contemporary system design or else they would have no purpose at all. They therefore take the form of conceptual 'soft' standards (i.e. containing broad guidelines) rather than 'hard' standards (i.e. comprising specific, prescriptive rules). This emphasis on compliance to a collective empirical norm is made at the expense of requiring and enforcing interoperability between conforming systems

Similarly, standards-setting must walk the line between over-determination and under-determination, both of which can serve to undermine their promulgation (Koskenniemi, 1997). Over-determination occurs when elements that would be expected to fall outside the scope of standards are, in fact, included. Under-determination is the opposite behaviour, whereby a standard's scope does not include expected elements. Star and Bowker (2007) also describe a different form of under-determination whereby elements fall within scope of a standard that nonetheless fails to address the needs or nature of such elements. This often manifests in terms of 'other' or 'miscellaneous' categories of classification or the 'brutal' semantic mapping of terms to a-priori fixed vocabularies (Lehane, 2014) that attempt to force element membership into narrow or inflexible categories with perhaps, inappropriate treatment. The complexity of standards-setting process can result in over/under-determinations that work against the aims of standardisation (Hanseth, Jacucci, Grisot, & Aanestad, 2006). Analysis of those disenfranchised by existing recordkeeping and archival standards (as described above), or instances where standards are circumvented (for an example, see Hurley (2005b)) can inform requirements for standards-setting for the Archival

Multiverse.

Finally, standards may be classified as either *Reference*, *Quality*, or *Interface* standards (David, 1987), with Reference standards further subdivided into *Terminology* and *Procedural* sub-types (Timmermans & Epstein, 2010). From the discussion above, it is clear that recordkeeping and archival standards have thus far been conceptualised as Reference standards, largely concerned with the classification of records, and striving for internal consistency within collections. Little consideration has been given to participant-oriented interoperability in the form of Interface standards. Moreover, as with J. Evans, McKemmish, and Reed (2009), I showed that effective interoperability must be designed into standards, processes, tools, and systems and cannot be easily or reliably retrofitted (Rolan, 2015).

Thus, in order for recordkeeping standards to become blueprints that encourage and sustain an infrastructural approach, they need to be developed with interoperability as a first-class design goal. The lack of such an interoperable design undermines the possibly of achieving the sorts of infrastructure required for participatory recordkeeping. At a semantic level, any record-keeping system, and indeed any interoperability mechanism it may employ, needs to have clear definitions of the contextual relationships of concern and the entities involved. These would be expressed as the documentation of records; the recordkeeping metadata modelled for, and maintained by, individual recordkeeping systems; the entities asserting those relationships; and the evidence that supports those assertions. However, the enforcement of prescriptive 'one-size-fits-all' standards (Star, 2002) is unlikely to be successful in achieving this. Instead, we should look to emergent web standards as a paradigm shift in the way we think about interoperability. In this way, it may be possible to design a networked and interoperable recordkeeping infrastructure facilitated by web-based affordances.

3.3.3 Interoperability and Web 2.0

Since the emergence of web-based practices over a decade ago, a number of standards and techniques for web interoperability are now reasonably well understood (Fielding, 2000; O'Reilly, 2005). Based on open standards and comparatively simple protocols, such approaches are fundamental to the web as an emergent platform for both collaborative interaction and systems interoperability. The broad and rapid adoption of Web 2.0 demonstrates that "loose standards with great adaptability may work better than rigidly defined standards" (Timmermans & Epstein, 2010). Web 2.0 behaviours are implemented using Application Programming Interfaces (APIs) — sets of programming instructions and standards that determine how software components should interact with each other. Using Facebook 'like' buttons on news stories, posting

blog links to a Twitter feed, and employing Google Maps to display locations are all examples of employing interoperable, web-based APIs. For example, the interoperability catalogue 'programmableweb.com' currently has more than 11,000[16] registered web applications (ProgrammableWeb, 2017).

Similarly, the use of *semantic web* approaches (Berners-Lee, Hendler, & Lassila, 2001) may be a mechanism for implementing a highly interlinked graph of the kind that may describe the Archival Multiverse. However, initial forays into the semantic web — for example, with Linked Open data (LOD) — for recordkeeping metadata have been problematic as the results tend to be extremely complex (*Mid project technical review outcomes - HuNI Wiki*, 2013; Rolan, 2015). This complexity is exacerbated by the unconstrained proliferation of LOD vocabularies such as those referenced in Vandenbussche, Atemezing, Poveda-Villalón, and Vatant (2015) that muddy the semantic interoperability waters.

Nonetheless, an infrastructural approach, together with the sort of standardisation experienced through the emergence of paradigms such as Web 2.0 and the semantic web, may achieve the necessary degree of networked, participant-oriented interoperability required for participatory recordkeeping.

The foregoing discussion of recordkeeping interoperability also begin to address my second and third research sub-questions.

ii. *What forms of interoperability are necessary to support participatory recordkeeping?*

iii. *How can an interoperable and participatory recordkeeping infrastructure address issues of disenfranchisement and participation?*

However a more complete answer to these sub-questions will have to wait until Chapter 4, in which I describe the elicitation of requirements for participatory recordkeeping.

3.3.4 Recordkeeping infrastructure

The suitability of a networked architecture for recordkeeping infrastructure was articulated at the earliest days of the world wide web (McCarthy & Evans, 2008; Roberts, 1995; Sherratt, 1996), throughout the last decade (S. Anderson & Allen, 2009; McKemmish et al., 2005; Reed, 2005a) and more recently, in support of public information systems in general (McCarthy & Evans, 2012) and participatory recordkeeping in particular (J. Evans, 2014). In one case — although squarely within the archival paradigm; and not embracing of a participatory intellectual

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[16]Approximately 11,000 in the early days of my research. Now, this number stands at almost 18,000. See https://www.programmableweb.com.
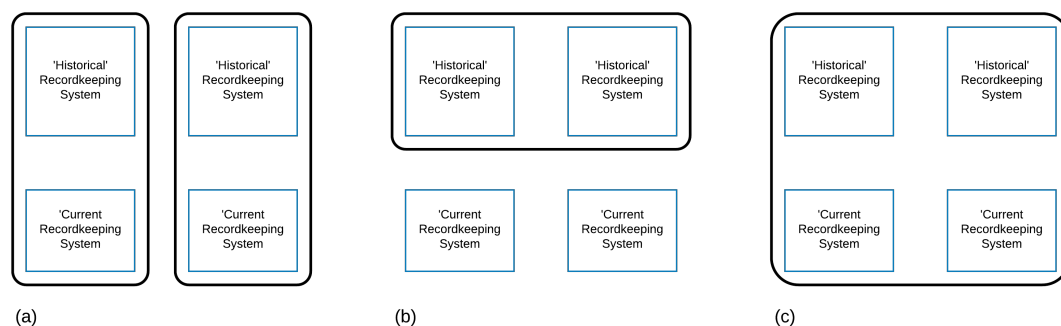
Figure 3.1: Recordkeeping systems and interoperability

treatment of records — this concept has been articulated as a distributed Archival Commons, comprising a federated network of archives with the generation and association of "links between objects using accepted Web standards". Such a space would "allow users to engage with archival materials as they pursue their own needs regardless of repository or institution" (S. Anderson & Allen, 2009). The Archival Commons, shown in Figure 3.1 (b), is usually conceived as a federation of archival systems that deal with 'historical' records; a kind of 'horizontal' interoperability of archives. However a logical extension of this concept into the recordkeeping paradigm is Reed's (2005a) 'Archiving System', which encompasses the full plurality of the records continuum as shown in Figure 3.1 (c) and better aligns with notions of the Archival Multiverse as a global, interconnected network.

Note that most recordkeeping systems do not really address records pluralisation in this way only, addressing the first three dimensions (Create, Capture, and Organise) of the Records Continuum Model, potentially, achieving the sort of 'vertical' interoperability shown in Figure 3.1 (a), to which Bearman (1989) refers in his Archival Methods essays. There is an obvious gap here between the conceptualisation of recordkeeping infrastructure for the Archival Multiverse, and the reality of archival systems and standards implementation. One reason for the difficulty in translating such requirements into a practical implementation is the lack of direct support by recordkeeping standards to guide how this could (and, indeed, should) be achieved. As discussed above, the structuration of such systems and standards continues to be a major barrier to such development. However, the question must be asked: is such a design possible or is it merely wishful thinking?

Thus, given an understanding of the problem domain and having identified networked and interoperable participatory recordkeeping systems as a possible avenue of exploration, the issue of interoperable design leads to my second research question from Chapter 1:

2) *Can infrastructural and participatory approaches to recordkeeping be addressed through trans-formative design?*

This question asks whether such recordkeeping infrastructure can actually be designed and practically implemented. I need to get down into the weeds of detail here; beyond the broad-brush visions of McCarthy and Evans (2012), Reed (2005a), and S. Anderson and Allen (2009), what would such a design actually entail, and what would it look like? Perhaps, the meta-model approach that I explored previously (Rolan, 2015) could be applied to metadata beyond the Australian Series System or even to LOD vocabularies in order to unify the heterogeneous approaches to recordkeeping. Importantly, too, this question concerns the potential for such infrastructure to bring about transformative change for participants in records and recordkeeping, address the fundamental problems of disenfranchisement from records, and establish new societal structures for recordkeeping. I address this question through articulating the requirements for participatory recordkeeping (Chapter 4), the development of functional and conceptual models (Chapters 5 and 6), and the instantiation of a proof-of-concept system (Chapter 7).

Conclusion

In this chapter I have presented the background to this research project, outlining its theoretical underpinnings, and identifying the gap in understanding that I intend to address. I have identified the structural problems in our conceptualisation of records and recordkeeping that manifest as widespread disenfranchisement of participants in records. Such issues present and justify an imperative for a new, infrastructural design of recordkeeping systems.

We must remember though that no infrastructure is value free (Star, 1999), and "there can never be an absence of violence. Any approach to, or model of, standardization which claims such an absence is seeking to fool all of the people all of the time" (Duff & Harris, 2002). If such a design proves feasible and efficacious, it is therefore necessary to understand its impact on our understanding and execution of recordkeeping itself. This, then, is the third research question introduced in Chapter 1:

3) *In what ways does my design impact (i) mainstream theories of records, archives, and record-keeping; (ii) professional practice; and (iii) transitioning to a participatory paradigm?*

This question asks how such a design informs the contemporary body of recordkeeping theory and practice. What affect does workable participatory recordkeeping have on the various discourses around custody, rights in records, provenance, and authority? What are its limitations? Where is the violence and who is affected? Remember, too, that infrastructure is built upon an

installed base — rarely, if ever, is infrastructure development a green-field project, particularly with respect to public IS. This material and temporal complexity means that infrastructure is progressed (repaired, upgraded, or changed etc.) in modular increments (Star, 1999). There is obviously a tension here between incremental improvements to infrastructure that maintains continuity of practice and service, and step-change improvements that address structural problems. Mechanisms of transition from legacy paradigms are also a necessary consideration of this question. I address this question in Chapter 8 where I present the ramifications of my findings.

This then is the core framing of my research: the intersection of the recordkeeping perspective — exemplified by a continuum understanding of the Archival Multiverse and participatory approaches — and the design of systems (and, by extension, standards) that support past, present, and future records and practices. It can be seen that recordkeeping systems interoperability is a fertile area for research, there being significant theoretical, practice, and design issues to be resolved.

Concluding remarks for Part 1

Although I present these background chapters in a logically structured way, their genesis was not so straightforward. While I always knew that I was going to perform a design science study to solve what I perceived as structural issues in recordkeeping systems, most of the details — from being able to articulate a epistemologically critical stance on recordkeeping, to the details of the research methods that I would actually employ — emerged somewhat in parallel. In Part 1, I aimed for a balance between a convoluted narrative and a simple (if not somewhat misleading) statement of 'this is what I intended to do all along'.

As I mentioned in Chapter 3, it is difficult to place myself in my frame of mind at the beginning of this research — particularly in terms of my understanding and command of the literature, which I think, has expanded over the last few years. This recreation of my journey through the framing of the research has been a bit tricky to write, particularly limiting myself to literature that was available at the time. That, together with the tension between logically building a narrative treatment of my research over the course of this thesis, and spilling it all in Part 1. There is a fine line between, on the one hand, providing sufficient background to frame the activities, backtracks, and insights described in the later chapters, and, on the other, being infuriatingly vague with a lack of substance and constant forward references enveloped in mystery.

I hope that I have succeed in the former while avoiding the latter, and that I am now in a position to describe the design artefacts in some detail in Part 2, assuming that I have made clear my research background, problem, aims, and methods.

Part II

Design Artefacts

Having framed my research in Part 1, the purpose of Part 2 (Chapters 4, 5, and 6) is to introduce and discuss the three design artefacts: the statement of requirements; the functional model; and the conceptual model. Throughout these chapters I will describe the engagement of design activities with the kernel theories; the building and clarification of concepts; my application of the research methods and systems development techniques introduced in Chapter 2, and the detail of each design artefact as well as their immediate impact on the research questions. Discussion regarding the evaluation of these artefacts as well as their broader implications will be left to Part 3.

Part 2 differs from the rest of the thesis in that two of its chapters each comprise a published article along with some contextualising introductory and concluding remarks. Chapter 5 presents the functional model published as 'Agency in the Archive: a model for participatory record-keeping' in *Archival Science* in July 2016. Similarly, Chapter 6 presents the conceptual model published as 'Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata' in the *Records Management Journal* in June 2017.

I elected to incorporate published articles as chapters of this thesis for a couple of reasons. On a personal level, I felt that I needed progressive validation of, not only my research outputs, but my ability to articulate them in a rigorous way — well before I started work on the thesis proper. Hence I went through the process of publishing these models as a part of the actual evaluation activity of the design artefacts as well as an exercise of confirmation of my under-standing. In terms of this thesis, one benefit is that this material has already undergone the sort of strengthening revision that comes from peer-review as well as demonstrating that the mate-rial is publishable in its own right. Of course, this is exactly the sort of reason that universities such as Monash promote a 'Thesis-by/with-Publication' model.

The depth of analysis required in a thesis — in contrast to the word limit and narrower focus of journal articles — means that there is a need for some additional material in each of these chapters as well as the framing of each article in the context of the larger work. My introductory and concluding remarks in each chapter serve this purpose. They also provide an opportunity to reflect on the publication process, in particular, the reviewers' reception to transformative recordkeeping design. Additionally, a little time has passed since the publication of the articles and such remarks also allow me to indicate recent developments in the material where required.

I published these articles with an eye to their future inclusion in this thesis and tried, as far as possible, to write them in such a way as for them to make sense in the context of the larger work. Note, though, that one drawback of this format is some repetition of seemingly redun-

dant material — particularly in the case of the articles' introduction and background sections. Their description of the research project, together with its background, aims, and methodology mirror that presented in Part 1 of this thesis. And, of course, the articles introduce and reference literature in a way that may seem out of place in the context of this larger work. Nevertheless, I trust that these distractions can be overlooked and that they do not unduly impede the flow of Part 2.

In contrast, Chapter 4's statement of requirements ended up being treated a little more discursively the other two artefacts; for example, it is not a formal specification for systems development. However it is an articulation of the rationale for certain design choices and is a significant step forward in understanding the wicked problem of participatory recordkeeping design.

Finally, the three artefacts correspond to the research outputs shown in the upper right of the methodology diagram of Figure 2.2 (note that, while the proof-of-concept instantiation was, indeed, an output of the design, I do not consider it to be a design artefact per-se for reasons that I explain in Chapter 7). Although the artefacts are presented as three distinct chapters, it should be remembered that design science is a highly iterative methodology, with no clear, linear path between requirements gathering, modelling, and the proof-of-concept instantiation and evaluation described in Part 3. Thus while the three chapters in this part present the requirements and two models as separate, ostensibly chronologically sequenced artefacts, the reality is that they emerged in parallel as my understanding of the problem space grew. Perhaps articulating a coherent linear presentation of such interlinked and temporally emergent material is inherently difficult; however I hope to, at least, convey the requirements that led to the functional model, and the manner in which both of these influenced the conceptual model.

Chapter 4: Requirements

We must be systematic, but we should keep our systems open.

Alfred North Whitehead; *Modes of Thought*

A good rule of thumb for successful systems development is that one should elicit a comprehensive and well-articulated set of requirements[17] (Hull, Jackson, & Dick, 2011). Similarly, as described in Chapter 2, specification of meta-requirements is a necessary first step in a design science approach. For both of these reasons, being able to articulate the requirements for transformational design of recordkeeping systems is a core contribution of this project. Consequently, in this chapter, I will introduce and discuss these design requirements. The chapter covers the different types of requirements, the methods by which they were obtained, their detail, and the implications for transformative design.

As I began this project, I obviously had some idea about the rough shape of the solution space-for example, the broad-brush outline of the issues to be addressed, articulated in Chapter 3, together with hints from my previous Masters work. As my thinking around the problem space started to coalesce, I began to keep notes regarding a 'statement of requirements' that would both inform the design and software development efforts but more importantly, become one of the design science artefacts as a contribution to understanding the problem space.

It soon became apparent that I was constantly moving between three distinct sets of requirements. The first concerned the business of doing recordkeeping design in the broadest sense in which issues of modelling, interoperability, transition, and professional acceptance could be explored. What should the scope of recordkeeping design comprise? What sort of interoperabil-

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[17]This is not to suggest that I am advocating a big-design-up-front or waterfall development approach here. This statement equally applies to agile approaches as well. The point is that at whatever level of granularity the 'next piece of work' is approached, the designer/developer needs to have a clear understanding about what is to be achieved.

ity is achievable in the real world? What sort of cooperation could the design assume between disciplines, institutions, professionals, and communities? How prescriptive should the design outputs (e.g. as standards) be? How does the complexity and breadth of design affect its uptake by the professional community? In other words, I wanted this design to be more than an abstract, academic exercise; not a 'spherical cow'[18]. I needed to understand how to design for the real world so that the approach had, at least, the possibility of being adopted. What were the design requirements for achieving this goal?

Secondly, given an understanding of how to proceed with recordkeeping design, what were the requirements for the specific design artefacts? What should interoperable participatory recordkeeping systems do and what elements of this are in need of transformational design? What did the models need to represent? What should be their constructs and internal relationships? These are, of course, the meta-requirements traditionally given as an input to conventional design science research.

Lastly, I needed to determine requirements for the proof-of-concept instantiation. What aspects of the design needed to, or indeed could, be evaluated? What affordances and behaviours should the instantiation exhibit? This set of requirements is closer to a traditional software specification. However, because these requirements pertained to a specific instantiation that exercised a subset of the functionality of the models, they lie outside the meta-requirements that inform the design itself. The scope and features of the proof-of-concept instantiation are discussed in Chapter 7.

The rest of this chapter is structured to explore the first two sets of requirements that, together, form a design artefact. In both cases I used different methods in an attempt to consolidate the experience of others' work in the field into a coherent set of requirements. In the following sections I will describe these methods; the elicited requirements or insights themselves; and any immediate issues that impacted the design activities.

4.1 Patterns and Anti-Patterns

The first set of requirements, those concerning the process and scope of the design exercise itself, can be considered in terms of patterns (and by extension, awareness of anti-patterns) in interoperable recordkeeping systems design. I have borrowed the term *pattern* from the software engineering community — who, in turn, had appropriated it from the urban planning and architecture and architecture community. In this sense, a pattern is a recurring abstraction or

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[18]The term 'spherical cow' comes from a science joke about overly simplistic models. The joke has taken many forms; one example can be found at http-//www.physics.csbsju.edu/stats/WAPP2_cow.html .

behaviour that manifests in a variety of contexts, amidst numerous competing concerns, and that results in positive outcomes (Appleton, 2008). I take the term pattern to represent some sort of 'best practice' in recordkeeping modelling and systems design that is conducive to usefulness, adoption, and ease of implementation. Anti-patterns, then, correspond to 'lessons learnt', pitfalls to be avoided, and aspects that, while they may seem commonsense or unavoidable, turn out to be less than useful or even inhibiting to the endeavour.

Save for the occasional reflective pieces by individual designers (for example, Pitti (1997); J. Evans (2014)), there is little literature concerning the practice of transformative recordkeeping design from which generalised patterns/anti-patterns could be derived. In this instance, I felt that the first set of requirements would be best elicited directly from designers involved in similar endeavours. To this end I conducted a series of interviews in mid 2015, with participants purposefully sampled for their domain expertise.

I was keen to meet with members of the International Council on Archives (ICA) Expert Group in Archival Description (EGAD) as their project had similar goals as mine — albeit from a narrower, archive perspective. The EGAD members had been selected for their prior experience and this, together with the fact that EGAD itself had been running for three years by the time I held my interviews, meant that this group possessed a wealth of expertise into which I could tap. I also engaged with other academic or professional experts in order to obtain a broader perspective beyond EGAD. I chose European experts partially for opportunistic reasons — I was scheduled to attend a conference in Europe at the time — and partly because I had already had done some work within the Australian and North American jurisdictions and felt that exposure to the European perspective would be broadening and complimentary.

A list of the interview participants and their roles at the time of the interviews is shown in Table 4.1. It should also be noted that the participants were interviewed as individual, professional experts. In the transcripts that follow, their views do not represent any organisations with which they were affiliated at the time of the interviews.

Table 4.1: Requirements interview participants.

Name	Notes
Geoffrey Yeo	Honorary researcher in archives and records management at University College London
Jaana Kilkki	Director of the Collections Management Division and Deputy General Director, National Archives of Finland; EGAD member
Bill Stockting	Head of Content and Metadata Processing South at The British Library; EGAD member
Florence Clavaud	Responsable des référentiels documentaires, Archives Nationales de France; EGAD member
Kerstin Arnold	Research associate, Federal Archives of Germany; Archival Portal Europe work package "Europeana interoperability" lead

As described in Chapter 2, these semi-structured interviews were recorded for later transcription, complimented by the notes I took during each interview. The interviews themselves were based upon the instrument reproduced in Appendix A, however the interview protocol often strayed into conversation (Feldman, 1999) or even a kind of yarning (Bessarab & Ng'andu, 2010) in order to rapidly build rapport and move beyond the formal interviewer/participant setting. Even though this form of interaction came naturally to me, I did spend some time casting about for a methodological justification for this departure from traditional interview protocols. It was only when talking with colleagues working on indigenous recordkeeping that I realised that some qualitative methods such as yarning, conversation, or even friendship (Tillmann-Healy, 2003) that have gained recognition in recent years (albeit in indigenous research contexts) were remarkably applicable to the way I conducted this research. So it is from such traditions that I borrow these more flexible qualitative techniques for interactive information seeking.

I would usually commence an interview by offering a potted history of my background and interests and then ask the interview participant to give a brief description of their career or path to their current role. This approach is similar to the Social Yarning protocols that involve the swapping of 'bona fides' (Bessarab & Ng'andu, 2010). For example, I would usually make 'settling-in' conversation and then open up with something like:

> "[Greg:] So I'll explain a little bit about what I'm about and we'll take it from

there. I'm a PhD candidate. I've actually worked most of my life in IT...

[Bill:] OK.

[Greg:] ...building systems and doing things.

[Bill:] Thank you, us archivists need and continue to need that sort of input, as I am sure you are very aware..." (Bill & Greg)

It is this "entering judiciously to let the interview participant know that you 'have been there'" (Ely, 1991, p. 61) that can lead to the opening up of a conversation space (Dean, 2010). For example, later on in the interview with Bill Stockting about openness in archival documentation, we are having a real conversation.

[Greg:] I like your term about 'throwing out hooks' to bring them in. In Australia, there's all sorts of institutions; there's only two APIs in Australia. One is the National Library, which a big aggregator...

[Bill:] Trove.

[Greg:] Trove.

[Bill:] Which is fantastic. Whenever anybody says here 'what do you want?' we all look and say we just want that. (Laughs)

[Greg:] (laughs) [...] We want to bring people in though our portal which actually is counter productive in bringing people in.

[Bill:] I agree.

[Greg:] [...] And all these institutions say, 'we are the centre of the universe, come to us, and look at our stuff'.

[Bill:] Give it twenty years and the institution won't functional any more.

[Greg:] Yeah! And I think there's this protection... this collection view. Like you said, end-users don't care...

[Bill:] No.

[Greg:] ...about the collection boundaries and anything that an institution does to prop up these collection boundaries is counter productive.

[Bill] I think it's partly the nature of what we think of as professionalisation..." (Bill & Greg)

Such conversations would continue; prompted, if necessary, by questions taken from the semi-structured interview instrument. At all times I tried to be careful to not dominate the conversation or lead the answers. Such recounting and swapping of anecdotes and viewpoints — sometimes in agreement, other times in opposition — can be considered to constitute Research Yarning (Bessarab & Ng'andu, 2010). I am convinced that this process led to deeper exploration of the patterns/anti-patterns in the interview participants' experience than would simple narrative accounts as answers to interview questions. In doing so I beleive that I gained deeper insight into the structuration of recordkeeping systems design, than I would have done so with such accounts of surface phenomena.

Interestingly, keen as I was to keep the interview on track, there were times where I interrupted the flow to voice agreement or re-focus a discussion. Upon transcribing the interviews, however, I noticed that, although at the time I may have felt the conversation was digressing, in hindsight I should have kept quiet. Often when playing back the interviews, I felt that I interjected too often. This is a risk of a conversational method where, even with the best of intentions, the researcher still has preconceived ideas about what should transpire (Ely, 1991, p. 60).

> [Bill:] I think the argument is that we cannot manage it, we cannot manage it in that way. We cannot do the boring things about capturing, managing, and to that we should — as our library colleagues, in a sense, always have done, — maybe we should be looking for information...

> [Greg:] (taking advantage of a pause) It's interesting how you phrased that before, so maybe in fact whether you actually describe something in ISAD-G, or in CIDOC-CRM, or whatever is actually more to do with the disciplines and the business of the institution...

> [Bill:] It may well do...

> [Greg:] ...more than the consumer perspective...

> [Bill:] It may well do...

> [Greg:] So CIDOC may support the business of being a museum and the sort of activities they perform.

> [Bill:] I think to the extent that you can practically use it, I think that CIDOC-CRM is wonderful. (Continues to talk about museum standards)

In this example, while discussing a view of a corpus of material to be mined for information, I was keen to steer the conversation towards requirements for (interoperable) metadata. Although Bill continued with a valuable comparison of metadata standards, I think that, by interrupting, I missed some insights about the practical documentation of material.

I transcribed the interviews myself and then analysed them using NVivo11. The analysis codes were derived in a somewhat grounded manner (Herring, 2013). Although I did have some preconceived ideas about the high-level codes from my research questions and literature analysis, the subsequent levels of sub-codes emerged organically from the material. These codes are shown in Table 4.2. Note that my intent here was not to perform an in-depth grounded analysis of the interview material, but to divine any common patterns/anti-patterns for recordkeeping design and interoperability.

Table 4.2: Requirements interviews analysis codes.

Primary codes	Emergent secondary codes
Access	Authorisation beyond Public; Google; Linked Open Data; Portals; Rights
Archives 2.0	As a means to overcome resource constraints
Interoperability	Design; Quality; Reproducibility; Traceability; Trust
Modelling	Conceptual differences between disciplines Relationships-as-context; Relationships-as-entity; Modelling VS implemenation
Multiple viewpoints	Aggregations of records; Archives VS manuscripts dichotomy; Authorities; Community archives; Identifying stakeholders
Practitioner Attitudes	Organisational Politics; Participation in design process; Professional Politics; Readiness for change; Acceptance of change; Understanding of conceptualisation/models/modelling
Resourcing	Additional resources needed for richer documentation; General resource constraints; Resourcing differential between disciplines; Sources of funding
Standards	Depth of description; Incremental VS transitional change; Process of standards setting; Types of standards
Transition	Stages of Documentation; Incremental VS transitional implementation; Technical Readiness

4.1.1 Interoperability

As discussed in Chapter 3, J. Evans (2007) describes a litany of barriers to interoperability that stem from inadequacies in recordkeeping standards and systems design. A starting point was therefore to explore the manner in which recent endeavours[19] may have attempted to address, or at least, work around such obstacles. In the interviews I attempted to discern patterns in contemporary participant-oriented interoperability of the type described in Part 1.

What I found, however, was that the pursuit of participant-oriented interoperability was not reported; nor was participatory recordkeeping on any mainstream agenda. While this finding was arguably reassuring in that it supported my research contention of a design gap to be addressed, it was disconcerting that these issues were not in view for any of the practicing interview participants (and, by extension, the institutions that they represented). Where interoperability with external systems was being addressed, it was in relation to the establishment of metadata-exchange with specific institutions or large aggregation services. In the European context these were local institutions such as libraries or museums, local jurisdictional aggregators; for example, the UK Archives Hub (Jisc, 2017), the Archival Portal Europe (Archival Portal Europe Foundation, 2016), or the broader Europeana project (Europeana, 2017). I was curious regarding the reasons for this situation. After all, wasn't the bulk interchange of metadata old news; a solved problem? I was expecting to hear of burgeoning Linked Open Data (LOD) projects (especially as the Europeana data model was ostensibly a LOD conceptual model) — not struggles with bulk-data exchange.

It is interesting to note though, that my expectations were, to some extent, a product of cultural conditioning. I had a working assumption that all jurisdictions would at least be aware of the problem of the fragmented multiverse as described in Part 1. However, not every European jurisdiction is faced with a fragmented or heterogeneous recordkeeping network. For example, the (comparatively mono-culture) Finnish social contract based on trust of centralised services has led to a ubiquitous recordkeeping infrastructure that is not only greatly standardised, but highly centralised as well.

> "But their idea is to give those records to the institutions that are there already. I have been the one there who has been talking about participatory ideas. They themselves are more institutional. And I was wrong. We have a community of Jewish people, we have a community of Cathars. Their records are here at the National Archives. [. . .] The basis of this difference is in the different system of

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[19]It being almost a decade since the Evans investigation.

society. In Finland, in Nordic countries, the government is present everywhere and everybody expects the government to fund what they are doing. [. . .] For example, the archives of the private companies, they don't get funding from the companies, they get funding from the government." (Jaana)

Where possible, all of the other jurisdictions represented in the interviews were exchanging metadata in the form of EAD-encoded finding aids. The 'where possible' qualifier is important here as such capability was certainly not ubiquitous. At the time of the interviews, and despite the breadth of the APEx project, some institutions were struggling to achieve even this level of interoperability. For example, the British Library was in the throes of commissioning their first generalised data sharing interface, while the Archives Nationales de France system (designed in 2009, commissioned in 2013) had no capability for metadata exchange.

> "Interoperability, we can discuss from different perspectives. For the perspective of the archivists it would be good if we could connect our system to the ones of the ministries. [. . .] But there is no data exchange between the systems. This is the first problem. Another problem is that we need to exchange data with other institutions, cultural institutions to enrich our data. The main one, it's not the only one, the National Library has for example has a lot of authority records on people or institutions. And we are currently trying to align these records with ours." (Florence)

Moreover, even with EAD as the 'lingua franca' of these closed aggregation environments, the variability of recordkeeping metadata provided by participant organisations had led to the sorts of problems described by J. Evans (2007). All of the other practicing interview participants described various difficulties in metadata exchange, even given this narrowed scope and with this low bar of standardisation. Notably it was only Kerstin who couched this in terms of a lack of interoperability — in her case, between the various APEx participants — resulting in very shallow sharing of metadata. She noted that this situation was only marginally more effective than individual holdings being indexed directly by search engines such as Google.

> "And I think that it might also be a question of interoperability with regard to what do institutions provide to such portals. Because you could also say, OK your portal just gives the first access point and then everything relates back to the various web sites of the providing institutions. But then [. . .] you could also just type the name of the institutions that you might be interested in into Google and find the web sites directly." (Kerstin)

As in France, there often appeared to be a gulf between archival institutions as well as institutions from different disciplines that wished to interoperate. For example, integrating the archives and manuscripts catalogues at the British Library was still a work in progress — even at a conceptual level.

> "So we've still got a separate archive PAC, a separate instance for our archive management material rather than the main online catalogue and that's also a job still to do. And part of that is us trying to understand the relationship between the two types of data." (Bill)

Of course, the Finnish environment provides an exception to this divide, additionally demonstrating a cross-disciplinary and infrastructural approach mindset.

> "I think that what is very specific, peculiar in Finland today is that libraries, archives and museums make very deep cooperation and work together. [...] It's an infrastructure. It's an architecture. [...] And it's especially those ontology services that is the practical means of harmonising the different descriptive metadata practices of libraries, museums and archives." (Jaana)

It seems that the barriers described by J. Evans (2007) are pervasive and can extend into many aspects of recordkeeping including conceptualisation and modelling; professional and organisational readiness; and paradigms of recordkeeping systems design. However, as the Finnish example demonstrates, these can be overcome. Similarly, the SNAC project in the U.S. (Institute for Advanced Technology in the Humanities, 2016) specifically extends metadata exchange to include contextual relationships vie EAC-CPF encoding. Even my previous masters work (Rolan, 2015) demonstrated the possibility of integrating Series System metadata. Why was much of Europe 'stuck' trying to do batch exchange of encoded finding aids? What are the patterns (and anti-patterns) that can be discerned from these jurisdictional differences?

Part of the answer emerges from analysis using a framework such as the Ouksel and Sheth (1999) interoperability classification introduced in Chapter 3 (that defines systemic, syntactic, structural, and semantic layers of interoperability). For example, consider the use of EAD encoding of finding aids as an interoperability-enabling technology. Originally, EAD was developed as an analogue to the bibliographic MARC format (Kiesling, 1997) with the goal to support the "long-cherished dream of providing archivists and both professional and public researchers universal, union access to primary resources [...] which will enable users to discover or locate archival materials at any time and from any place" (Pitti, 1999). However, as Kerstin explains in relation to her work with EAD3, this dream has proved elusive: "With EAD being a rather

flexible framework that allows for adaptation to one's own circumstances, needs and purposes, the EAD instance from one institution does not necessarily equal the EAD instance of another institution" (Arnold, 2014). Moreover, the practicing interview participants reported varying use of EAD.

> "The SIAF recommends using EAD, you know it's not compulsory. I mean the local archival institutions are directed by the district, the local administration. So the local administration has some quite important freedom, they have a sphere of autonomy." (Florence)

> "We have decided to create our own profile of EAD. So we are not using EAD-2002 as it is in its complete variety but we are using it in a more concise but still flexible enough version." (Kerstin)

> "So at the moment we have our native XML in our system which isn't anything. [...] Why we didn't use EAD I don't know, but there we are. [In the new interface] we have a number of different flavours of EAD. So obviously we have an EAD single so you can just get the description itself. [...] And so you can basically ask for particular descriptions so the EAD, the full EAD you want then provides that and all of its children and the children's children." (Bill)

It is clear that EAD encoded finding aids (along with an exchange protocol such as OAI-PMH) support systemic, and possibly, syntactical interoperability. However, the "vexing looseness" of EAD[20] renders it unable to support semantic interoperability (Shaw, 2001). While it may be useful for finding-aid exchange in highly constrained contexts, EAD appears to be a poor choice for more generalised finding aid interoperability. But this doesn't answer the larger question: why, have some jurisdictions progressed their recordkeeping documentation while Europe and North America, for the most part, maintain the primacy of finding aid documents? Perhaps it comes down to the conceptualisation of the nature and purposes of recordkeeping metadata.

4.1.2 Conceptualisation and Modelling

The interviews, together with prior work described in Part 1, suggest that differences in capacity for interoperability can be considered in terms of a kind of maturity of conceptualisation of recordkeeping. One manifestation of such maturity is the development (and/or adoption) of recordkeeping metadata standards that reflect progression in conceptual modelling: from

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[20]And, of course, this looseness derives from ISAD-G, the standard for archival description for which EAD was designed to encode. Note, too that the looseness of ISAD-G was deliberate in order to allow for the extant diversity of finding aids.

finding aids to conceptual schemas. This conceptual trajectory can be characterised in terms of (at least) three developmental stages; the approaches taken in the various jurisdictions can be considered to lie somewhere along this tripartite spectrum[21].

Stage 1 — Artefact description

In the first stage, recordkeeping documentation is conceived as description of records-as-artefacts. This is the realm of a finding aid (Hurley, 1998); a largely textual and positivist description of material together with a curated narrative outlining the content and background of the artefact (or, more often, aggregation) in question. This is the conceptualisation expressed by the ISAD-G model and EAD encoding (Pitti, 1997). Due to its looseness of specification and artefactual focus, this perspective provides little scope for interoperability and even less opportunity for participatory approaches to recordkeeping.

> "We haven't got that. Because it's capturing a finding aid. And lots of younger American colleagues really are moving on from that, they really are. And for many years, having arguments just about, well, we have to bring people into the finding aid. The finding aid is sacrosanct. There's no other way in other than the finding aid." (Bill)

Stage 2 — Artefact-Actor modelling

The second stage involves documenting contextual entities that exist separate to material being described. Here recordkeeping documentation transcends curated text to encompass structured data models that manifest as metadata schemas such as those implementing the Australian Series System[22], the International Standards Organisation ISO23081 (International Organization for Standardization, 2006a) and, more recently, the Records In Contexts (RIC) model currently under development by the EGAD (2016). Such schemas are discussed in more detail in Chapter 6.

> "There was no understanding of the important of the larger contexts. There was only the agent. The agent and the functions are the basic access points. And you should in description sort of break those fonds in a way that you could link them to the actual record creators and so on and so forth." (Jaana)

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[21]Note, although I arrived at these stages from consideration of existing standards, conceptual models, and the interviews, Jaana Kilkki discussed a similar three-stage formalisation that had some parallels with mine. In her doctoral work on Finnish archival practice she was using postmodern discourse analysis to explore power structures in the Finnish recordkeeping context.

[22]The key word here is 'implementing'. The Australian Series System itself is not inherently Artefact-Actor — all it really specifies is that there are one or more contexts associated with a record and they should be modelled as such. Rather, the *implementations* of the Series System have been based upon Artefact_Actor conceptualisations. The reasons for this are discussed further on in this chapter.

This modelling is still artefact-oriented. However by introducing a formal treatment of actors and the 'business' functions they perform, its constructs reflect essentially modernist conceptualisations of provenance — Hurley's "Doers, Deeds, and Documents" (2008). This is somewhat akin to the use of classification schemes that constrain the field of discourse to a knowable set of 'things' (Shirky, 2005), that often give rise to inhospitable schemas (Star, 2002; Star & Bowker, 2007) or 'brutal' semantic mapping to fixed vocabularies (Lehane, 2014). Such metadata modelling begins to lay the foundation for the sort of interoperability with which I am concerned, but its expression in standards lack the necessary formalisation (especially of relationships) for it to be achieved (J. Evans, 2007; Rolan, 2015).

Stage 3 — Activity Modelling

The third stage is the recognition of records as representations of human activity as described in Chapter 5. A record may represent many activities and any activity may be represented by many records. Such conceptualisation is less concerned with the nature of records as physical artefacts, than with facilitating the expression of human activity and participation — including involvement beyond purposeful enactment (e.g. directly and indirectly affected parties, victims, bystanders etc.). Indeed, this approach also allows for other types of documentality (Ferraris, 2006) such as personal memory and performance. Notably, such a conceptualisation, requires a recordkeeping perspective that embraces the pluralities of the Archival Multiverse and the performative nature of recordkeeping as understood by records continuum and other postmodernist recordkeeping theorists (T. Cook, 2001; McKemmish, 1996; Upward, 2005b). Activity Modelling has yet to make its way into international recordkeeping standards; some of the reasons for this are discussed below and in the Chapter 8 discussion.

Here, again, the Finnish jurisdiction is ahead of the pack and beginning to embrace this third stage:

> "And what we are thinking now that we will do with this model, we will add the Temporal Entity and make a relationship between activity and Event." (Jaana)

Significantly, activity modelling embraces the ontological incommensurability of disparate world views allowing all participants in records to be represented and potentially participate in recordkeeping activity. If modelled well, such metadata should be able to facilitate interoperability at all levels of the Ouksel and Sheth (1999) classification. In this respect, the Finnish are yet to make the leap to actually supporting multiple sets of documentation from different perspectives:

> "But [a] more practical thing, discussing with you know has made me realise that there are perspectives for this agent authority record that I haven't been thinking about." (Jaana)

From the foregoing, it appears that most of the European Union recordkeeping jurisdictions that lie under the Archives Portal Europe umbrella are firmly established at Stage-1 while possibly beginning to explore Stage-2 conceptualisations. Anecdotally, that was my perception of the thinking in a large proportion of North American practice. Both of these contrast with the Australian experience where half a century of Series System practice has resulted in mainstream — but by no means universal — Stage-2 approaches. Canada, too, has embraced Stage-2 documentation in a number of jurisdictions[23]. Significantly, Stage-1 approaches were still being implemented in Europe long after limitations in it's usefulness were identified.

> "They are based on the ISAD-G hierarchical; they don't answer the present need. So for practical reasons also we would really desperately need a new metadata system. But this decision was done — I am sure it was the best decision at the time — but you can say a big mistake was done when we started to digitise records and we linked them, the metadata is the metadata… the descriptions for the traditional paper material." (Jaana)

> "But when we made the catalogue, the decision was made to just follow ISAD-G. This, of course, was a mistake. I was young and rookie enough, and not good at making decisions enough, to sort of go along with it. And, in fact, that pragmatism, was about getting, you know, senior management to sign off about not appearing to need this real search object to have to be about real users and real departments. But, nonetheless, it was still a mistake. And there we are. So we actually mangled these contextual departmental histories, sort of slapped them on top of… as a fonds-level description." (Bill)

Nonetheless, the interviews showed that there are those trying to affect change, and the EGAD Records in Contexts initiative is an international example of this. Consequently, despite slow progress in the field and somewhat less than successful implementation, some patterns did emerge as aspirational design objectives.

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[23]The Keystone Archives Descriptive Database of the Archives of Manitoba is an implementation of the (Australasian) Series system of recordkeeping documentation. In particular, this system holds the documentation of the Hudson's Bay Company Archives. See http://pam.minisisinc.com/pam/search.htm

Activities

As suggested above, the shift from artefacts and agents to activity was foreshadowed by the originators of the Australian Series Systems (Scott, 1966) and taken up by postmodernist and continuum recordkeeping theorists decades ago. The Stage-3 view recognises that "behind a document is the need to document [. . .] the action, the process, the broader function of the records creator" (T. Cook, 1994) and many of the interview participants operate from this perspective.

> "We also have, in the archival world, the Function, Business, Activity concept. I think for records managers this is a key concept, for any archivist this is a key concept because when you arrange a fonds you have to understand what kind of activities the creator has." (Florence)

> "Because when talking about archival description from a theoretical point of view then you are talking about something that is always starting from the activity. And if your starting point is not activity, then it's not in the strict sense archival description." (Jaana)

However the modelling of activities remained problematic for a number of the interview participants. While Jaana went on to clarify the difference between activity and the more formal definition of functions, others had difficulty reconciling the various activity perspectives relating to a given record.

> "The thing that makes Activity and Function different is Mandate. That mandated activities are functions and it's exactly what you were talking about. And it's a big problem in this description that the government functions are very formal and so on. And the same thing from a perspective of the private person who takes part in this function is totally different." (Jaana)

> "A rule can regulate an activity or apply to a purpose. And purpose and business is something of a class also. So we begin to play with these three things we see. I think purpose, activity and business can, in fact, be the same. I mean have a super-class. We don't really know, now what we do with this."[24] (Florence)

This aligned with some of my early modelling work — particularly the need to have some sort of activity-related super-class together with sub-types that represented different variations of activities. I also noted the fundamental relationship between activities and mandates.

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[24]These have since been reconciled within the EGAD RIC conceptual model.

Relationships

> "For me the value is in the relationship. That's where the value is, that's where the
> work is. It's about the travelling. So, again, I see this in very pragmatic terms. For
> me it's about the user, coming in, with a name; or a place; or a subject; or, you
> know, and starting somewhere. [...] It's about people being able to travel and so,
> in terms of that, in terms of, you know, bringing it back down to sort of hard user
> functionalities." (Bill)

The idea of relationships as formal elements of recordkeeping conceptualisation is not new. The
relationship (even the relationship as an entity in it's own right) figures heavily in Series System
implementations and jurisdictional metadata standards as well as international standards such
as ISO23081 (International Organization for Standardization, 2006a). Unsurprisingly, most of
the interview participants stressed the importance of relationships in conceptual recordkeeping
models for a number of reasons — to clarify the recordkeeping perspective; as the key to se-
mantic interoperability; to facilitate discovery and access; and to make explicit the shift towards
multiple viewpoints for recordkeeping.

> "Certainly people who, you know, I think it's going to show the obvious entities
> and the key relationships between them. We will stress those relationships which
> are archival, rather than all the possible relationships." (Bill)

> "These relationships, they are the archival perspective relationships. For example,
> if you compare this with the FRBR or the RDA model, the relationship between
> agent and material is totally different than from archival perspective. [...] It's
> not the entities, the entities are the same and they are pretty much semantically
> the same. But we see the relationships differently from museum, archive, and the
> library perspective." (Jaana)

However, the specification of a typology of relationships in a conceptual model is different
from enumerations of allowable relationship names that commonly occur in standards-related
schemas — for example, the Australian Government Recordkeeping Metadata Standard (Na-
tional Archives of Australia, 2015a) and even the first draft of the EGAD RIC model circulated
for comments (International Council on Archives Experts Group on Archival Description,
2016). Because these enumerated relationships have no semantic form, they multiply in re-
sponse to constantly emerging edge-cases or the ever-changing and subtle differences in the ac-
tors and activities they relate. Rather, a number of the interview participants support my con-

tention that, in order to achieve semantic interoperability, relationships need to be tightly constrained to a (small) number of relationship super-types that possess semantic meaning (Rolan, 2015). This is an extension of the meta-modelling principle of abstraction that aims to preserve interoperability in the face of local variation (van Gigch, 2014, p. 238).

> "And so you still have the general part that everyone agreed on and that is interoperable and then you would have sub-branches to that would allow specific domains to also include their data" (Kerstin)

Linked Open Data

A natural consequence of relationship modelling is the ability to express such relationships in terms of Linked Open Data representation for discovery and access. All of the interview participants were enthusiastic proponents of such an approach, however they did not see LOD as necessary for semantic interoperability but, rather, for (simplistic) discovery and access.

> "And, you know, I say we developed a relational model [. . .] I can see the potential. Particularly I think for archival material; particularly because of its specialness, and that 'record-ness'; that stuff, within a linked and open world. I get that. I can see the power in that. (Bill)

> "What I would like is that we add semantic web or something, a linked data module to our system in order to show our data as graphs. I think they are very natural graphs." (Florence)

> " You want technology to at least help you. So if, and these are all ifs, if the direction that we want to go in is something that looks at linkages, that looks at relationships between entities [. . .] somewhere along the line there will be tools coming out of [semantic web] work that we can take advantage of. If these tools materialise in the way that I think they will, and hope they will, then we have the basis on which to move forward." (Geoffrey)

Whilst I take note of the desire to participate in the broader semantic web, I will return to this topic in Chapter 8 because I feel there are significant issues with respect to the mapping of complex relationship entities to simple LOD triples.

Aggregations of Records

All of the interview participants highlighted the potential for new conceptualisations to break free of the constraints that physical media had placed on previous recordkeeping modelling.

This is not a new argument, (Weinberger, 2007) but it is significant that challenges to the primacy of physical arrangement in archives are now appearing in mainstream thought.

> "The paper world doesn't seem to offer any alternative, or any obviously workable alternative to collective organisation; collection management; and collective delivery to the customers. Whereas the digital world does, I think, allow alternatives. [...] There are still issues about context, about provenance, about the understanding of material which we must not lose. But perhaps what we lose is the assumption that the only way to protect those contextualites is by, kind of, solidifying the particular aggregations and say 'this is the Joe Bloggs collection, it's contextualised because all this stuff, arranged in this particular hierarchical order in some sense is a one-to-one reflection of Joe Bloggs and what he did in his life'. When, quite clearly, its whole bunch more complicated than that." (Geoffrey)

> "The idea of conceptual fonds was forgotten and the idea of conceptual model of fonds was turned into physical fonds. My understanding is that all the problems that can be now identified; all the things that should have been differently are based on the fact that what we originally thought to be conceptual was understood as physical." (Jaana)

Several recent conceptual models already mentioned (for example EGAD RIC, and the Finnish conceptual model (National Archives Service, 2013)) eschew the formalised hierarchies of records and aggregations (for example, Fonds, Record Group, Series etc.), and instead model generic 'record' and 'record-set' types. These generic types ultimately comprise records and a variety of formal and informal aggregations — either pre-established by those documenting records, or by the system or end-users aggregating records in response to some sort of query or other criteria.

> "And that's why, in this model fonds will only be a type. There is no fonds entity or series, or item. There is record and record set. If you want to use fonds, it is a type of record set." (Florence)

> "But archival record set would be made of archives or records and can also be of course record set for many archivists will be the series or fonds of course, but the idea is to also say that a record set can also be the one the end user generates or what the system returns to it." (Florence)

Even so, I still had problems with this distinction (between record and record-set) given the nature of multiple perspectives on recordkeeping. For example, not only could different parties have different ideas about what constitutes a record, but a single record from one perspective could be considered an aggregation of records from another, Having a record documented using different primary entity types from different perspectives would impact interoperability. I expand on this in Chapters 6 and 7 in terms of the model and the evaluation of the proof-of-concept instantiation.

Ontological Modelling

So it appeared that a formal conceptual model is central to transformational recordkeeping design, if only for reasons of interoperability, putting aside for the moment the concerns of participatory recordkeeping. In addition, what was apparent from the interviews was the importance of moving from empirical design based on past practice to one based on semantics; to take an ontological view of recordkeeping that transcends the face-value concepts borne of dealing with material.

> "And this I suppose ties in very much with something I said just now about theory and how it sometimes tends to get derived from particular practices. Because, quite clearly, it seems to me, what has happened over the years, is that the practical necessity of managing the stuff collectively has become transmogrified into some kind of principle that's how you have to do it: 'if you don't do it that way, you're not a proper archivist'." (Geoffrey)

> "We want to build the interoperable — what we would call semantic, whatever — we have to go to the more abstract level. [...] We have to analyse what type of entities and what type of relationships we have in libraries, museums, and archives, otherwise there won't be semantic interoperability." (Jaana)

I believe this is core to the transformational nature of design. To start again at first principles in the context of a new conceptualisation. I touch on this again in the section on standards-setting below.

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Interestingly, all of the interview participants acknowledged the disconnect between Stage-1 standards, systems, and delivery of services on one hand, and more mature conceptualisations of recordkeeping on the other. A common claim was that this was due to the reluctance of recordkeeping professionals to embrace change.

"I think we, and by which I mean archivists, in the past have too often felt that it is possible to come up with the definitive answer; this series is part of this fonds and that's how it is. [...] Whereas it seems to me the question is if I think that there is a relationship between this and that, what makes me think that? Do you agree with me? Do you see it differently? If so, why? I mean, there are a whole bunch of these questions that kick in. And they're not going to be easy ones to answer." (Geoffrey)

"But like I said, when I was discussing the whole postmodern perspective with [the EGAD delegate], he said to me 'I agree with you about everything, but the profession is not ready for these thoughts'". (Jaana)

How does this lack of readiness manifest? What impact does this have on recordkeeping design? Can we learn anything from the efforts in other disciplines? Or to turn it around, given that I intended to subject my design to expert evaluation, what did I need to put in place for it to be understood and accepted?

4.1.3 Readiness

Each of the interview participants indicated that adoption of new paradigms suffers impediments from a number of perspectives.

"Very often, huge amount of effort has gone into designing things that [...] cannot actually be sold out there in the real world because the political obstacles, the cultural obstacles, the financial resource — I don't know what they are, probably all of these things and others as well — are just too great to shift. And we, by which I suppose I mean the archives and records profession, has only got so much ability to try and move entrenched positions and that, I think, has been a big difficulty." (Geoffrey)

It appears that the barriers to the adoption or diffusion of new perspectives originate from a number of sources — from the professional practitioners themselves; from the organisational context; and from the technological characteristics or limitations of existing systems. This is a significant issue that impacts the transition to new infrastructure as described in Chapter 3. Care must be taken to address such impediments in order to ensure that any transition effort is conducted in a consistent manner and, once started, does not falter.

Professional Readiness

Part of this entrenchment, perhaps, can be ascribed to generational attitudes and practices of recordkeeping professionals. Additionally, the sort of change that transformational design brings about requires fundamental shifts in the world views of practitioners that may appear at odds with the conceptualisations upon which they have built their career.

> "I firmly believe archivists are strange beasts in that we are different in every genera-
> tion, what we do is different in every generation, the principles we follow shouldn't
> be, but the activities we carry out are different because we should be doing whatever
> it is necessary to pass it on to the next generation." (Bill)

> "When we talk of this, maybe we cannot always say it's a shift because for some
> people it's not so easy to imagine or some may be scared." (Florence)

And even if resistance to a given conceptual shift gives way to acceptance, practitioners may become entrenched in the new paradigm or toolset rather than remain open to higher-order principles.

> "What I would say, at that time, in '94, everybody was very sceptical about it, this
> is not going to work and so on. And now they are all doing their work according
> to those rules and they are all saying about this, the next phase, this is not going to
> work." (Jaana)

Perhaps this is due to the abstract nature of conceptual models, or even a lack of education in the sector on how to 'read' a model (Hofman, 2017, p. 648). Either way, all of the interview participants highlighted the importance of model instantiations or even comprehensive tools that explicate new approaches. This suggests that it is not the change per se, but the leap from conceptualisation to practical implementation that may be the stumbling block.

> "We are in a phase that everything is now, like you say, against our traditional
> thinking and we have to change the thinking. But also when we are talking about
> the person doing the description and doing the things — they are not interested
> in theory. They will then take the tools and then things change. It's not showing
> them these models and discussing all these issues theoretically. They just say that
> I just don't understand anything about this. But when they get the tools, then the
> change happens." (Jaana)

> "We also need to be able to explain our way of seeing things. Not only for our

systems, for the linked data. [. . .] For example, software editors. We need to give them some sort of model to build upon it, tools etc." (Florence)

Regardless of how a design is created, the important thing would be to get to a proof-of-concept as early as possible in order to engage the community and short-circuit debates around paper models.

> "So part of what I wanted to do was to get it and see what happens. So searching, that data, pulling off what ever they want there; groups of researchers; other partners. [. . .] It's a very pragmatic thing." (Bill)

> "When you don't know anything about techniques, you may say I cannot see anything of this and I cannot see what it means and what it brings to me. So again I think proofs of concepts as something to invest in. And even if it comes to nothing, being able to see you have learnt something. You just have to try and see." (Florence)

While this observation is somewhat obvious — and, actually, is the basis for design science instantiation and evaluation — it does have bearing on the process of development of recordkeeping standards, which I discuss below.

Organisational Readiness

Additionally, limitations imposed by the organisational context present barriers to the adoption of new paradigms. The first of these is a contemporary side-lining of recordkeeping and the corresponding downward pressure on operating and project budgets. Funding cuts and shortfalls were reported by all practicing interview participants. However, beyond the this absolute level of funding is, perhaps, disconnect between management expectations or understanding and emerging needs of the recordkeeping mission.

> "In a lot of organisations, the records manager is not in control of their own destiny and 'Yes, I would love to do this, but I'm told by my boss that I can only do X so I'm sorry, but. . . ' And that, I mean, that issue happens everywhere, all the time because, sadly our profession doesn't have the level of clout that pushes it up to the point where it's always able to call its own shots." (Geoffrey)

Consequently, the organisational recordkeeping mission may be cast in terms that may be at odds with professional objectives.

"We live in the real world, and the real world demands results at levels that are not always levels we would want them to be at." (Geoffrey)

"There was a real focus on metadata cataloguing, projects where I talked about ISAD-G and the second version of ISAD-G, and ISAAR. Lots of conversations about those things in the profession here. [...] But focus has been taken away because employers and funders want what? Access and availability and local interaction, working with schools, and all of those things are absolutely right. But it's meant that, you know, the cataloguing has sort of [diminished]." (Bill)

"We have had a very large role in records management previously but as part of the whole government information infrastructure. And because of the budget. We've had very big budget cuts and we don't have the resources. So we have to start to... Our duties, our functions have to be accommodated to the finances we have."
(Jaana)

Many of the interviews noted how other cultural memory institutions — particularly libraries and museums — have been successful in securing greater levels of funding. Perhaps the story that these institutions are able to tell is simpler (Bastian, 2017), however it remains that we have done a poor job of advocating for the recordkeeping role in an organisational, if not broader, societal context (Gilliland, 2015; Oliver, Evans, Reed, & Upward, 2009).

How greater, then, is the challenge of advocating for change — in particular transformational or conceptual change. Moreover, initiatives that appear to be change for change's sake can easily be discounted. It is an old saw, but communication needs to be in terms that align with the prevailing management culture and organisational view of the nature of problems to be solved (Snowden & Boone, 2007)[25]. Unfortunately with recordkeeping regarded as an overhead or, at least, treated as a net cost centre, justification needs to be made in terms of a business case — either for financial or compliance reasons. Improved recordkeeping service provision, however we may define it, appears to not figure prominently in mainstream management agendas.

"If you can't tell them that story, then you suddenly find your budgets drying up. So harsh practicality kicks in. [...] Brilliant, fantastic, we'll digitise all of our stuff and put it out there. And we'll be able to tell management what a wonderful job we've done in putting that stuff out to the entire community and they'll be so

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[25]The reference given here regards the Cynfin framework that describes various domains of operation in which organisations may find themselves. While management has a tendency to operate in simple or complicated domains (i.e. able to wield 'best practice'), transformation fits squarely in the complex domain of 'unknown unknowns'. Messages suitable for one domain may be inappropriate for others.

pleased with us. In the short term that worked, but in the long term the end result
was fewer users in the reading room and then the budget gets cut, so you know."
(Geoffrey)

"And, you know, part of that problem I say is the business case for why do people
want this data? What do they want to do with it?" (Bill)

Of course there is a tension here because 'business' benefits may not necessarily be quantified
a-priori. In an interconnected world, network effects result in emergent opportunities and
successes (O'Reilly, 2005). One way of approaching this is through the instantiation of models
as a path to their acceptance in the management context. Once again, dwelling on theory may
be less useful; and practical demonstration, perhaps with familiar data as I describe in Rolan
(2015), would bolster an argument for change.

"That's why here we need a proof of concept. I think it's the only way to deal with
this. As we cannot share the idea really and we have also for this project, when I
have proved it, we will have to write reports to communicate." (Florence)

One opportunity for communicating the benefit of transformational shift is through addressing
the fear of management (and indeed members of the recordkeeping profession) that increasing
documentation complexity in the face of reduced funding is a fools errand. Perhaps this is a
very reasonable fear given the older paradigm of description.

"We have a backlog of about seven kilometres of unprocessed private archives. [We
have a] policy that, in principle, defines three levels. So that the highest level is,
of course is a very thorough description and a very detailed arrangement. And the
lowest level is called inventorial level [. . .] and the level of description is such that
they can be ordered and accessed electronically. In practice we don't have resources
to do anything but the inventory level." (Jaana)

"You're trying to produce something that is more fully reflective of the records and
their contexts; but you're also trying to produce something that is much more com-
plicated and much more resource demanding than that kind of thing that you were
doing before. And you're wanting to do that in the situation where you probably
don't have any more resources than you had before, so you're tying yourself in a
knot." (Geoffrey)

However, in Stage-2 and Stage-3 systems, context is formed via creating relationships with other
entities — many of which will already exist prior to the documenting of a particular record.

Thus the effort to create contextual entities is amortised over the many records to which they will be connected. The net result is that, despite the richness of contextual documentation the total effort to document records under the new paradigms should not increase.

> "Many people commented when you have all these entities and all these relations that means more description. But sort of, again, the devil is in the detail, the vision of this all is that you [. . .] describe the material, those attributes that describe the material. [. . .] Everything else is authority services which are described together. Making the contexts for the material is mainly making those relationships; not describing anything in a traditional way." (Jaana)

Of course there is still a technical impost in shifting to new paradigms. A number of the practicing interview participants noted technical preconditions that need to be in place for such change to be effected.

Technical Readiness

Such preconditions constitute a final set of barriers to change that result from the path-dependent technological implementations entangled with entrenched perspectives on recordkeeping. In particular, the typically stand-alone systems that implement Stage-1 models often do not provide some necessary precursors to interoperability and the effort needed to get the data 'into shape' may be non-trivial (Prongué & Schneider, 2015, p. 127). The necessity of moving from textual finding aids to schema-based documentation necessitates the breaking out of elements into distinct entities and forming links between them. It is not uncommon for mature systems to have insufficient interlinking between elements that can be leveraged in a networked world.

> "We have the national bibliography expressed as triples but we don't have that archival dataset expressed as triples yet. And one of those issues is that we haven't really got links." (Bill)

> "We have been discussing a lot about either using EAD as a basis for linked open data or doing an RDF variation of our data set so to say. But we haven't gotten yet into the specifics of defining something that actually could be used as the basis for a test implementation for instance." (Kerstin)

> "I think they are very natural graphs. In our system online we have no such representation of data. We have links between records and between records and finding aids." (Florence)

And even if some relationships are in place, through the use of ISAAR-CPF or some other schema, another problem is the absence of globally persistent and unique identifiers for records and other contextual metadata entities. Stand-alone systems often do not have such identifiers assigned; Even in a web-portal environment, system administrators may even treat URLs in a cavalier manner — even though the impact of changing URLs has ramifications in the broader, web-connected, recordkeeping world (Laurent, 2016).

> "And, OK, you've got the relationships between them, and you've got, you know, where it's available, you've got hooks back to the context — that's great. But, none of this is expressed in terms of FOAF. And you haven't got VIAF or any other identifiers in it. You know, the things that are necessary in a linked, open world." (Bill)

> "It will be also the time for us to, for example, discuss the question of URIs. Because our system doesn't provide any persistent URIs. For example, you know, we have no namespace. We don't use ARK." (Florence)

The APEx project has addressed this problem through the use of internal (to the project) identifiers that combine an institutional id with the internal (to the institution) identifier. Of course this doesn't guarantee uniqueness or permanence, but quality checks can be set up on ingest to catch a number of problems. Note that checking incoming content against existing data is not applicable in the open, network paradigm described in Part 1 where recordkeeping systems may not even be aware of one another. In the absence of such quality checks, systems need to be able to rely on the permanence of others' identifiers.

In summary, those intent on transformational change need to embrace a sociomaterial strategy in order to overcome all of these barriers. In particular, such change requires assistance of technology in order to explicate concepts; assist with the transformation of data; and to overcome resourcing issues.

> "I firmly think if we haven't got (a) the will to do it and (b) the technology to help us, we're not going to get there. Without the will, we're clearly not going to shift. If we have the will but not the technology, then we're going to hit the resource issue." (Geoffrey)

4.1.4 Standards Setting

As discussed in Part 1, a major mechanism for the development and promulgation of new paradigms is through the process of standards development, and the use of standards them-

selves. It is not uncommon for this process to be fraught (Timmermans & Epstein, 2010) and, unsurprisingly, each of the interview participants expressed dissatisfaction with current mechanisms of committee-based recordkeeping standards-setting. In particular, the EGAD member interview participants, while supportive of the constitution and leadership of the group, expressed frustration at the slow pace of their process and the tensions that emerge between members. International standards setting is difficult enough from a language and cultural perspective (Oliver, 2014) and obviously such tensions may arise from different perspectives on the standard begin developed — whether the focus should be on the standard's Reference, Quality, or Interface aspects and whether the standard in question should be oriented toward compliance, best practice, or be aspirational as described in Part 1.

> "…they're all written by committees. And it usually shows. And on any committee you're going to have some guys who are going to want to push the frontiers and some guys saying we must take account of existing things." (Geoffrey)

However what was apparent from the interview participants' examples is that standards committees can easily comprise delegates with different conceptual understandings. Standard-setting-by-committee will be extremely difficult unless everyone is trying to solve the same problem (Popper, 1994, p. 35). In the context of the three stages described above, members may actually be working at cross-purposes, and attempts to clarify these conceptualisations may, in fact, significantly impede the deliberation process[26] resulting in the sort of under-determination of standards described in Chapter 3.

> "In the group that has built this model, there are representatives from private archives and all the other people are from — no, no we had some government agency recordkeepers there too — but it's very widely in the community of archives here. And those archivists that come from private archives, they don't understand functions at all. And they even sort of contest this, which I think is the basic theoretical conceptualisation that records are expressions of activities or functions." (Jaana)

> "And part of that for me — and again talking about the American community, but also talking about the UK community and other communities — it's pedagogical. It's about having that there and people having to begin to think about it. A different way of describing." (Bill)

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[26]This also accounts for the problems that Australian delegates to such committees have had in trying to introduce both records continuum and Series System concepts into standards. For example, see Hurley (2009).

> "And there was one situation where there was a room full of people, but in the
> end there were just two people discussing about how to name one certain aspect in
> order to really have the same understanding of it." (Kerstin)

> "That makes me think of the discussions on EAD3 you know, the latest version.
> We had… I am involved in the development team for this standard and what we
> wanted, some French colleagues and some European ones and I was to go further,
> far further. And we had to fight to explain why and there was no way out and the
> [other] way was adopted." (Florence)

A similar criticism is often made by members of the broader community that haven't been
included in the standards-setting process (Timmermans & Epstein, 2010). I discuss some of
these issues in Chapter 8 in relation to feedback solicited by the EGAD RIC team in the con-
text of this research. The ensuing compromise from a committee-led process means that such
standards are often under-determined (Koskenniemi, 1997, p. 574) — particularly when there
is a needed change in the underlying conceptual mode. If standard-setting is going to be at all
aspirational, then its design work may well need to be transformational. Some interview par-
ticipants also highlighted the large investment in time that such standards-setting requires, with
the implication that "the heavy costs of such activities can and do prevent the most compe-
tent experts from participating in standardization work" (Thévenot, 2009), further diluting the
standardisation effort.

> "I think we also have a problem with the model of working, within the ICA. I'm
> not sure, I think that this may be a step too far. This may be the last effort which
> is done as a group of professionals trying to fit it in. I think we need to find some
> money and employ someone and still sit as a committee. And would validate and
> would, you know, process. Would write the requirement, would have, you know,
> specced." (Bill)

An interesting comparison may be made with much of the internet experience whereby small
teams or even individuals develop simple interoperability protocols that are rapidly iterated
through real-world implementation, and subsequently widely adopted at internet scale (O'Reilly,
2005). Perhaps recordkeeping design and, importantly, standards-setting could take a similar
path to the internet community's experience. Alternatively, perhaps a formal steering com-
mittee could engage a small team to actually do the design work with the outputs earning the
imprimatur of the professional body. While this may not avoid the issues entirely — after all,
the steering committee would have to agree on the design requirements — it may prove to be

quicker and lead to more transformational outcomes.

One risk, however, of an insular expert design is that the design may become complex and increasingly detailed over time. The quest for a 'correct' design may lose sight of real-world constraints and result in the over-determination as described in Chapter 3. Such a disconnect from real-world issues is a criticism that is sometimes levelled at the CIDOC-CRM project, often held as an example of a modern conceptual model and pushed from some quarters to embrace cultural heritage concerns beyond the museum domain.

> "I think to the extent that you can practically use, I think that CIDOC-CRM is wonderful. But, remember, I use that practitioner [perspective]. It may become an information management tool. Certainly, in this country people use SPECTRUM and more prosaic standards [. . .] And yes, it's an extraordinary thing, the CICOC-CRM and, in a sense, I know they want it to be for everything." (Bill)"

> "[About CIDOC-CRM] they say exactly the same thing. This is brilliant but we can't use it. We haven't got the resources to do this stuff." (Geoffrey)

> "And again, but partly again, my pragmatism is about pedagogical things. If we create, you know, some spaceship model... we're talking to archivists around the world here. It's not going to be CIDOC." (Bill)"

The challenge for me seemed to be to develop a design that was both lightweight and transformational, and to get real feedback from a variety of perspectives. Of course this is not a new approach, but one that fits well with iterative design science.

One other issue that keeps being raised in the context of recordkeeping standards setting and conceptual modelling is the impact of convergence between cultural memory disciplines and the potential for the appropriation of their concepts, standards, and/or technologies.

4.1.5 Comparison and Convergence with Other Disciplines

Certainly metadata schemas from the other disciplines — for example CIDOC-CRM from the museum sector (CIDOC Documentation Standards Working Group, 2013) and FRBRoo in the bibliographic space (International Federation of Library Associations and Institutions, 2016) have matured from their cataloguing origins inasmuch as they now explicitly model temporal concepts such as activity and events. However they are Stage-1 or Stage-2 conceptualisations, with the activity metadata only concerned with the creation, use, or curation of artefacts. The bibliographic schemas aim to document the "path from the initial idea for a new work in a creator's mind to the physical item in a user's hands" (Bekiari, Doerr, Le Bœuf, & Riva, 2015),

while the museum schemas are concerned with documenting the "historical, geographical and theoretical background" (Crofts, Doerr, Gill, Stead, & Stiff, 2011) of collections and items. Note, however, that even within the CIDOC-CRM, the activity class comprises actions intentionally carried out by actors that result in changes of state in the cultural, social, or physical aspects of the items documented. Similarly it only deals with physical (and not performative) representations of other entities.

Even so, are there concepts or parts of design that we can appropriate from other disciplines? It is clear that, especially in the digital era, there are opportunities for convergence at many levels between disciplines. However with opportunity come challenges and even dangers in assimilating disparate world views (Bastian, 2017, p. 342). Perhaps, as several of the interview participants pointed out, not only is recordkeeping conceptually distinct from other cultural heritage disciplines (Bastian, 2017; J. Evans, 2007; International Council on Archives Experts Group on Archival Description, 2016, p. 331), but its Stage-2 and 3 conceptualisations are more complex.

> "Yes, another way of saying this is that archival science has some inherent complexity I think. One of the answers could be this- It's — I don't want to say that, for example, libraries have no problems — when you have to describe a book it is quite easier than when you have to describe an archival set. You have to consider the whole and the parts. It's... the rules for describing books were published in the sixties and since this time there have only been some evolutions... For archives, it's a kind of longer process." (Florence)

> "...we did have some meetings with some colleagues from the CIDOC-CRM community and also had some attempts to see if we can align something a little bit. But it concentrates on a few elements where we can really say OK this is something where we do overlap and the standards like Title, the ID of the unit, and possibly dates. But it often stops there. [...] Because, to some extent, they are just too detailed, and to another extent they are slightly aside of the concepts or understandings that would be there in the archival world of certain parts of the description." (Kerstin)

Moreover, several interview participants pointed out that bibliographic automation has been around since the 1960's. In fact, it is possible that the close proximity of the archival professionals to their librarian colleagues leading up to the introduction of recordkeeping standards has muddied the waters.

"And you can trace the influence of library standards, as I am sure that you have done, in RAD, in the different US standards, in MAD and in ISAD-G — you'll see it there as well. And then you add into that mix what we were talking about just now, the number of archivists who are working in libraries, so again you're exposed to the library view of the world. In North America, the first automated systems used by archivists came from library systems suppliers. To an extent that happened here in the UK, but less so than in North America but nevertheless it did happen here. You've got this kind of information-centric, content-centric view which has some influence, and indeed, deserves some influence because archives have content." (Geoffrey)

Nonetheless, the interview participants all supported the contention that integration of metadata between other disciplines is highly desirable for a number of reasons — not only through the mutual use of authoritative metadata schemes, but due to the added value of the archival perspective (Bastian, 2017, p. 345). Additionally, different metadata may be presented to end-users depending on the perspective needed — for example as a statement of responsibility or, alternatively, as one of contextual provenance.

"The library is very interested in our data because we are used to describe our creators in a very precise way. We have only a few thousand records but they are rich." (Florence)

"…there's a lot there that can be useful, but is not useful if you don't understand those contexts. And some of our library colleagues [. . .] begin to understand, actually there's lots of things we can produce entities and certainly objects [for. . .] Some of these things are, you know, not just ours. So, you know, places aren't just ours. Subjects, you know, well OK they're not ours either. People aren't ours, but we probably make some special demands and so we privilege them in our description. And it's quite important again for us to say that when we have conversations with other people because that contextual relationship is so important." (Bill)

The take-away for me here is that I need to explicitly consider interoperability of metadata beyond the recordkeeping context. As Bill explained above, even though all disciplines, and the recordkeeping profession in particular, lay claim to the 'specialness' of their perspective, much material and metadata may be used for recordkeeping purposes. In fact (and digressing slightly) most of the interview participants, echoing Duff, Carter, Cherry, MacNeil, and Howarth (2013), felt that tighter integration between disciplines needs to happen on a profes-

sional level as well.

> "…is archives a profession? Will it be a profession in ten years' time? How does
> it relate to records management, information management? Are records managers
> now really information managers? Are we information managers as archivists? I
> would say yes we are, I would say we have specialists. But then how do we relate
> to librarians? How do we relate to museum people? And what about their pro-
> fessions? And, in a sense, and people will probably find this as absolute heresy; I
> don't care what my label is, as long as the material is OK. And I think we need to
> re-think that." (Bill)

> "I myself see the future that there will be a need for specialised records expertise,
> but not a separate profession of records managers or recordkeepers and librarians."
>
> (Jaana)

Returning to interoperability, most interview participants saw the lack of an established record-
keeping conceptual model as a major barrier to interoperability with other disciplines and high-
lighted the need for such a model from which mappings to the other schemas may be made[27].
The interview participants saw such interoperability in terms of discrete mappings between
schemas — for example via services such as the Finnish infrastructural ontology broker men-
tioned above or a generic metadata broker of the sort described by J. Evans, McKemmish, and
Reed (2009).

> "I want to map our concepts to CIDOC, to FRBR, and also to PROV-O, to FOAF,
> to also there are other ontologies for example on organisations, you know, and so
> on. […] We don't need any of the entities that are here but need to build bridges.
> The strategy is to work from the archival point of view for the moment, and then
> to map." (Florence)

> "And the other problem is that we are… we have no reference model and that's
> why we need this ontology. For libraries you know FRBR, for museums there is
> CIDOC-CRM, but these are not usable as they are for archives." (Kerstin)

> "I think the problem with the conversation was that archivists, we weren't ready to
> have the conversation with them, because we didn't have an official statement from
> the ICA that said, you know, 'here we are, here's as it were our first go at this, an

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[27]Even though, perhaps on a jurisdictional basis, such conceptual models do exist — albeit without the necessary
affordances for interoperability. For example, though not internationally accepted (or even recognised), the SPIRT
schema (McKemmish et al., 2000) and Records Continuum models may be regarded by some as suitably detailed
reference models.

official statement of a conceptual model'." (Bill)

And even if the particular constructs from other disciplines are not directly applicable to record-keeping design there were some aspects of relevance to my project. Furthermore, there seemed to be consensus that common item-level description, can be shared between disciplines (for example as ISAD-G or RDA documentation). From this I understood that item-level description did not need to be a high priority in my design work.

4.1.6 Summary

The interview discussions were wide-ranging and covered a broad swath of the sociomateriality of recordkeeping. Despite being unable to find examples of participatory recordkeeping or participant-oriented interoperability, there were a number of patterns that could be identified in relation to the process and dissemination of design; barriers to change; and broader issues of intoperability. A summary of these can be found in Table 4.3.

Table 4.3: Summary of interview findings.

Participant-oriented interoperability is not widespread if at all in regular use. Similarly, there was no evidence of major participatory recordkeeping initiatives.

There are at least three degrees of conceptual maturity in recordkeeping- Artefact description; Artefact-Actor modelling; and Activity modelling.

Differences in conceptualisation are an impediment to the diffusion of designs; the development of standards; and, ultimately, the acceptance of change.

Transformative recordkeeping design must embrace the modelling of activities; semantic relationship super-types; flexible aggregations of records; and Linked Open Data. Modelling must proceed from an ontological basis to transcend the limitations of empirical perspectives.

Interoperability is needed between systems from disparate disciplines.

Conceptual differences between disciplines preclude the use of their conceptual models — although some entity types can be borrowed along with standards for entity description (e.g. Bibliographic RDA).

Interoperability requires (a) links established between contextual entity types; and (b) globally unique and persistent identifiers.

Instantiation of models is needed to both explicate new conceptualisations and demonstrate their practicality. Different instantiations may be needed for practitioner and management audiences.

4.2 Participatory Recordkeeping

As explained in the introduction above, the other set of requirements concerned the design artefacts themselves. What do participatory recordkeeping systems need to do and what affordances do they need in order to support participation and participant-oriented interoperability? Arguably the best way to determine such requirements would be through co-design with actual participants in records and recordkeeping (J. Evans et al., 2015). However I faced two problems with this approach. The first was that the participatory recordkeeping problem is so wide-ranging in all its manifestations that divining meta-requirements from multiple individual projects would be an enormous task. Secondly, I had neither the budget nor the time to form the kind of relationships needed — with even a small subset of participants — in order to elicit their requirements in a trusted co-design environment. Instead, I turned to the literature as a proxy for such engagement with individual participant communities and sought a Literary Warrant for my detailed requirements for participatory recordkeeping.

The nature of the relevant literature and my warrant process is explained in detail in the Chapter 5 article (and to a lesser extent in the Chapter 6 article). In summary, sources were gathered using a snowball approach for purposeful sampling (Williamson et al., 2013, p. 345) from seminal works or works by prominent archival researchers. Additionally, functional descriptions of public information systems supporting community or participatory approaches were likewise investigated. Finally a survey of issues from the last 5 years of journals including *American Archivist*, *Archival Science*, *Archivaria*, and *Archives and Manuscripts* were analysed. A total of 26 publications and the functional descriptions of 5 generalised systems were found to contain significant statements in relation to participatory recordkeeping. These sources are detailed in Appendix B.

Each source was analysed for statements that described or implied systems functionality relevant to participatory recordkeeping and coded using the QSR NVivo11 tool. The conceptual codes were guided by the description of records management processes drawn from in section 4.3 of ISO15489 (International Organization for Standardization, 2001b) along with some general codes. Not all of the ISO15489 records management process descriptions were used for coding as they were either not germane to the problem of schema modelling or were subsumed in other codes in this context. The final coded categories were- Overall architecture and design; Access Control (with sub-codes: Authentication, Authorisation, Reproduction Rights Management, and Tracing and Audit); Appraisal; Creation; Documentation; Discovery; and Retrieval.

I must admit that, in writing up these requirements, I struggled to find a way to express them

beyond a large set of declarative statements and to develop prose that would provide engaging reading. Therefore the following is a brief summary of the main points; while a complete list of the requirements and their justification from the literature is provided in Appendix C.

4.2.1 Overall architecture and design approach

(Summarised from Appendix C, Section C.1)

As described in Chapter 3, the suitability of a networked architecture for recordkeeping infrastructure has been articulated in various ways over the last twenty five years or so. Effective participatory recordkeeping is concerned with pluralities of records, of systems, and of communities — in a sense, the network of individual socio-technical systems is 'the system'. While not all functionality will be supported by every system in the network, collectively the distributed systems must exhibit interoperability and standardisation to facilitate network-wide support of participatory recordkeeping.

Records and documentation need to be exposed in such a way as to allow interlinking between distributed systems. However, the distributed nature of the system places an onus on system designers and operators to be especially vigilant and "respond to and protect against potential vulnerabilities, particularly those relating to privacy and security, that might be exposed" (Gilliland, 2014c).

Central to the concept of participatory recordkeeping is the idea of stewardship with the record-keeper as facilitator rather than a custodian or gatekeeper. Stewardship, with its twin goals of preservation and access that facilitate shared memory, treats archival material less as property and more as a jointly held cultural asset[28]. The system needs to separate the ownership and control of records from stewardship activities and support archivists in relinquishing control in a structured manner and fostering collaboration.

Thus, the system needs to be a safe space for a 'conversation' around records rather than the presentation of 'given' material. It must therefore exhibit hospitality to all participants alike. Such hospitality may be effected via 'virtual spaces' that can be configured to support differentiated rights. It manifests in various ways: the upholding of rights of all participants; the ability to hold alternative viewpoints, sub-narratives and counter-narratives simultaneously; striving to not 'shoe-horn' material, viewpoints, or participants into pre-conceived categories; pursuing the de-marginalisation of groups and avoidance of 'speaking-for' them; and transparent operation

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[28]Iacovino (2011) notes that changed attitudes towards property rights are needed to fully embrace this idea. Whether or not the current intellectual property paradigms (principally copyright law) are appropriate for archival material is a whole other matter and beyond the scope of this argument.

for all participants. The participant workflow is important in this context; the system needs to provide mechanisms for identifying and/or accepting nominations for participants and for the determination of their status.

One of the foundations of hospitality is the design of interfaces that are as simple as possible, while facilitating distributed and pluralistic documentation and access to material. This is not to say that the system should be simplistic, just that open systems need to pursue clarity (rather than jurisdiction-oriented complexity — see interoperability above). Key factors in global simplification, of the type that underpins emergent Web 2.0 technologies for example, are the following of global standards for representation and information interchange, together with the allocation of persistent identifiers to resources. Similarly, hospitality is also enhanced through the flexibility of system design, embracing material in a variety of formats and languages, and providing for the flexible definition of community protocols (for example for access) while acknowledging that these will evolve and promulgate over time.

4.2.2 Access control

(Summarised from Appendix C, Section C.2)

One of the major differences between traditional archive portals and participatory systems is that while the former generally have two levels of access (full access to all material by archivists; and public, read-only access to a sub-set of materials by everyone else[29] — see Reed (2014), J. Evans et al. (2015), and, as an example of the affect of such regimes, Wilson and Golding (2015)), participatory recordkeeping calls for granular and flexible authentication and authorisation regimes. The requirements for access control may be considered according to three interdependent aspects: Authentication (who is the participant?), Authorisation (what can the participant do in the system?), and Reproduction Rights Management. Additionally, from an integrity and provenance perspective, records of changes to material and metadata need to be kept and made available.

Flexible authorisation controls need to be provided at arbitrary levels of granularity — both in terms of the resources accessed and the participants who are authorised for access. This includes not only discovery and retrieval, but the creation, annotation, restriction, or deletion of material, and the setting of the access controls themselves. While authorisation of access to material needs to be dependent on the contexts of creation and exposure, it should be noted that cultural and privacy rights are not absolute. For example, privacy rights may need to be tempered by

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[29] Of course this generalisation does not take into account other mechanisms such as the shallow participatory affordances described in Chapter 3 or other paths to access such as requests under Freedom of Information or similar legislation. The point is that the primary portal-based access mechanism for archival material is generally two-tiered.

the need for accountability for past actions. A core aspect of participatory recordkeeping is that all participants, not just the record stewards, determine the access controls to be applied to their material both within an electronic system and in respect to any represented physical material. It should not be assumed that communities, families, or other participant groups are homogeneous; meaning that the system needs to support the negotiation of competing access rights between multiple participants.

Similarly, individuals within groups may have different perspectives on access, and may delegate responsibilities to others. Note that the conditions of such delegation may change over time or according to the status of the delegator or delegates. Where no explicit authorisation definitions have been nominated by participants, the default public access mandated under Archival legislation should be provided. However, the access control regime must be implemented in a transparent manner, employing documentation that explains the reason(s) for prevailing access control with respect to a given record.

The access control regime should span distributed systems, however, issues of privacy and cultural sensitivity scale differently when material is aggregated from multiple, networked systems. The system should ensure that the original intent of access controls within the local context be preserved. Additionally, the system should ensure that material that could compromise privacy, national, or corporate security is not inadvertently exposed even if this requires encryption of material to ensure access only by authorised participants. Given the need for granular access control, it is necessary to be able to verify the identity of participants that require access at arbitrary level of granularity, including individuals, families, communities, organisations or other groupings of participants. The architectural principle of flexibility is key here, and no pre-formed hierarchy or categorisation of system users should be assumed.

However, part of the agency of participants is the ability to exercise anonymity. Consequently, the system should provide a level of public access that does not require authentication. Similarly, participants with a greater level of access need to be able to identify themselves via a pseudonym. Obviously this depends on the level of utility expected in the system — there is a tension here between the right to be anonymous, and the consistent traceability of changes to material.

Authentication brings particular problems when dealing with distributed systems such as the requirement for interoperable access controls across disparate systems and the need to reduce onerous re-authentication whenever a different repository is accessed. Therefore, the networked environment requires a framework for trusted authenticators that can vouch for end users to others in the network — for example, a single-sign-on framework such as OpenId (The OpenID

Foundation, 2015).

Reproduction rights management is concerned with what authorised system users can do with material — usually in publication contexts external to the system from which the material was obtained. These rights normally manifest as reproduction permissions and attribution requirements in relation to the re-use of material including annotations and crowd-sourced material. A rights policy should be displayed by the system at any point where information may be entered into the system.

Stakeholders should determine the reproduction rights in records delegated to end-users, however there may be competing notions of ownership and granting of rights. Reproduction rights may also depend on the nature or format of material. Because records lie outside of the 'publication' paradigm, participants may acquiesce for material to be made available in one context, but may not wish the same rights to be granted in other contexts. In particular, while participants may allow material and documentation to be accessible within the context of the system, they may wish to prevent it from being disseminated beyond that scope. This means that documentation of the existence of material may be, perhaps, provided in a networked context but end-users may need to navigate (and authenticate) to local systems in order to access the detailed documentation and/or material.

4.2.3 Tracing and audit

(Summarised from Appendix C, Section C.2.4)

Activity by participants needs to be recorded for a number of operational and evidentiary reasons. In particular, the complete provenance of a record includes documentation of the recordkeeping-business related to the record. Hospitality requires the exposure of such metadata for complete documentation of the record as well as the ability to roll-back changes if necessary. This is because of the possible need to mediate between contested perspectives of records as well as the potential for inadvertent changes to be made by inexperienced system users. Where material has been made public, end users should have free and untraced access to such materials — unless access has been purposefully revoked by participants due to changed circumstances. However, this is a matter of trust; communities that, in the past, have had their records abused may wish to track who has accessed records. In the end, "The public and open nature of the space must be balanced with a sense of security" (Sellie, Goldstein, Fair, & Hoyer, 2015)

4.2.4 Appraisal

(Summarised from Appendix C, Section C.3)

The system needs to support archivists to proactively engage with communities to seek out appraisal participants and support them in all appraisal activities — determining which records should be created, preserved for their enduring utility and, possibly, destroyed when they are no longer needed. The system needs to support the pluralistic documentation of records and recordkeeping processes as described below that facilitates appraisal decision-making. Such decision-making is highly dependent on the level of trust that exists between record-holding organisations and other participants. Similar to access control, the system needs to be able to support distributed and negotiated decision-making relating to preservation and documentation.

In the disposal of material, the support of individuals' rights to self-determination must be balanced against the need to provide accountability through time. Even the removal of inaccurate information can have unforeseen consequences — underscoring the need for documentation of all recordkeeping activity.

4.2.5 Creation

(Summarised from Appendix C, Section C.4)

All participants should be able to create and maintain their own material within the system in a wide variety of formats (subject to the rights described previously). The system needs to accommodate the addition of a plurality of material by participants, or the broader community — whether primary traces, or other documentation and annotations. Such material needs to be managed as with other traces and documentation and, when linked to records, should be made available and be searchable along with the records themselves.

Stakeholders have a fundamental right to challenge records and exercise a right of reply — particularly in the case where they are the subject of records made by others. Similarly, the system needs to support the participants' right to annotate any recordkeeping content. In the interests of contextual accuracy, participants should also be encouraged to annotate material, providing interpretation, correction or additional context. Annotation functionality should be tailored to the format of the material being annotated and the annotations themselves should be able to be made in a variety of formats. As with other linked content, this material then should be made available and be searchable along with the original records; it should not be edited or subjected to any other changes unless it is felt to contravene cultural protocols, privacy rights,

or copyright, defamatory, or other legislation.

Likewise, the system needs to provide mechanisms for visitors to the site to submit additional documentation such as comments, questions, descriptive- and geo- tags etc. This content shall be subject to the same default public access policy and reproduction rights as other material. In particular, this functionality should include the ability to provide feedback about specific material to its participants — particularly if the material is felt to contravene cultural protocols, privacy rights, or copyright, defamatory, or other legislation.

4.2.6 Documentation

(Summarised from Appendix C, Section C.5)

Records in the system must be documented in such a way as to support the world views of the plurality of participants. This is a departure from traditional archival description that takes a single (record-holding organisation) or bifurcated (distinct institutional and community) approach.

The system's facilities for documentation need to operate in an inclusive manner that respects the rights of all voices and in recognition that no single participant can provide a complete account of a record. As different participants may view records from vastly different perspectives, the system must enable a plurality of documentation of records that accommodates the perspectives of multiple participants. These perspectives may change over time and interact in unexpected ways. The documentation needs to persist and retain meaning through time, and should provide cultural explanation of the relevance of material and/or warnings about cultural sensitivity. Rich context is also necessary to preserve meaning when material is aggregated in a networked environment.

Therefore such documentation needs to include the defining of contextual entities and their relationships with each other and records, as well as links to other material. Part of the task of supporting multiple simultaneous provenance is enabling participants to document records using their terminology and cultural ontologies. Instead of attempting to create universal classification schemes, participants need to be able to employ their own ontologies that, perhaps, develop over time. Where possible, the system should ensure that documentation claims are backed by evidence by provide facilities for the citation of appropriate sources. Ambiguous prose should be avoided and doubtful assertions need to be identified as such. However, standards and types of evidence vary between participant groups and so evidence-support needs to be treated in a culturally sensitive way by the system.

This context should also include details of documentation authors and description of relevant institutions and holdings. Contributors to documentation must be able to be acknowledged, if required, in terms of their choosing. While necessarily comprehensive, the overhead of documentation management should not be an impediment to casual or inexperienced participants.

4.2.7 Discovery

(Summarised from Appendix C, Section C.6)

The discovery of resources in a distributed, participatory system is different from conventional collection-oriented portals. Instead of static finding-aid approaches, discovery must be via dynamic browse and search facilities that support the plurality of end-user modalities. The browsing and navigation interface needs to bring together records and documentation from disparate sources and display it in culturally sensitive and flexible ways. All of the material (including records, documentation, annotations etc.) needs to be discoverable using terms and content as described by various participants; for example using location- and date- based searching, multi-dimensional image carousels, tag clouds, or facet lists. Discovery should also indicate related material and contextual elements, or additional material that could be of interest.

It is important that all participant perspectives are taken into account when displaying material and that appropriate language and terms are used. Navigation to material that could be distressing should be flagged with warnings and/or confirmations. Similarly, digitised material should be clearly displayed in a connected way and be highlighted to set record-seekers' expectations regarding retrieval. Where access to material is restricted or is not longer available, the discovery facility should display reasons for the restriction and the circumstances under which the restriction may be lifted. Likewise if undocumented material is known to exist, discovery services should indicate it's existence along with plans for its inclusion in the system. The discovery functionality must not leak sensitive or restricted material and should also guard against the possibly of 'dossier' creation or the 'outing' of individuals.

4.2.8 Retrieval

(Summarised from Appendix C, Section C.7)

Retrieval concerns the access of material from the discovery interface. It involves the display of records and documentation along with other content that informs the context of the material being retrieved. As with navigation and discovery facilities, material itself should be displayed using appropriate language and terms. Jargon, acronyms, or terms and language found within material that may be considered derogatory should be accompanied with explanations for their

use.

Like the discovery interface, views of records and documentation should show links to related material and contextual elements, or additional material that could be of interest. Depending on access rights, material may be made available in different formats, for example, images at different levels of resolution. Material and documentation need to be displayed along with licensing or rights information, specific to the context of the record seeker and the material itself.

Participants should be able to maintain 'virtual collections', for example as the result of searches or as an aggregated list of items of interest and such virtual collections should be able to be compared side-by-side. Similarly, seekers should be able to manipulate results into these collections, for example by degrading, resizing, rotating or cropping images.

Conclusion

This chapter presents the first of the design artefacts: the meta-requirements for the wicked meta-problem of participatory recordkeeping and the participant-oriented interoperability needed to support it. While I did elicit some requirements in terms of patterns/anti-patters from domain experts, the bulk of the detailed requirements were derived from Literary Warrant as a proxy for co-operative participant design. The relationship of these two empirical sources and the design science kernel theories (Venable, 2006) (i.e. the existing body of knowledge relating to recordkeeping theory and practice) to these meta-requirements is shown in Figure 4.1, which relates to the methodology diagram shown in Figure 2. in Chapter 2. All of these inputs to the design science process influenced the design methods and outputs, as will be seen in subsequent chapters.

The two sets of requirements taken together suggested that there is a real design gap and a need for coherent recordkeeping systems design from a participatory perspective. Nonetheless there are limitations of 'second-hand' requirements elicitation, and they are described in detail in Chapter 5. The main risk is that in being one-step removed from the design projects or participants themselves, the requirements are filtered through the lens of the academics or practitioners conducting their research or projects. Requirements and issues may have been missed or misinterpreted, and we have seen above that different conceptualisations of recordkeeping can limit perspectives or colour the interpretation of phenomena.

For example, the wide-ranging and, at times, contradictory nature of the participatory recordkeeping discourse may be explained using the conceptual maturity framework outlined above.

Kernel Theories (Recordkeeping,
Modelling, Ontology, Data Design)

Empirical Data
(Literature, Interviews, and Existing
Systems)

Meta-Requirements
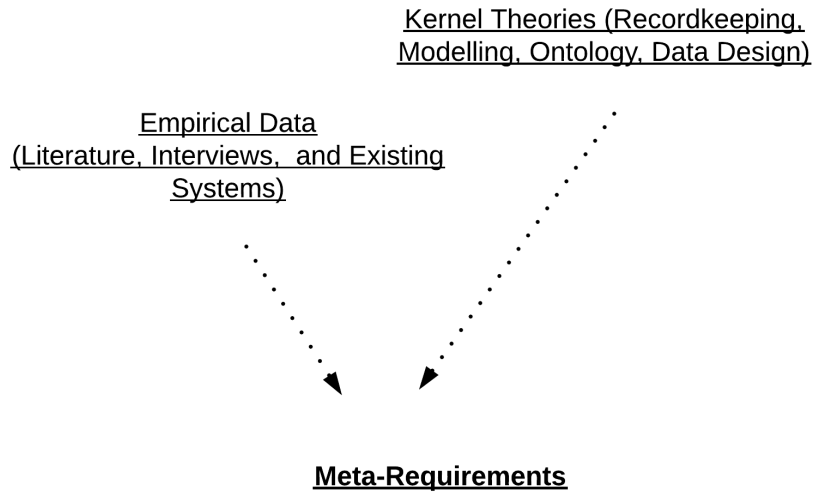
Figure 4.1: Relationships between design inputs and activities

Designers working within a Stage-1 paradigm may see participation in terms of annotation of finding aids — the logical extension of which is the cluster of Archive 2.0 approaches described by Eveleigh (2015) — with full authorship requiring the establishment of community archives as separate 'keeping spaces' for participants' records (Flinn et al., 2009). On the other hand, those working at Stage-2 or Stage-3 contexts may begin to see participation in terms of broader agency and interoperability. The elicitation of meta-requirements through Literary Warrant was an attempt to obtain a super-set, of these approaches in order to provide the maximum flexibility in design and to avoid the anti-pattern barriers of transition from previous paradigms to the new. Arguably, the range of sources selected for the Literary Warrant was broad enough to mitigate such issues and result in a broad and deep coverage of requirements.

The rich statement of requirements resulting from these two approaches addresses several of my research questions. To start with, it addresses my first and second research sub-questions from a practice perspective that complements the theoretical position established in Chapter 3.

i. *Can a comprehensive and consistent understanding of participatory recordkeeping be articulated?*

ii. *What forms of interoperability are necessary to support participatory recordkeeping?*

I have demonstrated that the meta-requirements for participatory recordkeeping can be articulated. Despite the seeming disparities in various perspectives of participatory approaches, when taken together, the set of requirements encompasses the breadth of participatory recordkeeping activities and characteristics. More importantly, it directly addresses my fourth research sub-question, and, in doing so, lays the foundation for the design.

iv. *To what extent can the detailed requirements and goals for such a system design be articulated?*

The consolidation of these requirements into a coherent framework, lays the foundation for addressing Huvila's observation that "different definitions of participatory archive could well co-exist and it would probably make sense to develop a model of different degrees of participation in archival contexts." (2011, p. 1). However, it is left to the functional model (described in the following chapter) to articulate a concise and complete definition of participatory record-keeping derived from these meta-requirements.

The patterns/anti-patterns arising from analysis of the interviews also informs and addresses my tenth research sub-question.

x. *(In what ways does my design impact:) transitioning to a participatory paradigm?*

As discussed above, the path-dependence of recordkeeping conceptualisations, the standards that flow from such paradigms, and the systems that are ultimately arise from application of such standards can all contribute to barriers that inhibit transformation. By developing an awareness of these factors, such impediments may be mitigated, or at least anticipated — leading to, perhaps, greater success in transformational recordkeeping initiatives.

<div align="center">* * *</div>

The following chapters in Part 2 describe the other two design outputs: the functional and conceptual models that address these requirements. Nonetheless, a design is only as good as its implementability and the best check on this design effort is an instantiation and evaluation of all of these design outputs such as is described in Chapter 7.

Chapter 5: The Functional Model

"But others are also 'I's: subjects just as I am, whom only my point of view —according to which all of them are out there and I alone am in here —separates and authentically distinguishes from myself."

Tzvetan Todorov; *The conquest of America*

In this chapter I describe the first of the design models; the functional or dynamic model. As explained in the introduction to Part 2, it largely comprises an article published as 'Agency in the Archive: a model for participatory recordkeeping' in *Archival Science* in July 2016.

This model started out as a way of understanding the detailed meta-requirements as described in Chapter 4; how to distinguish between the different sorts of participants and their needs in the system. Originally, I wished to publish the elicited requirements resulting from the Literature Warrant and needed a concise way of summarising those findings in terms of some sort of typology. The typologies of participation as explained in the body of the article, looked promising but resisted simple classification in the recordkeeping context. Consequently, the model underwent several iterations; starting as a simple tabular mapping to becoming the final, more complex model relating functional constructs and relationships.

In this more powerful representation, this model captures the dynamic aspects of the design. It is able to describe a networked participatory recordkeeping system — remembering that such a system is necessarily sociomaterial in nature — explaining what it is that the system needs to do and the scope of the affordances it needs to provide. As a functional model, it describes the types of actors involved in the system and the nature of their activities. It differs, however, from conventional functional models in that it is a meta-model that addresses the meta-requirements of the design science problem. The model is not expressed using a data

flow diagram, UML diagram, or flowchart. It does not specify data sources, sinks, and flows; states; transactions; sequences; or any of the other concrete representations of systems activity. Rather, it lays out the types of participants topologically, relating their systemic needs: the degree of agency to be exercised; the inscriptions of importance, the degree of requisite inter-system interoperability; and the nature of systemic activity. As explained in the article body, the complexity of this topology is best represented by a continuum diagram of the type developed at Monash University (Upward, 2000)

In the end, this sense-making model itself proved more suitable for publication than the (admittedly dry) list of system requirements. So, chronologically, although it was the last design artefact to commence development, it ended up being foundational for providing the context for the conceptual model and the instantiation discussed in Chapters 6 and 7 respectively.

Agency in the archive: a model for participatory recordkeeping

"…how to spread a participatory ethos more broadly in networks of archives and archival partnerships around the globe is one of the grandest archival challenges of all."

Gilliland and McKemmish (2014)

Introduction

The post-custodial reorientation of archives over the past few decades has exposed issues of trust and hospitality with respect to institutional record-holding (for example: Duff and Harris 2002; Hopkins 2008; McKemmish, Faulkhead, and Russell 2011). The primary response to these issues has emerged as *community archiving* initiatives that seek to establish alternative keeping-places for records (Flinn 2010), however it is only in the last 10 years or so that the term *participatory archiving* has begun to be used by theoreticians, researchers, and practitioners (Huvila 2015). Such use has generally been from the perspective of community-focussed archival practice (Caswell 2014; Shilton and Srinivasan 2007) or community engagement via on-line Archive 2.0 tools (Lehane 2006; Theimer 2011). More recently, analysis of obligations under international law or from consideration of human rights (Castan and Debeljak 2012; Gilliland and McKemmish 2014; Iacovino 2015), or in consideration of activism in archival practice (Evans, McKemmish, Daniels, and McCarthy 2015) have broadened discourses of such participation to include the term *recordkeeping*. In addition, investigations of particular communities and their records have contributed to these discourses in Australia such as those involving Indigenous communities (Ross, McKemmish, and Faulkhead 2006), and the Care-leaver community (O'Neill, Selakovic, and Tropea 2012) – where the capitalised term 'Care' is used to denote the ironic connotations of manifestly uncaring treatment, without the typographically heavy-handedness of continually enclosing the word in quotation marks (see Wilson and Golding, 2015).

Despite, or perhaps, because of this broad-based activity, definitions of participatory archiving or participatory recordkeeping have been elusive. Nevertheless, such definitions appear to encompass the management of records under community control (Flinn 2011); consideration of community or crowd-sourced submission and annotation of content (Haythornthwaite 2009); and the acknowledgement of the rights of multiple stakeholders in records — irrespective of the records' physical location or custodial arrangement (Gilliland 2014a).

The use of the single term *participatory* for this grab-bag of disparate and seemingly contradictory activities raises a number of issues. What are the links between community

and participatory archiving; or between participatory archiving and participatory recordkeeping? How can or should these all be reconciled? Similarly, what is the relationship between Archive 2.0 and these broader conceptualisations of participation? And, as asked at a recent symposium (Records Continuum Research Group 2015), what are the boundaries of participation - isn't everybody a stakeholder in every record to some degree? The term *participatory* seems overly broad as a description for ostensibly divergent practices and activities.

Additionally, community archiving endeavours have often focussed on the development of technical solutions that support project-specific requirements for community collections (for example: Huvila 2008). The resulting archives (and in particular, the archival control systems) enable the participant communities to manage records as stand-alone sets of material. Similarly, generalised community archiving applications have been developed as platforms with support for collection-oriented requirements, (for example The Mukurtu team 2015).

However, in the face of this collection-oriented view, records and contextual metadata elements are actually distributed across a plurality of systems (PACG 2011). An orientation around rigidly delimited sets of material (i.e. 'collections') may not be appropriate paradigm in the context of networked access, however necessary it may be to identify administrative jurisdiction. Thus, from a systems perspective, rather than limiting ourselves to discrete, bounded sets of records, should we not be designing for a single, global, highly interlinked network of records and contextual metadata elements? The role of an archival system from this perspective is to facilitate the stewardship of part of this network (Caswell 2014), while interoperating with other systems to provide consistent, controlled, and accountable access to records.

This suggests that participatory engagement with records needs to be considered in terms of networked and interoperable recordkeeping infrastructure. In other words a conceptualisation based on the archival commons (Anderson and Allen 2009), the Archiving System (Reed 2005a), and the public information service (McCarthy and Evans 2012) needs to be employed in order to embrace both the multiverse of records and metadata as well as the pluralities of participatory archival practice. What are the system requirements for networked participatory engagement with records?

This essay is an attempt to address these issues by describing the various manifestations of such engagement in terms of a consistent framework; answering Huvila's call for "a model of different degrees of participation in archival contexts" (2011, p. 1) . A literary warrant for participatory engagement with records was developed to determine a typology of potential participants and the sorts of activities in which they may wish to engage. This typology is useful from two perspectives. Firstly it may be used to understand the participants themselves, together with their characteristics and needs. Secondly, such a typology can provide the foundation for the design of services and systems that satisfy such needs. To this end, this essay concludes with a discussion about the nature of systems for participatory engagement with records that may be used to understand the limitations of existing recordkeeping systems and projects as well as to support the design of future recordkeeping systems.

A few notes regarding terminology

It is important at the outset to address the terms *archiving* and *recordkeeping*, particularly as to how they apply to participatory activity. This is necessary in order to not only situate the literature from which they are drawn, but to coherently define a typology that may be used for further analysis.

To start with, **record** may be defined as a trace or representation of activity where such traces have value to individuals, organisations, and/or societies — "whether that be for a nanosecond or millennia" (McKemmish 2001, p. 336). A record also comprises metadata that documents the "transactionality associated with the original creating intent[s]" (Reed 2005b, p. 6) and provides for its evidentiary nature – even if such notions of evidence turn out to be contingent, contested and elusive (Yeo 2007).

From a life-cycle perspective, the term *archiving* may be considered to assume "a particular custodial model of the archival process, [that] primarily considers retrospective description, i.e. taking place after records have been transferred to a formal archival repository" (Eveleigh 2015, p. 54). Along these lines, the two-word term *record keeping* refers to those activities that may take place prior to crossing this archival threshold (Duranti 1996).

However the term *recordkeeping* has a different meaning in the continuum sense (Reed 2005a): as an all-encompassing description of activities germane to the record life-span. From a records continuum perspective, recordkeeping encompasses the decision to create records; their management throughout the multiple contexts of creation and use; and their preservation or destruction based on ongoing needs. It is this meaning of recordkeeping that will be used throughout this essay. Recordkeeping activities include *appraisal* (defining which records should be created or brought under control and identifying those that have enduring value), *documentation* of records and recordkeeping activities in the form of metadata, *preservation* of records for as long as they are needed, enabling *access* to records and performing *disposal* according to negotiated appraisal agreements. In general, these are not 'once-off' activities but may occur repeatedly through the life-span of records. Records may, at any time, be re-appraised; have their documentation corrected or augmented; or have their preservation or access regimes changed. Participation in recordkeeping, therefore, may need to begin with the creation and purposefulness of records and may continue for the remainder of their lifespans (and indeed beyond). The term *recordkeeping informatics* refers to the technological and social aspects of information systems involved in recordkeeping (Oliver, Evans, Reed, and Upward 2009, 2010).

Consequently, the activities implied by the term recordkeeping may be considered to be a general superset of the activities usually ascribed to the term archiving — participatory recordkeeping therefore being a superset of participatory archiving. However, as both approaches may use the same terms for differing purposes, there is still scope for confusion (for example, with the term *appraisal*). Unless explicitly stated otherwise, this essay will employ the meaning of the terms stated within this section.

To complete this list of definitions, the term *archive* (archives pl.) will be used to refer to any jurisdictionally bounded recordkeeping system that deals with records or record metadata — whether historical or current. *Archival Multiverse* is a term coined by the Pluralising the Archival Continuum group that refers to a recordkeeping landscape that embraces "the pluralism of evidentiary texts, memory-keeping practices and institutions, bureaucratic and personal motivations, community perspectives and needs, and cultural and legal constructs" (PACG 2011, p73.). It naturally encompasses multiple recordkeeping systems and archives, and suggests that a multiplicity of perspectives on recordkeeping is needed, rather than singular, institutional viewpoints.

Finally, note that the (capitalised) term ***Archive***, when used, refers to the gestalt of socio-technical archival systems, recordkeeping practices, and stakeholder behaviours. From a continuum perspective, the Archive embraces the whole archival multiverse, but it may have a narrower meaning and scope if considered from a life-cycle orientation. Occasionally the term *recordkeeping and archives* will be used when referring to standards that employ either term in a distinguishing manner.

Approach

This study sought to elicit perspectives of participatory recordkeeping from the contemporary body of relevant academic, policy, and systems design work. The assumption of this approach is that, despite describing a wide range of systems and services, the academic findings, policy statements, and design decisions could be mapped to requirements for, or descriptions of, networked participatory infrastructure. This approach, while pragmatic (in contrast with co-designing with stakeholders directly), does impose some limitations. These limitations and the risks of this approach are described in the following section.

A number of sources were selected as providing a literary warrant for participatory engagement with records. They were categorised as follows:

1. Key publications and literature surveys concerning participatory archives;

    These sources of requirements are drawn from survey articles, for example, Huvila (2015), or theoretical papers concerning participatory recordkeeping — from broader (Gilliland and McKemmish 2014) or narrower (Iacovino 2015) perspectives.

2. Legal instruments or commission reports that impact obligations or rights of record-stakeholders;

    These sources, while not dealing directly with participatory recordkeeping systems (or even recordkeeping systems in general), nonetheless discuss the rights and obligations of record-holding organisations and other stakeholders, for example, United Nations Commission on Human Rights (2007). In addition commission reports also identify shortcomings of contemporary archival service delivery and make recommendation in terms of policy and/or practice, for example, Paterson (2007).

3. Reports of community-specific participatory recordkeeping initiatives;

    These academic papers describe investigations into community-specific recordkeeping projects, which are participatory in nature — for example, Krause and Yakel (2007), Shilton and Srinivasan (2007), or Trust and Technology Project (2008).

4. Systems developed to support generalised collection-oriented community archives.

    Such systems have been developed as generalised platforms for community recordkeeping — for example: The Mukurtu team (2015) or NZ Micrographic Services Ltd (2014) — or as participatory recordkeeping platforms built with a specific community or group of communities in mind, for example: the Ara Irititja Project (2011).

Sources were gathered using a *snowball* approach for purposeful sampling (Williamson 2013, p. 345). Initially, seminal works or works by prominent archival researchers were analysed. Where these only provided a high-level summary of primary sources (particularly, in the case of legal instruments or reports), the referenced source documents were also added to the source set. Additionally, referenced public information systems that had been developed to support community or participatory approaches were also added to the source set. Finally a survey of issues from the last five years of prominent journals was conducted. Where titles and/or abstracts indicated potential inclusion in the source set, the article in question was examined. The journals included *American Archivist*, *Archival Science*, *Archivaria*, and *Archives and Manuscripts*.

Each source was analysed for statements that described or implied systems functionality relevant to participatory recordkeeping. Such statements were coded using the QSR NVivo qualitative research tool. The conceptual codes were drawn from the International standard ISO 15489 for Record Management Processes (ISO15489-1 2001) along with some general codes. The final coded categories (NVivo nodes) were: Overall architecture and design; Access Control (with sub-nodes: Authentication, Authorisation, Reproduction Rights Management, Tracing and Audit); Appraisal; Creation; Documentation; Discovery; and Retrieval. A total of 26 publications and the functional descriptions of 8 generalised systems were found to contain significant statements in relation to participatory recordkeeping.

Finally, a survey of literature relating to discourses of participation (described in the next section) yielded five major typologies of participation. The results of the coding, the coded statements, and the contexts of the originating sources were then used to interpret these typologies of participation in the context of recordkeeping activities.

Limitations of the approach

A risk of this approach (extrapolation from literature) is that not all aspects of participatory recordkeeping may have been surfaced. This is because the projects referenced by the examined sources embody assumptions and constraints of extant recordkeeping system technologies and approaches that may not have necessarily been 'good' examples of

participatory systems. Similarly, this study was itself not participatory in nature — the analysis of sources representing a first-order proxy for true participatory requirements elicitation. Again, there is a risk that by not engaging directly with potential participants, not only have their voices been filtered through a layer of interpretation and assumptions, but requirements or details may have been missed.

This risk, that the requirements may be incomplete, is a product of the *sociomateriality* of information systems and their investigation. Despite the view that information systems may be analysed independently of their setting of use (Wand and Weber 1995), many researchers now acknowledge that IS investigation only has meaning in the context of social setting (Cecez-Kecmanovic, Galliers, Henfridsson, Newell, and Vidgen 2014). This indivisibility of material artefacts and their social embeddedness, termed *sociomateriality*, leads to entanglements over time in a non-deterministic manner (Svahn, Henfridsson, and Yoo 2009).

Arguably, the investigation of sociomaterial phenomena, such as a participatory recordkeeping system, should be situated in a context of its use. Thus this present study can only obtain a 'starter set' of requirements to be verified in context with actual stakeholders through various mechanisms beyond the scope of this article (for example: the creation and evaluation of system designs and prototypes).

Typologies of participation

The language employed by participatory archiving and recordkeeping literature is drawn from discourses of *participation* that emerged from studies of development interventions in western urban contexts or non-government organisation (NGO) initiatives within developing nations. Such discourses are generally couched in terms of the ceding of power and acknowledgement of rights from the top-down and empowerment and the exercise of rights from the bottom-up; "a shift from control by authorities to control by the people or citizens" (Cornwall 2008). It has given rise to a number of typologies of participation beginning with Arnstein's 'Ladder of participation' (1969) and continued by Deshler and Sock (1985), Biggs et al. (1989), Farrington and Bebbington (1993), White (1996), and the Organisations for Economic Co-operation and Development (OECD) (Nuclear Energy Agency 2004). The common metaphor of these typologies is a graduated, cumulative scale of behaviours that ranges from disengagement to comprehensive sharing of power between stakeholders, with each graduation on the scale encompassing the activities of any lower levels.

Farrington and Bebbington (1993 p 105) propose a simple typology of participation in terms of *breadth* and *depth* — breadth being an assessment of inclusiveness or *hospitality*, and depth corresponding to the degree of empowerment enjoyed by stakeholders. Accordingly, participatory recordkeeping can be expressed in these terms and the sources examined in this study may be categorised as shown in Figure 1. In the recordkeeping context, the depth of empowerment concerns the degree to which stakeholders may possess and exercise *agency* in relation to recordkeeping activities defined above. In other words, the ability of participants to act effectively (Giddens 1984, p. 9) in relation to in the appraisal, creation, documentation, preservation, access control, and disposal of records.

The literature describes participatory initiatives and infrastructure located upward (i.e.deeper) and/or to the right (i.e.broader) from traditional recordkeeping or archival regimes. While literature surveys, legal instruments, and commission reports describe aspiration for broad and deep participatory engagement, contemporary participatory projects and extant generalised systems occupy a middle ground, exhibiting some degree of hospitality and facilitation of empowerment. Archive 2.0 initiatives focussed upon crowd- or community-sourced interaction also occupy this middle ground, however, while they exhibit a broad degree of hospitality, they provide a shallower level of engagement than, say, a community archive.

However community archiving projects, while empowering for their target participants tend not to be arbitrarily broad and deep. This is due to two reasons. The first is that, as reactions to the policies and practices of inhospitable record-holding organisations, such initiatives aim to create distinct and safe spaces for community recordkeeping (Flinn 2011). They are not necessarily designed as part of networked infrastructure nor do they necessarily aspire to encompass a wider catchment beyond the immediate community. In particular, such narrowness does not admit space for the negotiation or resolution of conflicting rights in contested records, as it is generally assumed that the serviced communities, or community segments are sufficiently homogeneous in their requirements.
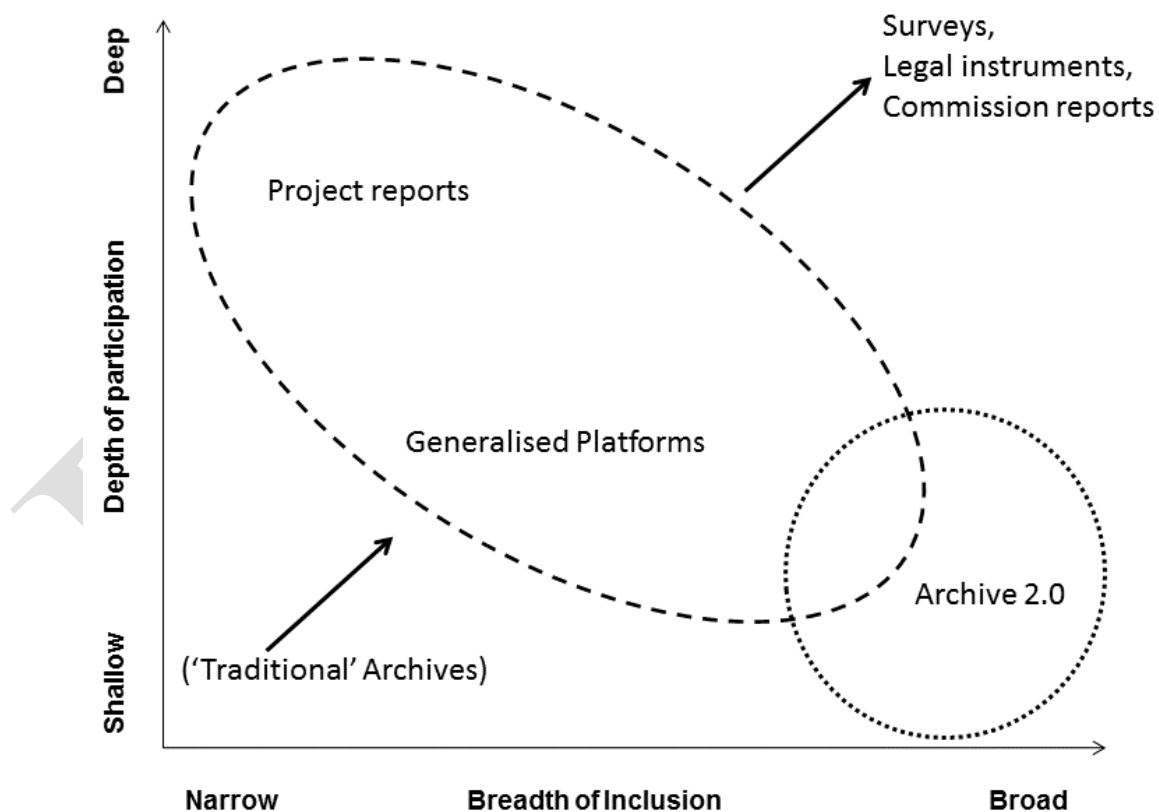
Fig. 1. *Typology of endeavours (after Farrington and Bebbington (1993))*

Secondly, such projects often take place in jurisdictions that operate within a custodial paradigm that draws a distinction between 'archival' practice and other aspects of recordkeeping. This narrowing of recordkeeping concerns results in shallower implementations that do not address all areas of participatory recordkeeping — for example, participation in the appraisal and creation of records. Similarly, generalised platforms do not provide for negotiation of competing rights and are generally more concerned with providing repositories for community archives than infrastructure for pluralistic participatory recordkeeping.

As a consequence, this study, in eliciting concrete requirements from this middle ground and 'soft' requirements from the aspirational surveys, instruments, and commission reports, has had to extrapolate the concrete requirements into the broad and deep space as well as interpret aspirational goals as infrastructural requirements.

The high-level typology shown in Figure 1 allows for the rough categorisation of endeavours reported through the literature as either perpetuating the status quo; occupying a progressive middle ground of engagement; or having the potential for transformational change. However, for detailed analysis of systems, projects, technologies, and participant communities a finer-grained classification of approaches is needed. Can the detailed typologies of participation that have emerged from the discourse of developmental participation be used in this way?

A comparison of various typologies of developmental participation is shown in Table 1 — from Arnstein's 'Ladder of participation' (1969) through to a more recent OECD classification (Nuclear Energy Agency 2004). Each of these typologies was originally depicted in tabular or ladder form by their respective authors, with levels of participation increasing from bottom to top. These typologies range from four to eight levels and represent different approaches for describing participation (for example as verbs indicating core activities at each level; as adjectives describing each level; or via characterising nouns for each level). Table 1 is an attempt to align these typologies in order to discern commonalities between them. As such, it appears that the levels of each of these typologies may be considered in terms of four main divisions: nominal or non-participation; delineated or transactional involvement; recognition and co-operation; and empowerment or ownership.

Table 1. Typologies from the participation discourse

Arnstein (1969)		Deshler & sock (1985)		Biggs (1989)	White (1996)	OECD (2004)
Degrees of citizen power	Citizen control	Genuine participation	Empowerment	Collegiate	Transformative	Support
	Delegated power		Cooperation	Collaborative	Representative	Delegate
	Partnership					Co-decide
Degrees of tokenism	Placation	Pseudo-participation	Assistencialism	Contractual	Instrumental	
	Consultation			Consultative		Consult
	Informing		Domestication		Nominal	Inform

122

Non-participation	Therapy								
	Manipulation								

While it is possible to align such typologies as has been done in Table 1, the positioning of intent and involvement on such scales is open to interpretation. Arnstein (1969) argues that movement up the ladder (concomitant with a greater sharing of power) is both a core need of stakeholders and an ethical obligation of those with power over developmental activities. By depicting the lower levels of the ladder as a deliberate withholding of power and misdirection of stakeholders — the playing out of an "empty ritual of participation" (p. 216) — she categorises measures below the top rungs as "degrees of tokenism" (p. 217). Deshler and Sock (1985) also take this view, drawing a distrinction between 'genuine-participation' and 'pseudo-participation'. Others such as White (1996), Biggs et al. (1989), and the OECD (Nuclear Energy Agency 2004) are more measured, recognising participation as a journey for all stakeholders with something to gain for every involved party at each level of engagement.

However, as Cornwall (2008) points out, although these typologies suggest a normative progression towards more 'genuine' forms of participation, the contextualisation of activities blurs the delineation of participatory activities. In particular, while Arnstein (1969) acknowledges the inhomogeneity of participant groups, Cornwall (2008) goes further, arguing against a simplistic progression, claiming that "Different purposes, equally, demand different forms of engagement by different kinds of participants" (p. 273). She concludes that, without a dynamic understanding of "the dimensions of difference that matter" (p. 278), attempts at inclusion may not only be ineffective, but may have net negative consequences. In fact, White (1996) argues that it this very ambiguity of participation that provides fertile ground for further disenfranchisement.

The complexity of engagement may be exacerbated by a number of factors. For example: the negative associations with 'invited spaces' (as opposed to spaces that people create for themselves) and past experiences; participation fatigue; fear of reprisal; and the stereotyping of participants, all may act as a major disincentive for engagement (Cornwall 2008; White 1996). These factors are reported in the archival literature in terms of rejection of invitations to those disenfranchised from records, for example: Bastian (2002) and Hopkins (2008). Even archival services that provide simple annotation and social-media functionality may have failed to recognise the complexity and divergent needs of record seekers (Haythornthwaite 2009; Liew, Wellington, Oliver, and Perkins 2015).

To the extent that these typologies are useful in considering developmental participation, they also have the potential to inform classification of participatory recordkeeping activities. However, despite some forays into the modelling of archival systems development (for example: Anderson 2008), it appears that typologies of participation based on a meta-narrative (Lyotard 1984) of normative progression may not hold in the recordkeeping space. It is difficult to imagine how the pluralisms of the archival multiverse "that change and are molded and constructed by the ongoing actions of archivists, archival institutions, and researchers" (Duff, Monks-Leeson, and Galey 2012, p. 72) could be mapped onto a linear typology. What is needed instead is a method of modelling complexity in the recordkeeping space that may be applied to participatory approaches.

A continuum of participation

Continuum Informatics, as described by Upward, Reed, Oliver, and Evans (2013), is one approach to dealing with this expansion in complexity. In particular, records continuum theory has, in no small part, informed the discourse of recognition of multiple participants in records and their rights in creation, appraisal, preservation, access and disposal (Reed 2005b); and the ever-expanding web of record-related stakeholder relationships that is 'always becoming'. One expression of this body of work is the Records Continuum Model that stands alongside a number of related models including the Information, Publications, and Cultural Heritage Continuum Models (Upward 2005a, 2005b). Conceived in the 1990s, these models continue to be actively explored, for example the amalgamation of the Records Continuum and Cultural Heritage Continuum Models as a means of explaining emergent memory-making phenomena such as YouTube (Gibbons 2015b).

The Records Continuum Model

The Records Continuum Model is an attempt to formalise post-custodial archival theory with broader sociology-based conceptions of memory and information processing. It was first articulated in its present form by Upward (1996, 1997) working closely with others such as McKemmish (2001), Reed (2005b) and Iacovino (2006); and has subsequently been published, referenced, critiqued and explored in many fora.

The model owes much to structuration theory as illuminated by Giddens (1984) and depicts recordkeeping activities or routines that are interdependent with the structures of both society and the Archive. It aspires to be a framework that deals more successfully with the complexities of modern recordkeeping than the linear life-cycle models underpinning custodial archival practice. The Records Continuum Model is shown in Figure 3.
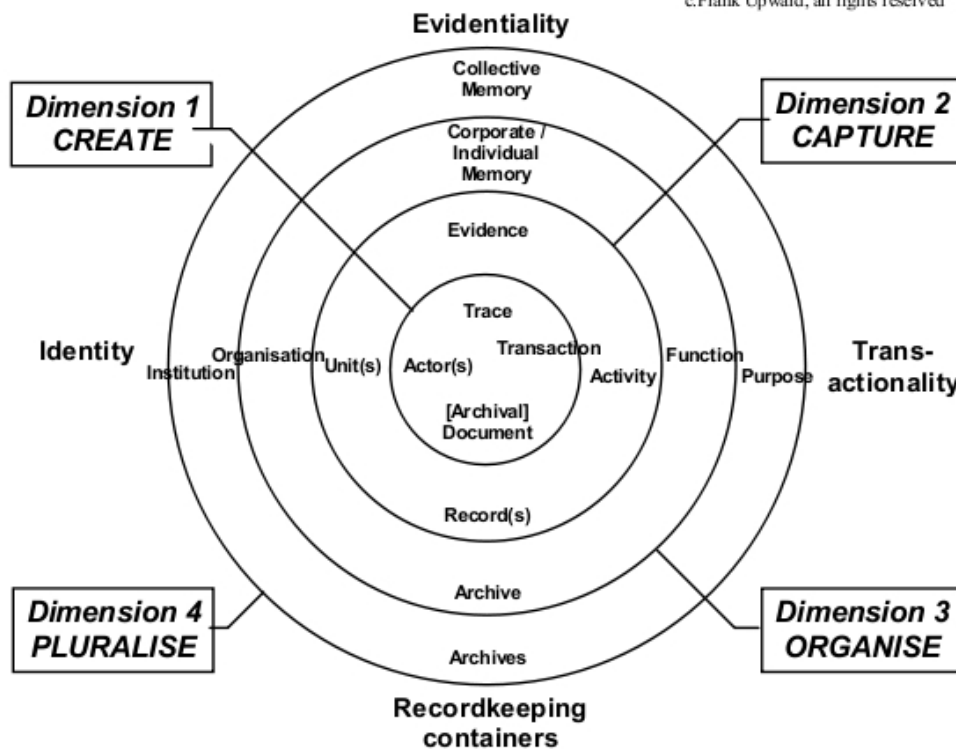
Fig. 2. The Records Continuum Model

The model comprises four axes (*Identity*, *Evidentiality*, *Transactionally*, and *Recordkeeping Containers*) that traverse four dimensions (*Create*, *Capture*, *Organise*, and *Pluralise*). The axes correspond to recordkeeping concerns, the origins of which may be found in traditional diplomatics employed to establish and verify the authenticity of archival documents (Duranti 1998). Progression along each axis corresponds to increasing level of aggregation or generalisation – for example, on the Identity axis: from individuals, through collective groupings to institutions or society as a whole; or on the Recordkeeping Container axis: from individual documents through collections to the Archive.

However this is a point of departure of the continuum approach from traditional, artefact-oriented archival theory. We are all moving in spacetime and our agency corresponds to the interplay of affect as a result of this movement. It is our records that bind the evidence and memory of human activity that unfolds through time into either the spatial dimensions as artefacts, or as performances in their own right (that have their own temporal parts). Records have agency too, manifesting as their ongoing entanglement in human (spacetime) activity (Gilliland 2014b; Wilson and Golding 2015). This temporal dimension is crucial to recordkeeping informatics — from the path-dependency of actors prior to records-creation, through the circumstances of creation, to records' ongoing affect in human activity. Consequently, records cannot not be considered solely as relics; end-products that exist in space and endure through time. Rather, they are representations of time-bound phenomena (Lemieux 2014; Upward 2009; Yeo 2007) and recordkeeping modelling needs to transcend

the static classification of artefacts, to encompass treatments of their movement through spacetime.

This is why the progression through the dimensions of the Records Continuum model also represents increasing degrees of spacetime distanciation as described by (Giddens 1984, p. 298). In the Records Continuum Model this spacetime distanciation is interpreted as originating from the instants of record creation (Upward 2005b, p. 198). Thus, it is not a life-cycle model, but one that attempts to explicate the spacetime characteristics of the continua of recordkeeping structures and activities. The model is not simply a linear extension of an archives-oriented life-cycle model that encompasses record creation prior to accession into an 'archival' jurisdiction, nor does it represent some sort of circular lifespan (Duranti and Franks 2015, P. 344). It is a topological model (Upward 2005b) that describes features of records and recordkeeping. Like other topologies (e.g. landscapes) that are modelled (e.g. via maps) various features may be invisible or perceived differently depending on where a viewpoint is topologically situated.

For example, if viewed from the perspective of records *creation*, then metadata added during *capture* into a recordkeeping system is not visible. However, from the *organise* perspective, the capture-related metadata is perceived as forming an intrinsic part of the record. Moreover, this capture-related metadata forms recordkeeping-business records (McKemmish, Acland, Cumming, Reed, and Ward 2000) that undergo capture, organising and pluralisation in their own right. Thus the Records Continuum Model is necessarily recursive; the layers of metadata accrete around a trace throughout its life-span somewhat like the layers of an onion, each layer having its own topology that may be similarly modelled. Records are always constantly at the edge of creation; they are "always in a process of becoming" (McKemmish 1994).

While the Records Continuum Model presents a recursive, topological approach that describes the complexities inherent in recordkeeping (Upward 1996), it is evident that these complexities embody a pluralism in each dimension that, while perhaps implied (Upward, McKemmish, and Reed 2011), is not articulated in the model. Pluralism here is meant in the sense of *"a condition or system in which two or more states, groups, principles, sources of authority, etc., coexist"* (Stevenson 2010); for example, acknowledging more than one creator of a record. Not to be confused with the *Pluralize* dimension of the Records Continuum Model which concerns the disembedding of a record from its original context in order to be disseminated, "connect[ing] with other memory banks across even wider reaches of time or space" (Upward 1997).

More importantly, the model does not explicitly address issues of agency in relation to this pluralism. In recent years, the model's term 'create' has been recast as 'co-create' in attempt to address such issues (Gibbons 2015b; McKemmish et al. 2011). However, the semantics of co-creation, with its suggestion of collaboration and purposefulness of action, still does not reflect the complexity and pluralities of the relationships between participants and records.

Nonetheless, there should be a way to interpret or transform the Records Continuum Model to provide a similar topological perspective of agency rather than the records themselves.

A Continuum Model of Participatory Recordkeeping

If records are recognised as representations of human activity (Lemieux 2014; Upward 1996; Yeo 2007) then a continuum model may be constructed using dimensions that represent distanciation, not from a record's creation, but from the activity that it represents (Attwood 2008; Ketelaar 2012). Correspondingly, axes can be drawn that encompass the various manifestations of participatory agency. Such a model is shown in Figure 3 followed by an overview of its important features. The subsequent section presents a more detailed exploration of the model together with some worked examples of its application.
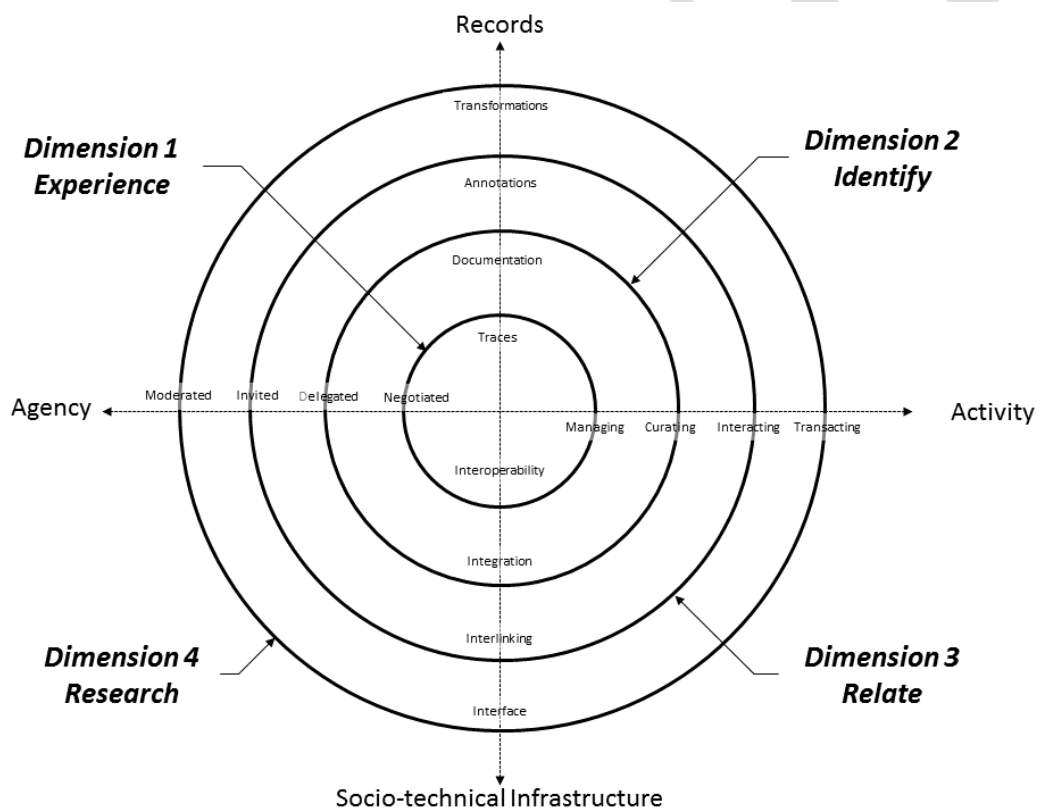
Fig. 3. A Participatory Recordkeeping Continuum Model

The dimensions of participatory distanciation represent the attitude of participants in relation to the activities represented by records. They are based on an amalgam of the 'stages' of participation articulated in the development discourses discussed earlier and shown in Table 1. These dimensions may be described as follows:

• **Experience**

Participants who directly *experience* the activities that a record represents may have the deepest need for participatory control of recordkeeping activities (including pre-creation planning or appraisal as well as record creation itself) and of any records already in existence. They may feel a sense of ownership of records, and are most affected by disenfranchisement in respect to recordkeeping (Gilliland and McKemmish 2014).

An example of a participant at this dimension may be a Care-leaver in relation to records of their time in Care (O'Neill et al. 2012).

- **Identify**

    Participants who have not directly experienced the represented activities may, nevertheless, still *identify* with the activity that gave rise to the record, and consider it to be part of their ongoing lived experience. While not necessarily requiring full control over such records, Participants may need to be able to control a description of, and access to, such material.

    An example of a participant at this dimension may be a community in relation to community records (Christen 2008).

- **Relate**

    Participants may *relate* to the representations provided by records that, while they do not form part of their lived experience, underpin a significant connection to the circumstances of the records' creation or the actors involved. Participants may wish to be able to annotate or contribute auxiliary material to such records and to be identified as having done so.

    An example of this dimension may be contributors to the Australian World War I 'Discovering ANZACS' (National Archives of Australia 2015) web site.

- **Research**

    Participants may be interested in records and the represented activities from an intellectual perspective. They may only require transactional access to material for their *research*, together with the possibility of contributing transformations (for example, transcriptions, translations, minor corrections etc.) to the body of record-related material.

    An example of a participant at this dimension may be an academic researcher. However, the term 'research' is intended to have a broader meaning than just the activities of traditional academic, historical or administrative researchers. It may indeed include formal research but also includes any intellectual, artistic, or even 'infotainment' interest in records by any member of the general public.

It should be remembered that, as with the Records Continuum Model, these dimensions form a continuum of perspectives — "a continuum from proximity to detachment"

(Attwood 2008, p. 77 — quoting Phillips, 2004). Moving between these dimensions can be considered as pivoting from having a viewpoint 'within' the record looking out (e.g. an 'owner' of a record having lived an experience), to being 'outside' the record looking in (e.g. as a researcher, investigating the activities represented by a record). As such, it appears that four dimensions provides suitable granularity for analysis. However, it may turn out that the distinction between the second and third dimensions are unnecessary. Or, alternatively, exercising the model may surface the need for greater granularity and additional dimensions. Further research involving the instantiation of systems that embody these dimensions is needed to clarify this point.

Nevertheless, participants may occupy different points on this continuum at the same time depending on the particular records involved. Similarly, multiple participants may have contrasting perspectives in relation to the same record. For example, some Indigenous communities may consider historical records part of their direct experience, "fusing" the people of the past and the people of the present" (Attwood 2008, p. 82), while others may identify with past actors. Some participants may strongly identify with records, to which others may simply relate at arms-length. Finally, the individual or community perspectives may change over time (Russell 2005), as they adapt to the effects of distanciation (Attwood 2008).

The four axes of this model that inform participation across these dimensions are related to the corresponding axes of the Records Continuum Model. They are defined as follows:

- **Agency**

  The *Agency* axis represents the continuum of agency of participants in records. It is based on the Records Continuum Model concept of identity that accounts for "actors, […] the authorities and responsibilities within which the archives are made and used, […] and that the records reflect the authorities and responsibilities that support an act" (Upward 1996). However, this model is less concerned with the aggregation of individuals into power-wielding organisations as it is with describing how any agency is exercised. The major points on this continuum, in order of decreasing agency, are *Negotiated* control, *Delegated* responsibility, *Invited* collaboration in some well-defined context, and the *Moderated* use of transactional functions. These degrees of agency and their characteristics are drawn from the development discourses discussed earlier and depicted in Table 1 — empowerment or ownership that facilitates, not only control, but a platform from which negotiation can take place; recognition and co-operation that encourages and allows delegation; limited collaboration realised as invitations to well-demarcated involvement; and the supervised transactions of nominal participation.

- **Records**

  The *Records* axis describes the recordkeeping material in which participant may most need to exercise agency (based on the concept of evidence from the Records Continuum Model). These include the core *Traces* themselves, *Documentation* of the traces, *Annotations* by third-parties, and *Transformations* which may include transcriptions, translations, minor corrections etc.

The intent of this axis is not to suggest that participants' access should be constrained to particular types of material, but to indicate at what point in the records continuum, systems need to support participant agency. For example, in the first dimension, this may be agency in recordkeeping activities that may begin even before the creation of original traces (and, by extension, this includes all of the other associated types of material). In the third dimension, participants may only need agency in annotation activities.

- **Activity**

  The *Activity* axis describes the continuum of recordkeeping activities in which participants may be involved (based on the transactionality axis of the Records Continuum Model). It spans *Managing* the recordkeeping environment, *Curating* sets of material, *Interacting* with systems and other participants to augment sets of material, and *Transacting* with services to obtain material and contribute transformations.

  The Records and Activity axes are drawn from the warrant analysis that explored differences between conventional recordkeeping and archives services; community archiving systems; Archive 2.0 initiatives; and aspirational participatory recordkeeping requirements.

- **Socio-Technical Infrastructure**

  The *Socio-Technical Infrastructure* represents the continuum of policy, procedural, human, and technological systems that need to be employed to support the various dimensions of participation (drawn from the concept of recordkeeping containers from the Records Continuum Model). It comprises the use of *Interfaces* for transactions, *Interlinking* of disparate systems for interactivity, the *Integration* of systems to enable the sharing of material and *Interoperability* that facilitates distributed management. The points on this axis are drawn from degrees of systems interoperability, for example as described by Ouksel and Sheth (1999).

Again, it may turn out that there are additional axes that inform participation across the dimensions and that further research through instantiated systems could expose such requirements.

The intersection of these axes with the dimensions gives rise to a number of sociomaterial system characteristics that provide different levels of support for agency in recordkeeping. These characteristics of, or requirements for, participatory recordkeeping may be discerned by reading 'around' the model at the various dimensions:

- The first (deepest) dimension of participation requires interoperable infrastructure that underpins the negotiated management of records. This is the sort of environment envisioned by Gilliland and McKemmish (2014) and Iacovino (2015).

- Participation at the second dimension requires integrated systems that underpin delegated curation of documentation and other archival material. This is the

community archive space described by Caswell (2014) and Trust and Technology Project (2008).

- The third dimension requires interlinked systems that enable invited participants to interact with each other to share knowledge about records. This is the domain of Archive 2.0 initiatives (Theimer 2011).

- The fourth dimension requires interfaces that support the moderated transacting of material to/from researchers. This is the traditional archival interface.

There are several further points to be made in this overview. Firstly, like the Records Continuum Model, this model is recursive. Participants may introduce traces, documentation, annotations, or transformations at any dimension, and by doing so, become first-dimension participants with respect to the introduced material. In other words, such participants have rights and require agency with respect to such material. Secondly, the Archive is a contested space (Ketelaar 2012). The participation of multiple stakeholders in the documentation of records means that systems must be able to deal with multiple, possibly incommensurate ontologies of documentation that may be used for arrangement, description, discovery, and access (Russell 2005). Thirdly, the two continuum models interact. Participant contributions at any dimension are records in their own right and occupy the topology described by the Records Continuum Model in terms of their creation, capture, organisation and pluralisation. The two models work in tandem to admit "the possibility of analysis of multiple simultaneous complex inequalities" (Walby 2007) that are inherent in records and participant agency.

Note that all dimensions are in play at any given moment with respect to different participants and participants' relationships with different records. Participants may need to exercise the agency of different dimensions at different times or contexts — and it is important to remember that the types of agency defined at inner dimensions includes that of outer dimensions. Consequently, the systems and frameworks we design are required to support multiple levels of agency — even if individuals choose not to avail themselves of them. Also, unlike other continuum models, distanciation through these dimensions does not represent aggregations of actors, motivations, or material, and generally represents shallower interaction. The most complex participatory environment of the first-dimension should accommodate participants that experienced the circumstances of a record's creation and require the greatest agency in its recordkeeping. However, the model remains a topological one that supports a multiplicity of perspectives depending on where and when the viewpoint is situated.

Applying the Participatory Recordkeeping Continuum Model

While remaining mindful of the multiplicity of simultaneous perspectives that a continuum model exposes, this section provides a more detailed description of the predominant aspects of each dimension. It concludes with a more complex example, exploring the interactions of participants at all dimensions.

Starting with the first dimension, the needs of participants are based on records that are not only inextricably bound to a sense of self and identity (McKemmish 1996) but that may have concrete positive uses and/or negative consequences in participants' day-to-day lived experience (Gilliland 2015; Humphreys and Kertesz 2012; Wilson and Golding 2015).

However, it should not be assumed that communities, families, or other participant groups are homogeneous (Huvila 2008). This, together with the contested nature of records, means that seemingly competing access rights may need to be *negotiated* between multiple participants (Department of Social Services, Commonwealth of Australia 2015; Gilliland 2013; Iacovino 2015; Ross et al. 2006). While the need for access to material is dependent on the contexts of creation and exposure (Bingo 2011), it should be noted that cultural and privacy rights are not absolute. Additionally, rights need to be tempered by the need for accountability for past actions (Iacovino 2015). In relation to contested incidents — from minor disputes to international tribunals — rights in records must be granted for all parties engaged in accountability determination, including those bringing a complaint as well as any accused.

Care-leavers

Such is the case with Care-leavers and *records* of their time in out-of-home Care. In Australia, the abuse or mistreatment of individuals and families that experienced out-of-home Care have been the subject of more than 80 formal enquiries over the last 25 years. A consistent finding throughout these enquiries has been the systemic failures in recordkeeping and access to records that are still an ongoing source of trauma. Care-leavers have a fundamental need to discover and access records of their time in Care and to have agency throughout the subsequent lifespan of such records (Wilson and Golding 2015). However, Care-leavers commonly experience enormous difficulty in simply locating, accessing and making sense of their records (O'Neill et al. 2012). Beyond access, however, the first-dimension agency of Care-leavers in recordkeeping should include determining which records should be created, preserved for their enduring value and, possibly, destroyed when they no longer have value (Caswell 2014); contributing to the documentation of records; and controlling access to records in which they are referenced (Department of Social Services, Commonwealth of Australia 2015). The fact that an individual's or family's records are dispersed amongst disparate systems, means that systemic *interoperability* of recordkeeping systems is needed to facilitate such *management*.

Some Care-leavers seek to prevent the destruction of their records by those avoiding accountability (Find and Connect Web Resource Project 2013) or due to administrative policy (Australia. Parliament. Senate. Community Affairs References Committee., Hutchins, and McLucas 2004), while others would prefer to destroy records that may have no residual administrative value, but continue to perpetuate ongoing trauma (O'Neill et al. 2012; Russell 2005). Similarly, many participants express the need to be able to control access to their records by, say, researchers, questioning the need for any third-party access. If subjects of these records cannot achieve this essential agency, their records remain "weapons of affect", retaining their potency long after the subject has left Care, perpetuating dislocation and trauma (Wilson and Golding 2015, p. 11). There is obviously

a tension between those who would see their records destroyed, those who would prefer them kept as evidence, social or historical researchers, and record-holders that treat the records as simply objects subject to disposal schedules. It is apparent that, in these situations, destruction or retention of records should be treated on a case-by-case basis, weighing their impact on those affected against societal, evidential, or historical needs. As shown in the more complex example below, a one-size-fits-all Records Authority (or Control Schedule) is a blunt instrument indeed.

In the (common) case where record-holding Government or Care organisations do not cede record-controlling agency to the Care-leavers themselves, some allow annotation of records by Care-leavers as an attempt to 'right the record' by providing their own account of their time in care. In fact, within some Australian jurisdictions, this right of annotation is mandated by privacy legislation (see Department of Social Services, Commonwealth of Australia, 2015). However, is a third-dimension activity whereby record-holders, recognising the connection to records by external parties, allow the annotation of records under strictly controlled conditions. It appears that, in Australia at least, there is no second-dimension delegated control of records to Care-leavers as described by Evans et al. (2015).

Indigenous peoples

This is in contrast to the experience of some Indigenous peoples and their records. In Australia, institutional and private record-holders possess not only 'collected' artefacts, but colonial records relating to Indigenous peoples (Russell 2005). Some of this material contains traditional stories or precious Indigenous knowledge that either forms part of the ongoing Indigenous lived experience, or knowledge lost to the Indigenous communities as a result of colonial activities (including recordkeeping and collecting) in the first place (Ridolfo, Hart-Davidson, and McLeod 2010). Indeed there are some programmes of repatriation of such records to communities for first-dimension management (Denison, McKemmish, Waugh, and Eades 2012) that enable Indigenous communities to re-appropriate, reclaim, and incorporate such records into their knowledge systems (Russell 2005). However, for the most part, record-holding services for Indigenous communities are conceived in the second dimension to *delegate* curatorial control to those who most closely *identify* with the material.

One example is the Storylines project in which the State Library of Western Australia (2015) delegates *curation* of Indigenous material to local communities. In this project, colonial and Indigenous records may be documented, annotated, and transformed by community members, however the library retains physical control over existing artefacts in its custody. A similar approach was proposed by the Trust and Technology Project (2008) to develop a Koorie Archive System (KAS) that would enable participants to "describe, organise, and interpret [the] collection of records" held by the Public Records Office of Victoria (Denison et al. 2012, p. 5). Both the Storylines system and the KAS were conceived as stand-alone systems with some *integration* with the main archival control systems of the holding institution.

A similar delegated, curatorial agency is bestowed when record-holding organisations engage in 'digital repatriation' of material into community care (Christen 2011). The supply of digital copies treats records as an artefactual 'end product' and does not admit

community involvement in the (ongoing) recordkeeping of the original records. However, access to such copies means that not only can they be *documented*, annotated and transformed as the community sees fit, but that the knowledge and memories may be preserved irrespective of the actions of the record custodians.

Archive 2.0 and friends

The Archive 2.0 approach employed for third-dimension participation has been covered extensively in the literature, most recently by Eveleigh (2015), and involves the annotation or 'retrospective documentation' (Anderson and Allen 2009; Eveleigh 2015) of material in custody (for example: Krause and Yakel 2007). These *annotations* may include submitting documents, images, information, or links to external resources; identifying connections between items; asking questions and/or providing answers; and narrating personal connections to material (Sedgwick 2008). *Interaction* in the third dimension may range from individuals engaged in 'lightweight' interactions, to committed contributors, invested in a community of knowledge (Brabham 2012; Haythornthwaite 2009).

Typical of dimension three, participants in the Australian World War I 'Discovering ANZACS' (National Archives of Australia 2015) web site are *invited* to engage in activities "'around' the archive and not within it" (Palmer 2009, para. 21). Such activities in this case include transcribing and making links between records, and contributing comments and stories about records. The Discovering ANZACS site is separate from the main National Archives portal. The contributed material, while *linked* through to records on the main site cannot be accessed through the main portal discovery mechanisms.

The 'Polar Bear Expedition Collections Next Generation Finding Aid' project described by Krause and Yakel (2007) is another example of such an approach and which introduced commenting and 'social browsing' functionality (i.e. public bookmarks and link-paths) to form a 'Finding Aid 2.0'. As with Discovering ANZACS, visitors to this site typically possess a family connection to a veteran and participate by interacting and contributing material, that form layers of annotations around original records. And, again, the records are kept intact under control of the record-holder who continues to provided the 'authoritative voice' of the collection.

The archive portal

This 'authoritative voice' is strongest in recordkeeping services provided through reading-rooms and portal *interfaces* to collections. For some fourth-dimension participants, the authority of this voice is paramount, for example with the presentation of diplomatic documents as described by Kennedy (2009). For others, this 'voice' is an unwanted filter (Hopkins 2008; Ridolfo et al. 2010) through which records must pass; such researchers would eschew this artificial interface (Hedstrom 2002) in favour of rawer view of archival material. In either case, participants engage by *transacting* in a narrow range of activities — mainly discovering and accessing material. Note that this ambivalence towards archival services holds in other dimensions as well. For example first-dimension participants may appreciate the curatorial role of archivists (Blais and Enns 1990) and in many cases there is a demonstrable need for authoritative documentation and assistance in understanding the context and meaning of records.

Fourth-dimension transacting may extend to custom requests for material, for example the Digitisation-On-Demand service at the National Archives of Australia (2013), as well as the submission of *transformations* of records to be incorporated in the primary collection, such as with the the National Archives of Australia and National Library (Trove) transcription projects (Ayres 2013). However, archival outreach and engagement programmes may involve different interfaces for the provision of materials and reception of transformations of various complexity. In all cases, the record-holders act as moderators — retaining the authority to control the acceptance or rejection of submissions and how they are incorporated into the records and documentation (Haythornthwaite 2009).

A major differentiator between dimensions three and four is that the *moderated* participation in the fourth is structured around "individuals as independent contributors to a collective enterprise", but not a collaborative community that may exist or accrete around the material (Haythornthwaite 2009). Regardless, the transactional interfaces in the fourth dimension need to be carefully designed. Unwanted agency in records may not only be eschewed, but repel researchers looking for services that match their conceptions of authoritative record-holders and vice versa (Hopkins 2008; Kennedy 2009; Krause and Yakel 2007; Ridolfo et al. 2010).

Fourth-dimension delivery may sit well with providers of traditional archival services but, as has been demonstrated, there is danger that a focus in this area may distract from the broader social missions of archives (Lehane 2006).

A more complex example

Kathy Carbone (2015), investigating the inaugural artist-in-residence programme at the City of Portland Archives & Records Center in Oregon (the Center), describes how artists in the programme created derivative works from records including poems, performances, and works of art. This particular project was in relation to records of surveillance of Portland activists by the Portland Police Bureau that occurred between 1965 and 1985 — the "Watcher Files". Carbone traces the history of these records and identifies a number of candidate stakeholders including:

- The individuals surveilled and the organisations with which they were affiliated;
- The police bureau and officers who conducted the surveillance;
- The lead detective who stole and maintained some of the files after the surveillance programme was discontinued (It is not clear whether any distinction was made between these additional records and those from the original programme);
- The Portland *Tribune* newspaper and journalists to whom the records were donated some five years after the vigilante detective's death;
- The Center, and individual archivists that sought to preserve the records;
- The Oregon State Archive and archivists, that ordered the records be destroyed in line with the state's record retention policy; and
- The artists who created the derivative works.

The complexities that arise from interaction of all of these stakeholders are worth deconstructing in terms of the model.

To start with, the activists, as subjects of surveillance, have had their first-dimension agency in the resulting records largely denied, particularly throughout the archival phase of the records' lifespans. This was done firstly by the state archive that ordered the destruction of the records and secondly, by the Center that preserved them, but as public records — both acting without regard to the needs of those most affected by the records. Contrast this approach with that of the Stasi Archive that not only ensures the preservation of records of surveillance for historical purposes but applies strict privacy controls to their contents (Beattie 2009). Similarly, neither the police bureau; the vigilante officer or his descendants; nor the newspaper had any agency whatsoever in this process.

Furthermore, activist-artists who had works confiscated by the police (Kathy Carbone, email correspondence, December 2015) suffer additional violations of rights. These works have subsequently surfaced as part of the Watcher Files and are in custody of the Center. Who owns these works? Who enjoys the moral (reproduction) rights in relation to these works? This situation is analogous to the Indigenous material and its eventual repatriation discussed above.

All of this highlights that perhaps the state's record retention policy was cast at too high a level to support the needs of record participants. A first-dimension analysis indicates that appraisal processes, systems, and policy/process outputs need to be nuanced, granular, and dynamic in order to support the needs of first-dimension participants.

The artists created derivative works that may be considered as transformations of the records. From the perspective of the Center, they are not transformations in the transactional, fourth-dimension sense as they were not re-incorporated into the archive as modifications or additions linked to the original material. However, from a multiverse perspective, if the galleries, performance spaces, and the Center itself are taken as a inter-networked whole, then the artists may be considered as researchers contributing alternate readings of the records as transformations. The difference in this case is that the derivative works are not tightly-bound to the original records as with dimension-four transformations. Instead, they are more like the arms-length annotations found at dimension-three, preserved on systems separate from, but linked to, the main archive portal.

Alternatively, this project can be seen as a kind of second-dimension 'digital repatriation' of records — albeit into the hands of the artists, rather than the activists themselves — in which the artists were delegated the agency to document the records as they saw fit. In some cases, the artists worked with the surveilled activists to produce 'Talk-Back' documents in which the activists could effect a kind of 'right-of-reply' to the claims made in the surveillance records. In this way, the activists could exercise some first-dimension agency in determining the public content of records - even if they had no control over the existence of the records or their public nature. This participation engendered a similar sense of empowerment in the activists as experienced by other first-dimension participants in relation to agency in their records (Russell 2005; Wilson and Golding 2015).

Thus it can be seen from this example that multiple participants exhibit differing needs for agency in recordkeeping, some of which was met by the record-holding organisation, and which can all be mapped to the dimensions and axes of the model.

Discussion

It is clear that participatory recordkeeping requires not only a fundamental hospitality to multiple participants but, to paraphrase Huvila's (2008) term, a radical user (re)orientation within recordkeeping practice. This is not a simple matter of re-tooling the technical systems or making adjustments to policy, but an overhaul of the complex and entangled socio-technical system of recordkeeping in society to address its "overlapping, non-saturating and non-nested systems of social relations" (Walby 2007). Such a transformation is not easy to accomplish.

One problem is that true participatory recordkeeping is predicated on hospitality to stakeholders. A difficulty occurs, however, when boundaries are drawn around a sociomaterial system, as they must, whether such boundaries are material, jurisdictional, or ideological. There are always *others* located outside the boundary and the realpolitik of situated recordkeeping practice means that there are some who will never get a seat at the institutional or community table. As Duff and Harris (2002) ask:

> *"Can the mainstream ever accurately represent the marginal? How can we invite in what is always beyond our limits of understanding? [...] How can we invite in what we wish to resist - the voices, for instance, of white supremacists, or of hard drug dealers, of paedophiles, rapists, pimps, and so on, and on, and on?"*

Thus individual record-holding systems may not, and probably cannot, be universally hospitable (i.e. ideally broad).

Secondly, not all of the model may be implemented, even for those to whom the record-holding organisation may wish to be hospitable. Some changes may be straightforward, while other activities, such as opening up appraisal and the maintenance of material to those who are not professional archivists or part of the record-holding organisation may prove to be problematic on a number of levels (Miller 2000). Similarly, existing standards and schemes do not easily facilitate participatory approaches, particularly in relation to the incommensurability of stakeholder ontologies and standardised classification schemes. New conceptual models for recordkeeping informatics may be required to enable a plurality of documentation to be linked, via the records, in support of the perspectives of multiple participants. Consequently record-holding organisations may have difficulties in achieving the depth of participation to which they may aspire.

Archival aggregators — for example: National Library of Australia (2015) or Ancestry.com (2015) — with their lowest-common-denominator, public information approach to collection and description are not part of the inner-dimension problem (or solution) space. Rather, the starting point has to be interoperable, networked systems that enable participants to access a layered infrastructure that, in toto, provides required breadth and depth. Record-holding organisations that are not able to support all participatory recordkeeping functionality or be arbitrarily hospitable, could interoperate with others in

the network such that, in combination, participant requirements are met. Such interoperability by record-holding organisations could be justified as follows: 'We may chose not to be hospitable to participant X or provide function Y, but are prepared to interoperate with other systems in the network, some of which may provide such hospitality or functionality'. Perhaps this is a modern version of the famed quotation regarding the right to free speech attributed to Voltaire (Hall 1907). Of course building such an infrastructure is no guarantee that they will come — there are some recordkeeping jurisdictions that are not only shallow and narrow, but refuse to interoperate with others on ideological grounds (Gilliland 2014b).

It should be remembered, though, that record-holding organisations that deliver services aimed at the outer dimensions of participation may be satisfying the needs of those participants very well. Rather than simply ignoring deeper recordkeeping needs, they may be engaged in transformation, working through the issues surrounding the transfer of agency to participants. Similarly, as Cornwall (2008) argues, participants engaged at outer dimensions may not only be satisfied but may also similarly be working their way inward, gaining experience, acknowledgement, and leverage for negotiations ahead.

However, without deliberate understanding of the needs of participants, initiatives that fall-short of transformative participation can have negative consequences for participants beyond the obvious silencing of voices and the withholding of power. Chambers (2006) describes a number of ways in which ill-conceived or token participatory programmes can negatively impact participants. Such activities waste limited resources, particularly if the participants are the subject of repeated programmes of this nature. Expectations that are raised and not met can exacerbate perceptions of alienation and disillusionment. Even more injurious are programmes that serve to extract information from participants, or worse, use it against participants' best interests. Finally, programs may cause conflict within communities or expose participants to danger from outside sources by virtue of their involvement. There are many ways for recordkeeping initiatives to fail while appearing to be participatory in nature.

Conclusion

This essay started by questioning the various definitions and degrees of participatory engagement with records that have been reported in the literature. From the outset, a distinction was drawn between *archiving* that takes place after records have been transferred to a formal archival repository and the continuum term *recordkeeping* that encompasses all activities germane to the record life-span.

A literature warrant was employed to develop models of participatory recordkeeping including requirements for supporting networked infrastructure. Analysis of the discourses around community development identified a number of similar typologies of participation — in particular, the 'ladder of participation' approach. However, when attempting to apply these typologies to participatory engagement with records, a number of shortcomings were identified. The linear, meta-narrative approach popularly discussed in the development literature was rejected in favour of a continuum approach to modelling participation. Based on the Records Continuum Model, a Participatory Recordkeeping Continuum Model was

proposed that involved the distanciation of participants from the activities represented by records.

A number of types of participatory engagement found in the literature including community archiving, Archive 2.0 initiatives, traditional researcher engagement, and participatory recordkeeping have all been identified and situated within the model. In particular the model can be used to answer questions about the boundaries of participation in various scenarios together with the associated rights, roles, and responsibilities of participants. It is, however, a new model and may be subject to change or further refinement as it is exercised. In particular, the limitations of the literature-based approach taken in this study mean that fewer or more dimensions may ultimately be identified, or the axes may prove to be asymmetrical with respect to distinctions between categorisations.

Nonetheless, the model shows that any treatment of participatory engagement with records that attempts to solve problems of severe disenfranchisement, for example, as explored in: Gilliland and McKemmish (2014) requires a continuum approach — the Records Continuum Model to deal with the complexity of records and a Participatory Recordkeeping Continuum Model to understand the complexity of participatory agency. In contrast, a custodial paradigm presents only two loci of engagement with participants: the inwardly-focussed archival threshold, at which accession, arrangement and description take place; and the public-facing discovery and retrieval interface, whether physical or virtual. This binary nature restricts the capacity to address the disenfranchisement of record stakeholders. The community archive (or dimension 2) is the limit of the first interface, and Archives 2.0 approaches (or dimension 3) at the second.

Particularly, in the case of Archive 2.0, the assumption that a third-dimension approach will suffice for all participatory needs of record stakeholders is misplaced. The risk of engaging crowds (if not communities) in this way (Haythornthwaite 2009), is that, unless the needs and modalities of contributors are understood (Sexton, Turner, Yeo, and Hockey 2004), initiatives may be less than successful (Brabham 2012; Krause and Yakel 2007; Liew et al. 2015; Palmer 2009). Moreover, the Archive 2.0 paradigm is not without its detractors (Kennedy 2009). Ultimately, transformative participation (particularly in the first dimension) requires intervention, negotiation, and re-negotiation of power and engagement at multiple points through the life-span of records.

Finally, it is anticipated that a Participatory Recordkeeping Continuum Model can be used to not only situate existing literature, projects and systems, but to determine the system requirements necessary to achieve the various modes of participatory engagement at each of the dimensions of the model. This is the next stage of investigation: to identify the features of socio-technical infrastructure required to support participatory recordkeeping. And the following, of course, will be to exercise and validate these models by designing and building the next-generation of participatory recordkeeping systems.

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Conclusion

It is clear that the Participatory Recordkeeping Continuum Model, based on an understanding of records as representations of activities, sits squarely within the Stage-3 conceptualisation of recordkeeping. The relationship of this model to the other design science elements is shown in Figure 5.1 where the solid black line shows the influence of the requirements on the model — both of which were continually influence by the design science kernel theories and empirical evidence. The meta-requirements were a precursor to the functional model that, in turn articulates and addresses these requirements.

The model is, at least, a partial affirmative answer to my second research question:

2) *Can infrastructural and participatory approaches to recordkeeping be addressed through transformative design?*

as it provides evidence that addresses the fifth sub-question

v. *Can conceptual and other models be developed that express the characteristics and affordances of a meta-solution?*

Of course, as I argue in the published article, this is a tentative conclusion, albeit one made with confidence. Exercising this model in other research or production contexts may surface shortcomings or omissions that indicate that the requirements from which it is drawn may need to be further examined or refined. This is totally expected in the context of wicked problem space. Nonetheless, the successful development of a functional model suggests that the problem of participatory recordkeeping is tractable, at least in terms of understanding the problem space. To this end, the model also directly addresses my first research sub-question by concisely distilling the essence of the requirements described in Chapter 4.

i. *Can a comprehensive and consistent understanding of participatory recordkeeping be articulated?*

Moreover, this model is an addition to the set of continuum models that attempt to describe the complexities of the records and information management space (Gibbons, 2015b; Upward, 2000, ch. 3). As a needed "model of different degrees of participation in archival contexts" (Huvila, 2011, p. 1), it directly (albeit partially) addresses my eighth sub-question:

viii. *(In what ways does my design impact:) mainstream theories of records, archives, and recordkeeping?*

By describing space-time distanciation — not from the point of creation of a trace that may
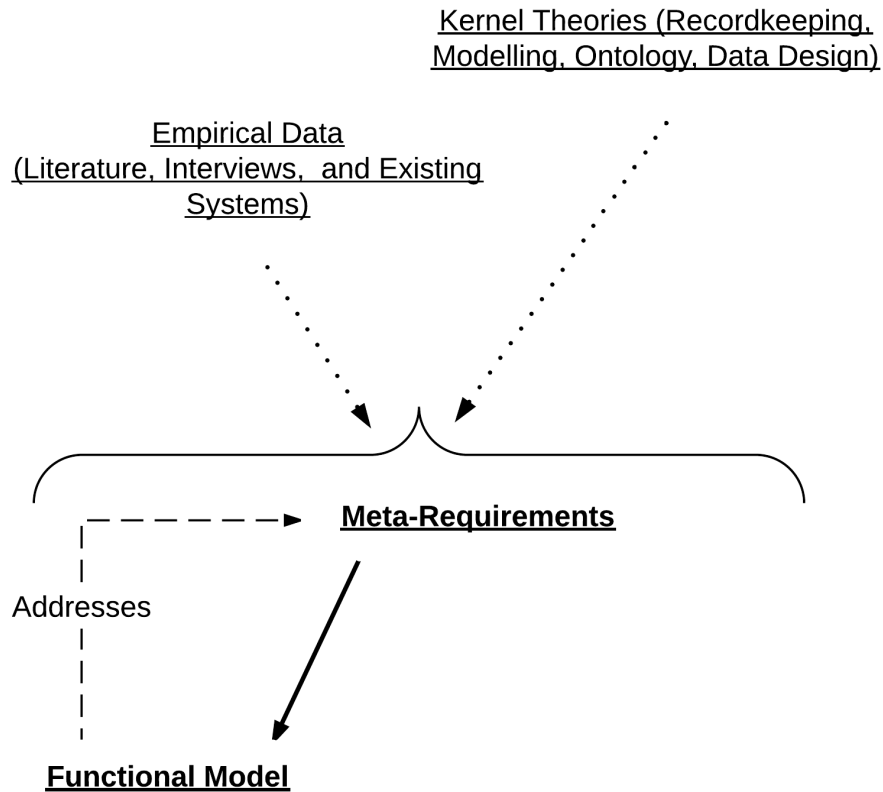
Figure 5.1: Relationships between design outputs and activities — functional model

become a record — but from the activity represented by such a trace, this model shifts the focus from artefacts and actors to the activities themselves. This shift is key to the transformational nature of this functional design. Aside from answering Huvila's call for a model that explicates the breadth of participatory recordkeeping requirements and practices, this model reveals the possibility for a new set of recordkeeping guidelines and standards that embrace participatory approaches in several ways that contemporary designs cannot.

Firstly, it provides a concrete rationale for conceptual models that directly facilitate and embrace a plurality of perspectives on records. An important consequence of the multiplicity of recordkeeping viewpoints is that there may not be common agreement on the nature of activities; the identities and roles of participants; and even the form and meaning of records. The Participatory Recordkeeping Continuum Model can assist in understanding how each of these manifest within a given context. Importantly, these different perspectives may be incommensurable; and yet, a supporting conceptual model must be able to simultaneously embrace them all while providing a basis for granular, dynamic, and pluralistic access control that facilitates the requisite agency of participants. Such a conceptual model is presented in Chapter 6 where these aspects are discussed in more detail

Secondly this model has potential as a reference model (Hofman, 2017, p. 639) which informs recordkeeping-related functional analyses — irrespective of whether they are performed from an archive perspective (either in terms of records management or archival appraisal), or from a holistic continuum point of view. By introducing the concerns of all participants in records beyond the immediate organisational context, such functional analyses would expand upon the scope of existing practice guidelines and standards such as the Australian DIRKS methodology (State Records New South Wales, 2007), and the ICA Functional Requirements for Records in Electronic Office Environments codified as (International Organization for Standardization, 2010) to name a few. The Participatory Recordkeeping Continuum Model could also similarly inform archival-appraisal analyses (when taking a life-cycle approach) to address the type of criticism of approaches such as Canadian Macro Appraisal levelled by T. Cook (2004) to better support "the archivist in the present [to construct] the past that the future will know".

As described in the introduction to Part 2, one reason I opted for the publication of this model was to obtain feedback that would act as a peer-evaluation of the model and my justificatory arguments for this part of the design. The following is an overview of some of the issues that were raised by reviewers and others.

5.0.9 Reception

Reception of the model was positive although, as expected, there were some challenges from various quarters.

Interestingly there was a little push-back regarding the model from some within the Continuum Informatics community. While there is precedence for theorists departing from the format of the original continuum models — for example Gibbons (2015a) eschewing the concentric and rectilinear 'circles and lines' — the Participatory Recordkeeping Continuum Model is the first to completely depart from the Create/Capture/Organise/Pluralise nomenclature. As explained in the article body, the shift of the perspective of distanciation from records to activities (or from Stage-2 to Stage-3 conceptualisation) necessitated re-visiting the verbs[30] usually employed to describe the model's dimensions. When presenting the model, I was asked whether it would be possible to re-cast the model to use the original dimensional terms. However I didn't then, and still do not now, see the benefit or the practicality of trying to align Create/Capture/Organise/Pluralise with Experience/Identify/Relate/Research. While there is

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[30]Always verbs. As Terry Cook explained, to "reorient ourselves from the content to the context, and from the end result to the original empowering intent, that is, from the artifact (the actual record) to the creating processes behind it, and thus to the actions, programmes, and functions behind those processes [. . .] we will move from nouns to verbs" (T. Cook, 1994).

undoubtedly some sort of semantic relationship between these two sets of terms, I feel that to revert to the former would be to lose the essence of what the model is trying to articulate.

I found this resistance to the new dimensional terms interesting in terms of individuals' attachment to the forms of the models — particularly as many of the original records continuum theorists have stressed the transience of the modelling (created at the time to explain concepts) and their 'moving on' from the models as point-in-time articulations that have subsequently ossified as artefacts. Significantly, "models are not cast in Stone [and] have to evolve over time as thinking and knowledge progress" (Hofman, 2017, p. 656). There is an ironic parallel here in that, while repudiating the 'record-as-relic' conceptualisation, the original continuum models themselves are sometimes treated as iconic relics in their own right. Perhaps this is an example of the entrenchment of the recordkeeping professional mindset described in Chapter 4.

Similarly, there was a query as to whether my model was constrained by Upward's original topology (Upward, 1997), and a suggestion that the division of each of the axes into four divisions seemed too 'neat' in the face of a messy reality. As with any critique of a modelling exercise, this sort of comment is fair. Reality is always messy and a model is, after all, a simplification of a 'slice' of reality that provides insight for a particular problem domain (van Gigch, 2014, p. 119). In the face of a continually changing understanding of the problem domain, the constraints and communicability of a model's format should be continually questioned. Indeed the deficiencies of a two-dimensional figure in attempting to describe complex phenomena have long-been discussed and recent work in continuum modelling (for example by Gibbons (2015b) as discussed above) is beginning to transcend the strictures of the Upward design.

In my case, I suppose that continued exposure to the 'circles and lines' format of the various continuum models may have coloured my approach in not starting from a blank slate. Nonetheless, I do stress the caveat described in the article body that this model needs to be further exercised to verify the appropriateness of each of the dimensions and axes, a topic to which I will return in Chapter 9. With this in mind, I still hold these regions to be distinct — even if the dimensions are fuzzy as they are with Upward's original model. That is the nature of a continuum: it is tricky to notice small increments of movement in any direction, but it is clear when you are in another region, and can recognise that some notional threshold may have been crossed. (Upward, 2005a).

Another point of discussion concerned the separation of documentation into different types along the Inscriptions axis, citing Huvila's (2008) warning against the separation of annotations from 'authoritative' documentation'. I do think the situation is a little different; particularly

with Huvila's characterisation of participants as two groups: archivists and Users; with the latter involved in rich description as "the participants are more knowledgeable about the archival material than an archivist alone can be". Of course I have no disagreement there.

However, I would argue that, not only are there are more than two groups, but those that have an increasing distance from the trace material (or, more precisely, the circumstances of its creation) are typically in a position to contribute to existing documentation — and by documentation, I implicitly mean schema-style contextual metadata along with narrative description. I hope that, by now, I have made it clear that authoritativeness is in the eye of the beholder and that all documentation, created and viewed from a multiplicity of its perspectives, may be considered authoritative. Either way the important points are that (a) all of this material constitutes records in their own right so that (b) the provenance of all descriptive material and transformations needs to be captured and made available to participants.

5.0.10 Usefulness

While the statement of requirements provided the foundation for this model as well as the conceptual model and the proof-of-concept instantiation described in Chapters 6 and 7 respectively, it was only after this functional model was articulated that the true scope of the other design work became apparent. The conceptual modelling only started to solidify after this model was produced, and it, as well as the instantiation, iterated rapidly as they developed support for its constructs. In terms of the conceptual model, the recognition of a continuum of documentation types (along the Inscriptions axis) was the catalyst for the introduction of the *Representation* relationship and removal of the *Record* entity. Up to that point I had assumed a conventional treatment of records as semantically distinct constructs. Similarly, the recognition that not all participants are able to exhibit agency in relation to the activities in which they are involved, led to a distinction between purposeful *Enactment* and more passive *Involvement*. In Chapter 6 I reflect upon the impact of these and other factors on the development of the conceptual model.

As regards to the proof-of-concept instantiation, the functional model provided the first inkling that the scope of the instantiation would have to be considerably narrower than my early ideas about what it would cover. As I discuss in more detail in Chapter 7, the proof-of-concept could, in no way, do justice to the requirements for access control, management, and delegation of agency etc. In Appendix D, I provide a summary of the functionality, indicated by the functional model, that did not end up in the instantiation. However, by articulating the requirements for participatory recordkeeping, the functional model did clarify the core requirements

for the proof of concept as well lay the foundation for future research described in Chapter 9.

Chapter 6: The Conceptual Model

Creation is important, he noted, "but what ontology, what view of identity, lies behind our concept of creator, author, writer?"
Terry Cook (quot. Brien Brothman); *Electronic Records, Paper Minds*

In this chapter I describe the third design artefact; the conceptual model for participatory recordkeeping. As with the previous chapter, it largely comprises a published article: in this case 'Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata' in the *Records Management Journal* in June 2017.

This model was the earliest design artefact to appear in the project (I had been musing about it from the start of the research), however it also took the longest time to develop. Consequently, it was the last design output to reach sufficient stability for publication. It is a good example of iterative design science as it drew on theory from a number of related disciplines; underwent constant iteration in response to the consolidation of requirements, the development of the functional model, the building of the proof-of-concept instantiation, and the evaluation activities; and emerged as an artefact with the capability of informing the construction of new systems and services — in this case, recordkeeping systems that support Stage-3 conceptualisation.

The model addresses one of the main meta-requirements for participatory recordkeeping: how to enable disparate — even incommensurate — ontologies to be expressed within a single conceptual recordkeeping framework. In doing so it not only facilitates the hospitality necessary for participants and their plurality of recordkeeping contexts, but it's use of semantically meaningful relationship types enables interconnection between divergent ontologies; paving the way for interoperability between disparate recordkeeping systems.

Note that, as foreshadowed in the introduction to Part 2, the article introduces some repetition. It spends some time describing the background to the project and the methodology that I employed. It also describes the proof-of-concept instantiation and its evaluation that I discuss in far more detail in Chapter 7.

Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata

Introduction

While a record's internal documentary characteristics may provide us with hints of meaning and provenance (Duranti, 1998), additional recordkeeping *metadata* is usually necessary to provide the context and therefore the veracity of a record's informational and evidentiary affordances (Cumming, 2007). Moreover, good metadata design is necessary for the best management of, and access to, records beyond their immediate transactional context (Gilliland, 2008). Such metadata may take many forms ranging from simple classification terms or textual description, to comprehensive entity-relationship database schemas (Evans et al., 2009; Gilliland and McKemmish, 2012; Schaffner, 2009).

The international community, through its various standards processes, recognises such metadata schema design as a core component of modern recordkeeping frameworks (International Organization for Standardization, 2001a, 2007). Such frameworks are needed to facilitate the "design of the capacities, and/or appraisal of the capabilities, of […] systems to create, capture and maintain adequate records" (Oliver et al., 2009). This shift of recordkeeping practice, from inventory control to strategic analysis of recordkeeping outcomes (Oliver et al., 2010), means that recordkeeping metadata must support the complete 'recordkeeping business' of "appraisal, control, preservation, retrieval, access, and use of records" across space and through time (McKemmish et al., 1999).

However, the documentation of records is increasingly being acknowledged as a contested space (Evans et al., 2015; Hopkins, 2008; Wood et al., 2014), comprising a plurality of stakeholders, with multiple — even incommensurate — perspectives on the context and meaning of records and the activities that they represent (Gilliland, 2014; PACG, 2011; Rolan, 2016). The issue of multiple perspectives becomes an operational problem when performing recordkeeping analysis: in attempting to reconcile the "discordant cacophony" of different intra- and inter-organisational (and, by extension, community) cultures (Foscarini and Oliver, 2012), analysts struggle to document records according to multiple, and possibly competing, world views with associated notions of meaning, access, and agency within a single system and its recordkeeping schema.

In actuality, recordkeeping systems do not exist in isolation, but within a network of records, metadata, systems, and stakeholders (PACG, 2011). In order to begin to address these pluralities, this network needs to be purposefully designed and based upon a flexible, granular, and interoperable infrastructure (Anderson and Allen, 2009; McCarthy and Evans, 2012; Reed, 2005). Unfortunately, existing recordkeeping and archival metadata standards and schemas promote

jurisdictional-specific implementation that neither affords interoperability nor attempts to address the incommensurability of differing stakeholder world-views (Evans et al., 2009). They either assume conformance to a common conceptual paradigm (Lehane, 2014) or, by side-stepping the issue of integrating multiple perspectives into an interoperable whole, lead to the development of localised and isolated systems (Evans, 2007; Rolan, 2015). A simple example of this is shown in Figure 1.

Such localised recordkeeping schemas and systems, together with schemes such as authority files, reflect the perspective of record-holders and their power to control discourse (Caswell, Cifor, and Ramirez, 2016; Hopkins, 2008; Ketelaar, 2005). What is recorded (and what is deemed to be a record); the meaning of records; how they are aggregated and arranged; as well as the documented identity, roles, and functions of the inscribers of records (and, indeed, the privileging of the inscribers or 'owners' of records above other participants) are all outcomes of the choices made when recordkeeping schemata are constructed in line with contemporary recordkeeping standards. This is also a perspective of records as agent-created artefacts. This view requires participants in recordkeeping to negotiate what Bearman describes as "the world of documentation" rather than explicating the rich contextual plurality of records corresponding to participants' "knowledge of the world being documented" (1992, p. 44) – in other words, an activity-oriented perspective.

The artefact-agent paradigm simply does not admit differing and especially incommensurate documentation of records within a single framework – either in terms of alternate records that represent a given activity, or alternative interpretations of records in terms of activities that took place and the participants involved. Contemporary recordkeeping standards and schemas are not semantically rich enough to allow the simultaneous definition or even association of disparate, collections of records and metadata.

The proliferation, not only of metadata standards and localised schemas (Gilliland et al., 2006; Upward et al., 2013), but of recordkeeping systems themselves, is resulting in missed opportunities for interoperability (Evans, 2007; Rolan, 2015). The pace of technological change, particularly as we transition into digital recordkeeping, is exacerbating this fragmentation and the inadequacy of existing recordkeeping paradigms (Cumming and Findlay, 2010). This disconnection of information and effective loss of records (Upward et al., 2013), leads to diminished utility of recordkeeping and the disenfranchisement of stakeholders in records at a community, organisational, and individual level (Evans et al., 2015; Gilliland and McKemmish, 2014).

To address these issues, the systemic design of recordkeeping metadata and systems as *infrastructure* is needed (Star, 2002). We require "coherence" rather than "sameness" and facilitation of "the processes of aggregating [records] with other information objects and their movement into other times and spaces" (Upward et al., 2013). Interoperability must be designed in from the start; it is not something that can be bolted on as an afterthought (Evans, 2007; Rolan, 2015). How should or can recordkeeping metadata support these multiple perspectives within an interoperable infrastructure?

This article introduces an infrastructural approach to metadata modelling that extends the common meta-ontology approach of Rolan (2015) and the constraint of schemas to a small number of ontologically defined entity and relationship types. The current research has resulted in a generalised *Meta-model for Recordkeeping Metadata*. This meta-model is an attempt to support interoperability between disparate systems and particularly between sets of ostensibly incommensurate record documentation, by enabling the shift from artefact-agent oriented to activity oriented schema design.

The rest of this article is organised as follows: Section 2 provides a description of the research methodology and design activities. Section 3 introduces the meta-model itself and provides a detailed description of its constructs. Although the research project is still ongoing, section 4 briefly describes the early outcomes of the design evaluation and discusses implications and opportunities for the meta-model. The article then concludes with an indication of potential future avenues for investigation.
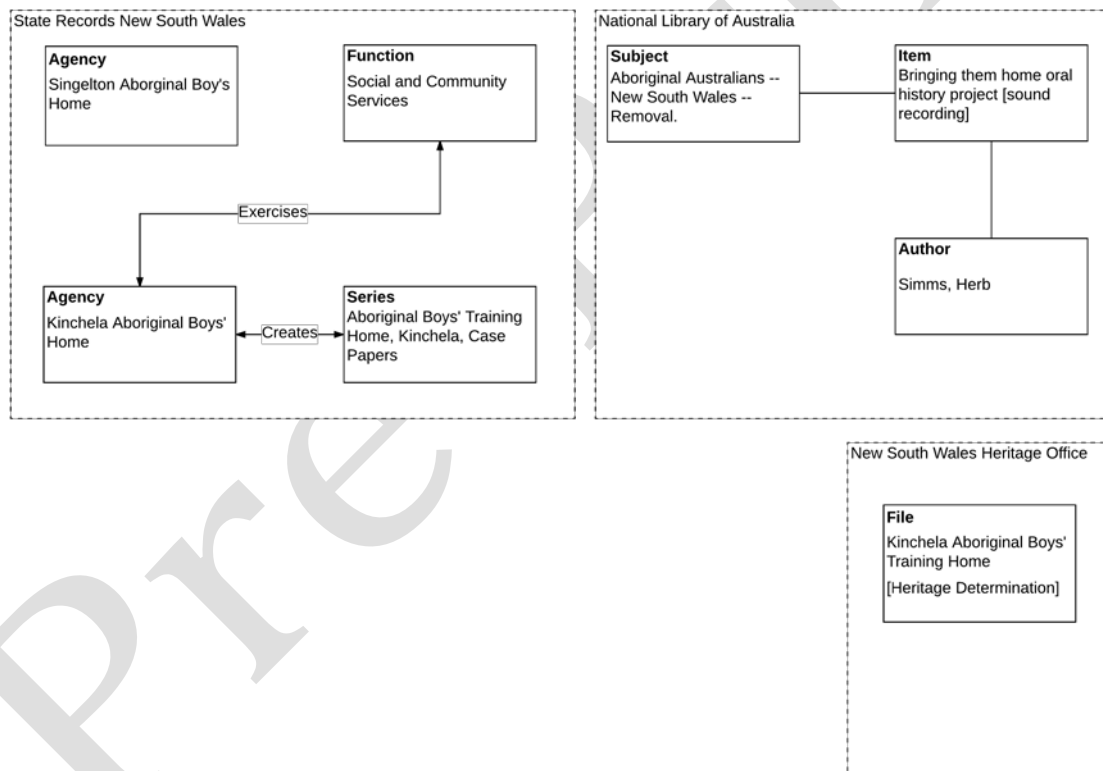
Figure 1. Example of multiple institutional perspectives

A brief note on terminology

This work is intended to encompass all recordkeeping contexts, including oral, documentary, and digital paradigms within personal, community, organisational, and institutional contexts. Consequently, a *record* may be defined as a trace or representation of activity where such traces (and their metadata) have value to

individuals, organisations, and/or societies –– "whether that be for a nanosecond or millennia" (McKemmish, 2001).

Similarly the (single-word) term *recordkeeping* takes the meaning here as an all-encompassing description of activities germane to the record life-span. Recordkeeping, in this sense, encompasses the decision to create records; their management throughout the multiple contexts of creation and use; and their preservation or destruction based on ongoing needs (Reed, 2005; Upward et al., 2013). It is this meaning of recordkeeping that will be used throughout this article rather than the two-word term *record keeping*, most often concerned with the keeping of records as physical things (Upward et al., 2013) and which may follow "a particular custodial model [that] primarily considers retrospective description, i.e. taking place after records have been transferred to a formal archival repository" (Eveleigh, 2015, p. 54).

To complete this list of definitions, the term *recordkeeping system* refers to a jurisdictionally bounded socio-technical system that is used to manage records and/or recordkeeping metadata — whether they be historical or current. While, technically, large consortia such as Europeana (Europeana, 2016) or SNAC (Institute for Advanced Technology in the Humanities, 2016) can be considered systems, this article takes the narrower definition of individual systems operated by a single organization or community (that may well participate in larger-scale recordkeeping infrastructure). Finally, the term *archive* (*archives* pl.) is used here to refer to a recordkeeping system and its data, the organisational context in which it exists, and any records over which the organisation has administrative or custodial control.

Research Approach

This research project uses an iterative and reflexive design-science methodology that employs systems development methods along with additional qualitative methods (for example, interviews and focus groups) for understanding and evaluation. While a consensus on a definitive practice of design science research is elusive, common features include the addressing of significant problems; the development of design artefacts — whether methods, models, or instantiations; and their subsequent rigorous evaluation (Venable, 2010). The systems-development approach frames an iterative Conceptualise/ Design/ Develop/ Evaluate workflow "with the intention of generating new knowledge and improving social [utility] of the system" (Burstein and Gregor, 1999) as shown in Figure 2.
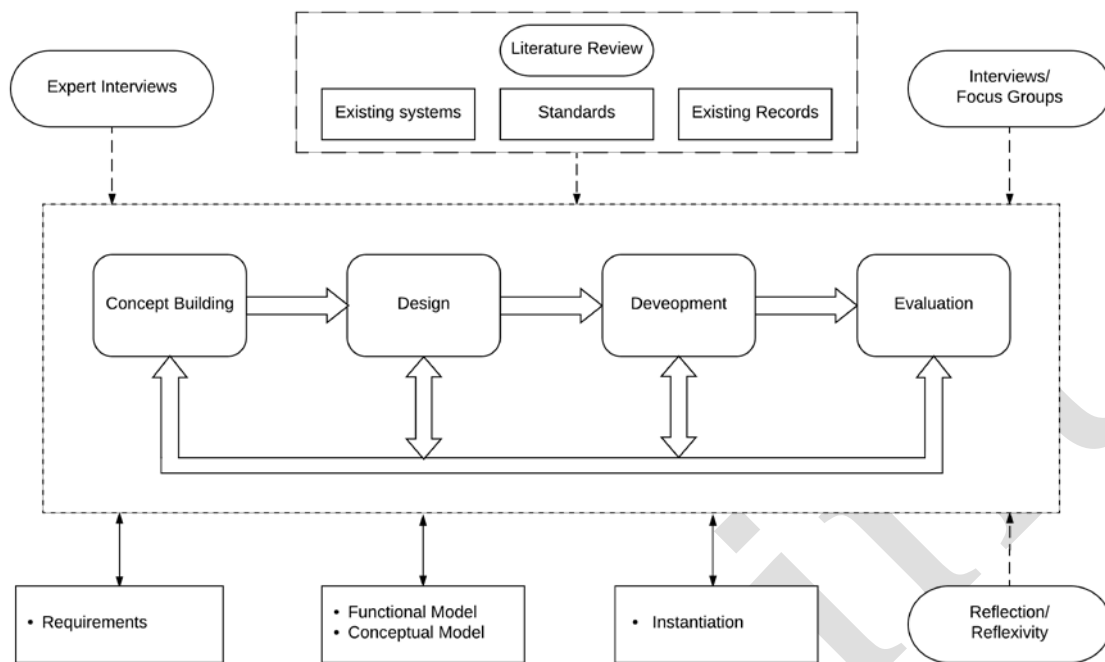
Figure 2. Research methodology

The choice of a reflective, design-science approach is a deliberate one as the objective here is to achieve transformative change in recordkeeping systems design. Beyond traditional recordkeeping research methods such as diplomatics, functional analysis, and literary warrant analysis, Gilliland and McKemmish (2012) argue that emergent interventionist methods from IS, including design-science, are also advancing recordkeeping research. It is this interventionist pragmatism that Goldkuhl (2012) argues seeks "to create knowledge in the interest of change and improvement" with a critical orientation stemming from an "interest [in] not only for what 'is', but also for what 'might be'." Moreover, supporting Rittel & Webber's (1973) analysis of 'wicked' (often sociomaterial) problems, Conklin, Basadur, & VanPatter (2007) also suggest that, when investigating pervasive, socio-technical systems, non-linear or iterative approaches "illuminate the hidden issues and flush out the hidden stakeholders". For these reasons, iterative pragmatist approaches such as design-science are more appropriate for tackling sociomaterial informations systems problems than the linear activities of discovery and justification.

The project comprises interviews with domain experts from academia and industry in North America, Europe and Australia; an adaptive literature review of participatory and recordkeeping discourses; the design of conceptual models; and the instantiation of a proof-of-concept network-based record documentation system. The *Meta-model for Recordkeeping Metadata* is one of the conceptual models and formed the basis of the proof-of-concept instantiation.

Background

A series of background interviews was conducted with domain experts in order to understand the directions which leading international record-holding institutions and practitioners are headed — as well as the challenges they have faced and overcome — in designing contemporary, on-line recordkeeping systems. The adaptive literature review and analysis covered articles that described or implied systems functionality relevant to recordkeeping in multiple-stakeholder contexts. Each source was analysed for statements that described or implied systems functionality relevant to multiple-stakeholder or *participatory* recordkeeping. Such statements were coded using the QSR NVivo qualitative research tool.

The conceptual codes were guided by the description of records management processes in section 4.3 of the Australian standard ISO 15489 for Record Management Guidelines (International Organization for Standardization, 2001b) along with some general codes. Not all of the ISO15489 Records management processes were used for coding as they were either not germane to the problem of schema modelling or were subsumed in other codes in this context. For example the literature did not include considerations of the volume, cost, or physical characteristics of the 'Storage' process, and the other storage considerations (e.g. access, security etc.) were covered elsewhere.

The final coded categories (NVivo nodes) were: Overall architecture and design; Access Control (with sub-nodes: Authentication, Authorisation, Reproduction Rights Management, Tracing and Audit); Appraisal; Creation; Documentation; Discovery; and Retrieval. A total of 26 publications and the functional descriptions of 8 generalised systems were found to contain significant statements in relation to participatory recordkeeping. This background material was used to inform the design activities.

Modelling Approaches

The schema-oriented metadata design approach is exemplified by the Australian Series System and its progeniture — for example, the early work of Scott (1966), the Australian Recordkeeping Metadata Model (McKemmish et al., 1999), the Australian national and jurisdictional standards (National Archives of Australia, 2015; and, for example, State Records Authority of New South Wales, 2001), the International Standards Organisation ISO23081 (International Organization for Standardization, 2007) — and, more recently, the Records In Context model currently under development by the International Council on Archives Experts Group on Archival Description (2016) (EGAD). The prevailing archival standards ISAAR-CPF, ISDF and ISDIAH (ICA, 2016) are also examples of this separating out of context from material description, though their contextual elements are limited in scope to just individuals, organisations, families, functions, and record-holding institutions.

One characteristic of this schema-oriented documentation is that its artefactual and agential orientation leads to a bottom-up or *topographical* analysis. Because it is concerned with surface features of records and the circumstances of their creation and management, constructs such as documents, artefacts, people, and organisations are typically selected as the primary entity-types of the resultant

metadata models. This has resulted in some ontologically questionable metadata constructs. For example, consider the ISO 23081 (International Organization for Standardization, 2007) and its suggested organisation of constructs into symmetrical-looking hierarchies in its Metadata Conceptual Model. While organisations (social concepts) may be decomposed into agencies or work-groups (social concepts), such organisational units (social concepts) cannot really be ontologically decomposed into people (physical things). Similarly, although relationships are defined as first-class entity-types, their role here is to simply link entities. Relationships in such schemas are not strongly typed in an ontological sense, and possess little semantic meaning beyond their jurisdictional names and dates of existence.

Such schema modelling, with its formal treatment of actors and artefacts, reflects an essentially modernist conceptualisation of provenance from the perspective of the record holder or owner. This is somewhat akin to the use of classification schemes that constrain the field of discourse to a knowable set of 'things' (Shirky, 2005). Lacking interoperability as a goal, such schemas do not readily afford development or extension into interoperable frameworks (Evans, 2007; Rolan, 2015) and thus lead to the proliferation of metadata standards and recordkeeping systems as described in the introduction. Such a topographical approach also explains the burgeoning numbers of Semantic Web vocabularies (Vandenbussche et al., 2015).

An alternative approach is one based on a top-down or *topological analysis* and recognition of records as representations of human activity. Conceptual models underpinned by a focus on deep structure should be ontologically consistent, be able to map to different perspectives, and better support interoperability. Note, though, that inadequacies in contemporary recordkeeping models may not be solely due to the topographical approach to their design. For example, interoperability, support of incommensurate ontologies etc. may not have been design goals. And, indeed, there have been successful 'bottom up' modelling approaches in other domains (for example Leung and Nijssen, 1988). Similarly, a topological approach is no guarantee of completeness. In actuality, all modelling iterates to some degree between 'bottom up' and 'top down' analysis. However, making the design goals of interoperability etc. explicit while focussing on ontological semantics is an expeditious way to arrive at a suitable meta-model, and this is most easily achieved from a primarily topological perspective.

The purpose of the meta-model is to define the design constraints and rules for subsequent recordkeeping schema modelling to ensure interoperability. It "embodies the properties which are abstracted from all models (there is more than 'one model')" (van Gignch, 1993, p. 252). Meta-modelling is "a process of design which is carried out at the metalevel and by which we define how the process of modeling (at the lower level of abstraction) is to be carried out."

Using this approach, a record may represent many activities and any activity may be represented by many records. Such conceptualisation is less concerned with the nature of records as physical artefacts, than with facilitating the expression of human activity and involvement. Furthermore, this approach also allows for other types of documentality such as personal memory and performance (Ferraris, 2006).

Significantly, it embraces the ontological incommensurability of disparate world views, allowing all participants in records to be recognised and potentially participate in recordkeeping activity. In other words, this conceptualisation facilitates hospitality to stakeholder involvement by facilitating the documentation of their world and not limiting metadata to an arbitrary world of documentation (Bearman, 1992). This approach was taken in order to arrive at a set of primitive elements and relationships, derived from the world being documented, for the purposes of recordkeeping informatics. An ontological analysis was conducted, with particular reference to previous ontological work performed in the documentation and information systems space.

Ontological analysis

To start with, Upward (1996), Yeo (2007), and more recently, Lemieux (2014) argue that records may be considered as representations of activities. Therefore an ontological distinction needs to be drawn between activities and other types of constructs, or more formally, between *occurrents* and *continuants* (Grenon and Smith, 2004; Simons, 2000). Occurrents (alternatively known as purdurants) are temporal entities; they unfold in spacetime and may have a duration and/or temporal parts. Occurrents exist only in their successive phases (Smith and Grenon, 2004) and cannot be considered whole until their temporal existence has run its course.

In contrast, continuants (endurants) have no temporal parts and, while they obviously endure through spacetime, they "exist in toto at every moment at which they exist at all" (Smith and Grenon, 2004). Continuants may be considered as point-in-time 'snapshots' of the occurrent that is the continuant's life. Alternatively, Simons (2000) argues that a continuant at a point in time is 'shorthand' for the totality of occurrents that have involved the continuant up to that point in time. Common continuants are physical things; substantial objects that occupy physical space.

Similarly, our world being documented is replete with conceptual entities (Margolis and Laurence, 2007) and, in particular, social objects that "exist only because we believe them to exist" (Searle, 1995). The work of Ferraris (2006), Smith (2008), and Robinson (2014) shows that the sociomateriality (see Cecez-Kecmanovic et al., 2014) of records results in the realisation of social objects such as nation-states, organisations, agreements, and roles etc. Thus an ontological distinction is made between substantial and non-concrete continuant entities. A special case of continuant is the agent: an entity that can either purposefully engage in an occurrent or have its agency affected by one.

Finally, the analysis of relationships extended the models of Purao and Storey (2005), and employed in Rolan (2015) within a recordkeeping context, with these constructs. The meta-model that encompasses these concepts is discussed in the following section.

The Meta-model for Recordkeeping Metadata

The Meta-model for Recordkeeping Metadata is shown in Figure 3. Its main objective is to facilitate interoperability between disparate recordkeeping systems

— particularly between those documenting potentially incommensurable ontologies. A secondary goal (though aligned with that of interoperability) is to provide a transition from legacy systems to new systems built for interoperable infrastructure. To this end it attempts to encompass the ontological rigour described above as well as provide sufficient granularity and flexibility to ensure that existing modes of documentation and levels of detail are supported, even in a transitional sense.
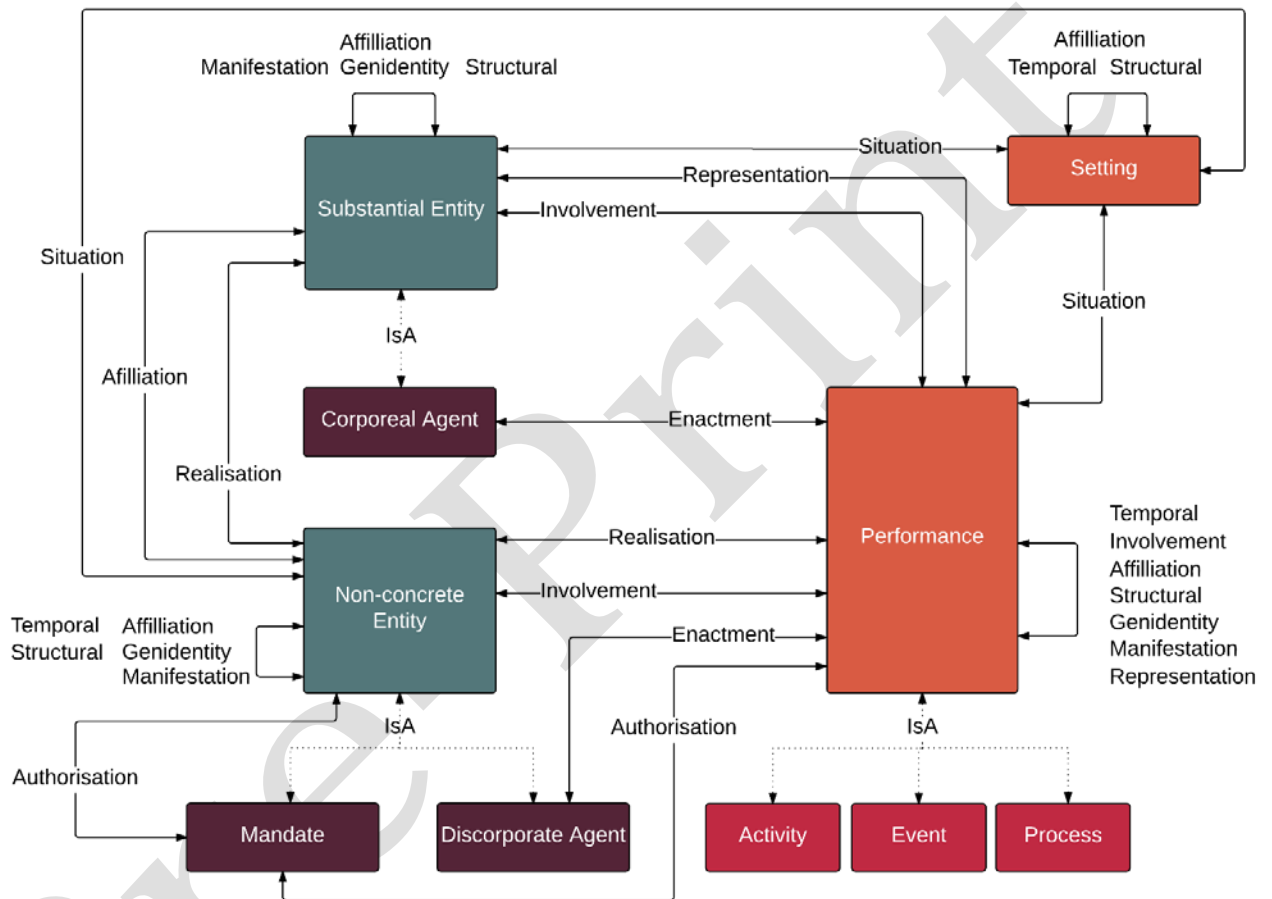
Figure 3. Meta-model for Recordkeeping Metadata

An example of the use of this meta-model is shown in Figure 4 which demonstrates a simple interoperable implementation of Figure 1. This example includes a posited 'Theoretical Community Archive' in which various institutional resources are connected from a particular viewpoint. Note that his is just one possible conforming model, comprising a subset of possible entity and relationship constructions. The example is discussed in more detail below.
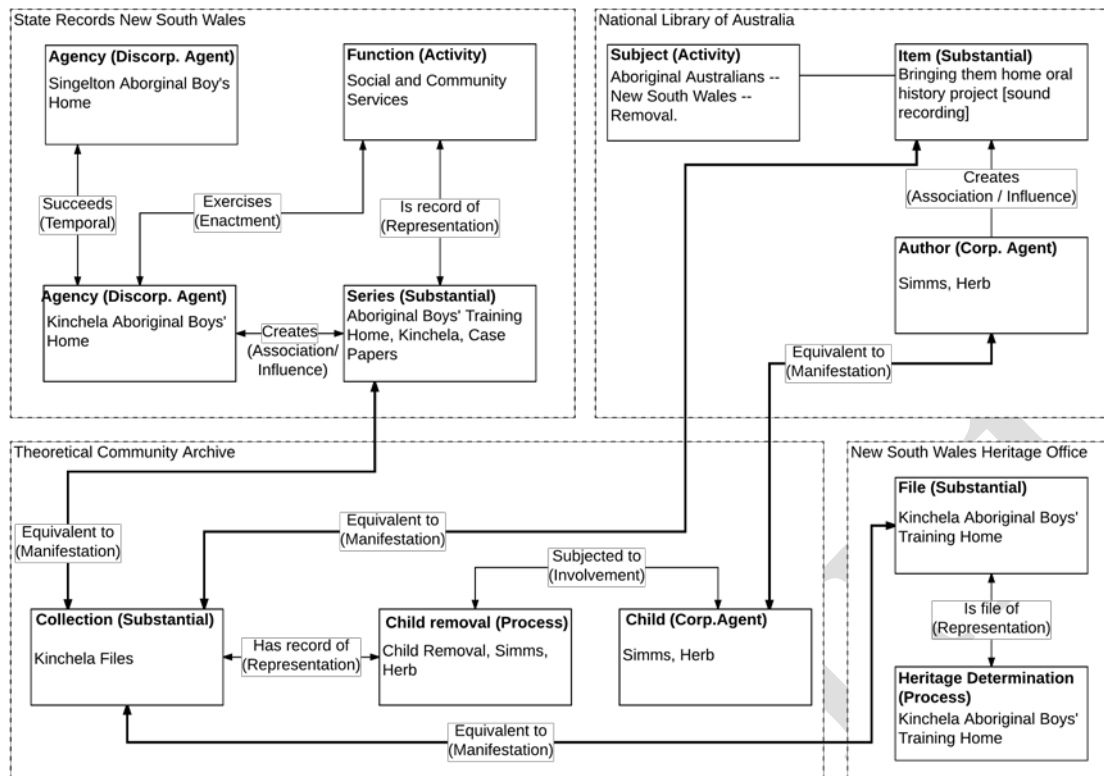
Figure 4. Meta-model approach for multiple institutional perspectives

Entities

Using a parsimonious topological approach, the meta-model comprises a small number of entity-types. Domain implementations can declare arbitrary sub-types of these entity types based on local requirements. The meta-model entity types are:

Substantial Entities

Substantial entities exist in space; they have spatial dimensions and can typically be located in relation to a spatial setting. Substantial entities are continuants. Examples of Substantial entities are mountains, trees, buildings, documents, and record-sets; and in Figure 4: the *Series*, *Collection*, *Item*, and *File* entities.

Note that, although arbitrary sets appear to be purely 'logical' entities, aggregations of Substantial entities are also Substantial (Grenon and Smith, 2004). From a teleological perspective of recordkeeping, this makes sense. Record-sets are arbitrary – one person's record is another person's set (and this is an issue with any schema that embeds notions of 'natural' aggregation hierarchies of this type). Splitting records and record-sets across different core entity types would break (or at least heavily complicate) interoperability between different ontological viewpoints.

The Substantial sub-type *Corporeal Agent* corresponds to humans (or their Substantial proxies) that exhibit agency. Corporeal agents can participate in various relationships — particularly with Performance entities — as shown in the

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next section. Examples of Corporeal agents are people, machines, and computer systems; and in Figure 4: the *Author* and *Child* entities.

Non-concrete Entities

Non-concrete entities are the non-physical continuants of the model. They do not have temporal parts (and are therefore not occurrents), nor do they exist in space (and are therefore not Substantial). Yet they are not abstract ideals in the purely theoretical existence sense (Ferraris, 2011, Margolis and Laurence, 2007); they exist as social objects and are continuants. As described above, Non-concrete entities often owe their existence to speech or documentation acts (Ferraris, 2011; Searle, 2010; Smith, 2012).

Non-concrete entities are often of the sub-type *Discorporate Agent* that also exhibit agency and can participate in various relationships with Performance entities. Discorporate Agents are held distinct from their Corporeal counterparts because of their entanglement with mandates. The creation and agency of Non-concrete entities is often mandated and documented in ways that individuals (or aggregates of individuals) are not. Consequently the contexts of Performances can be highly dependent on the web of relationships between Discorporate Agents on the one hand, and instruments, mandates, and records on the other. Examples of Discorporate Agents are nation-states, corporations, organisational units, and roles; and in Figure 4: the *Agency* entity.

Another special Non-concrete sub-type is the *Mandate*. As described in a number of recordkeeping metadata standards (for example International Organization for Standardization, 2007), a Mandate is an authority for some Performance to proceed or for the creation or abolition of a Non-concrete entity. Note, however, that a Mandate is a Non-concrete entity in its own right and is distinct from any (Substantial or Performance) instrument(s) by which it may be realised.

Performance Entities

A *Performance* is a spatio-temporal occurrent. It unfolds in time and can have a duration or temporal parts; From its inception, until the end of its existence, at any point in time it is incomplete. A Performance may also be tied to a particular spatial location. Performances may be associated with Substantial or Non-concrete entities. In particular, a Performance may also be associated with Corporeal or Discorporate agents through their purposeful enactment, or passive involvement. A Performance may be decomposed into finer-grained Performances that constitute its temporal parts. Examples of Performances are World War II, the allied invasion at Omaha beach on D-day, the shooting of one soldier by another, a bank transaction, the accessioning of a collection of records, and the digitisation of a photograph.

It is convenient to consider three sub-types of Performance: Activities, Processes, and Events.

- An *Activity* is not bounded in time, and is conceptually similar to the ambient functions described by Hurley (1995). Examples of Activities are Child Welfare, Industrial Action, and European Migration; and in Figure 4: the *Function* and *Subject* entities. Activities may be decomposed into other

Activities as well as Events, or Processes that are concrete instances of the Activity.

- An *Event* is logically considered to be instantaneous and occurs at a single, notional point in time (leaving aside the point that, due to the limits of measurement, even seemingly instantaneous events have some duration and that it is computationally simpler to model them with a start and end point). Events are important as referent points for temporal boundaries that define relationships and typically start and/or end Processes.

- A *Process* is bounded in time, with the potential for a start and end time. Examples in Figure 4 are the *Child Removal* and *Heritage Determination* entities.

These distinctions form a spectrum of granularity — from one perspective World War II, or the allied invasion at Omaha beach on D-day may be considered Events. Alternatively they may be considered as complex clusters of Events and Processes in their own right. Either way, they are Performances.

Setting Entities

A *Setting* is a spatio-temporal region as described inSNAP/SPAN ontologies of Grenon and Smith (2004) that are used to identify the location of other entities in space and/or time. Settings are occurrents and, like Performances, may or may not have notion temporal bounds. However settings are independent from any Performance. Settings may include spatial coordinates and boundaries, macro locations (e.g. a particular mountain), sites (e.g. a specific cave in a particular mountain, the nose on the face of a particular person), temporal spans and boundaries (e.g. D-Day, the twentieth century, the AIDS epidemic era), and spatiotemporal regions (e.g. the previous example of Omaha beach on D-day).

Relationships

It is important from an interoperability perspective that the set of relationship types in the meta-model is strongly constrained (see Rolan, 2015). Domain implementations can declare arbitrary relationship sub-types of this set, but should not introduce new primary relationship types. Relationships are first-class entities in their own right inasmuch as they can bear their own set of attributes. Note that relationships possess bi-directional semantics: for example: [Person] <is member of> [Organisation] / [Organisation] <has member> [Person] The allowable relationship types are described alphabetically as follows:

Affiliation

The *Affiliation* relationship type associates the following entity types: Substantial – Substantial; Performance – Performance; Non-concrete – Non-concrete; and Substantial – Non-concrete

Affiliation serves to identify two types of membership (a) the membership of a Substantial, Performance, or Non-concrete entity in some arbitrary (non-exclusive) aggregation of entities of that type or (b) the membership of Substantial and Non-concrete entities within Non-concrete groupings.

Examples of the former are: documents within a result set relating to indigenous child welfare, individual performances relating to rituals performed with saintly relics, or locations considered significant battlefields. Examples of the latter are: a person assigned to an organisational unit; a person being a member of a committee; a nation-state as a participant in a trade agreement, and a person fulfilling a role.

Authorisation

The *Authorisation* relationship type associates the following entity types: Mandate – Performance; and Mandate – Non-concrete

Authorisation serves to link a Mandate with the Performance or Non-concrete entities it authorises. Note it is formally the Mandate that gives the authorisation and not the (Substantial or Performance) instruments that give rise to the Mandate. (See the Realisation relationship).

Examples are: the 'child welfare' Mandate (the realisation of various instruments) that authorised the removal of indigenous children from their families; the Australia Act (realized by distinct pieces of legislation in Australia and the United Kingdom) that authorised the extinguishment of the UK's ability to legislate over Australian states and territories.

Genidentity

Genidentity is a reflexive relationship type that applies to Substantial; Non-concrete; and Performance entity sub-types.

A Genidentity relationship describes a 'coming forth' — usually as a result of a split, merger, or some other transformation. Genidentity is different from Affiliation as it involves the creation of new entities or the absorption of existing entities, rather than simply associating exiting entities.

Examples are: the two nation-states, the Czech Republic and Slovakia are devolved from the former nation-state Czechoslovakia; the pharmaceutical companies Glaxo Wellcome and SmithKline Beecham merged to form GlaxoSmithKline plc.

Involvement

The *Involvement* relationship type associates the following entity types: Substantial – Performance; and Non-concrete – Performance.

Involvement describes the situation where Substantial and Non-concrete entities are affected by a Performance in which they are not purposeful participants. This passive involvement by agents (but crucial for identifying candidate participants in recordkeeping) is not typically accommodated in contemporary recordkeeping metadata schemas.

Examples are: children are placed in Care; civilians are displaced by conflict; records are digitised by archivists; and in Figure 4: the *Subjected to* relationship.

Enactment

The *Enactment* relationship type associates the following entity types: Corporeal Agent – Performance; and Discorporate Agent – Performance.

Enactment describes the situation where Corporeal and Discorporate agents are purposeful participants in a Performance. It is only this purposeful participation that has traditionally been described in recordkeeping metadata schemas.

Examples are: case workers place children in Care; soldiers wage war and may displace civilians; archivists digitise records; and in Figure 4: the *Exercises* relationship.

Manifestation

Manifestation is a reflexive relationship that applies to Substantial; Non-concrete; and Performance entity sub-types.

A Manifestation relationship serves to associate various incarnations of an entity.

Examples are: a digital image may be a copy of a photograph; a document may be an index of a series; the Performance of holding up Mary's girdle on the external pulpit at Prato Cathedral is a summary or reconfirmation of a set of Performances relating to religious authority; and in Figure 4, the *Equivalent to* relationships.

Manifestation relationships could also be used to form a Work/Expression/Manifestation/Item hierarchy as expressed in FRBR. An example in Figure 4 are the *Equivalent to* relationships.

Realisation

The *Realisation* relationship type associates the following entity types: Substantial – Non-concrete; and Performance – Non-concrete.

Realisation associates Substantial or Performance instruments with the Non-concrete entities that they create or abolish (such as Mandates, as well as organisations, companies, roles, agreements etc.).

Examples are: a treaty (or its signing to be more granular) realises a trade agreement; a mortgage document (or signing) realises a debt; the Australia Act(s) 1986 (or their passing) realised the mandate for the extinguishment of the UK's ability to legislate over Australian states and territories.

Representation

The *Representation* relationship type associates the following entity types: Substantial – Performance; and Performance – Performance

A Representation relationship associates a Substantial or Performance entitiy with the Performance that it represents. This is the key recordkeeping relationship (see below).

Examples are: a bank ledger represents a series of financial transactions; the treaty of Waitangi, from the Maori perspective, represents a guarantee of protection rights and, from the British perspective, the ceding of sovereignty to the British Crown; and in Figure4: the *Is record of*, *Has record of*, and *Is file of* relationships.

Situation

The *Situation* relationship type associates the following entity types: Substantial – Setting, Non-concrete – Setting; and Performance – Setting.

A Situation relationship associates a Substantial, Non-concrete or Performance entity with a particular Setting.

Examples are: Leonardo Da Vinci was active in the Italian Renaissance; Da Vici's mural 'The Last Supper' was painted the Renaissance; The 'Veneranda Fabbrica del Duomo di Milano' organization dates from the late middle ages.

Spatial

Spatial is a reflexive relationship that applies to Substantial; Performance; and Setting entity types.

A Spatial relationship associates the relative spatial location of Substantial, Performance, or Setting entities. Spatial is a convenience relationship (described below) as it could be derived from analysis of spatial settings or location attributes if modelled.

Examples are: one series may be physically stored near another; two people may be co-located for some time span.

Structural

Structural is a reflexive relationship that applies to Substantial; Non-concrete; Performance; and Setting entity types.

A Structural relationship associates entities in some spatial or logical way –– either as part/whole, or consecution constructs.

Examples are: a series is a set of records; an agency comprises a number of departments; Wagner's 'The Ring of the Nibelung' comprises four operas; the biblical book of Genesis precedes the book of Exodus.

Temporal

Temporal is a reflexive relationship that applies to Performance entities.

A Temporal relationship establishes the temporal order of Performance entities and/or their subtypes in terms of preceding/succeeding or simultaneity. Temporal is a convenience relationship (described below) as it could be derived from analysis of Performance dates or start/end events if modelled.

Examples are: an election precedes an inauguration; the band 'Emerson, Lake, and Palmer' succeeded 'The Nice'; in Figure 4, the *Succeeds* relationship.

Convenience relationships

Convenience relationships are explicit associations between entities that actually could be derived from the entities themselves if the domain modelling and data is

rich enough. However such links are commonly used in navigation and visualisation and it is appropriate to describe them explicitly as an anticipated form of implementation optimisation. Convenience relationships are the types: Genidentity, Structural, and Temporal.

'Association' relationships

Association relationships are similar to convenience relationships inasmuch as they could be semantically derived from other constructs in the model, however they represent optimisations of a different sort. When creating relationships between entities, contextual information may be lacking in detail or even non-existent; for example: knowing only that a set of records is associated with a person or organisation without information about the activities or roles involved. Similarly, active relationships such as those relating to the creation, control, or ownership of records are very common metadata constructs. In both cases, having to create instances of intermediate Performance entities and the linking relationships as shown in Figure 5 may present a major impost on documentation of these simple, known associations.

Figure 5. 'Agency Controls Series' relationship cluster

Of course an implementing system could optimise 'behind the scenes', so to speak, presenting a simple association interface while maintaining all of the Performance entities and relationships in the data layer. However, it is clearer if the model

explicitly allows for the inclusion of these 'low-fidelity' relationships in order to facilitate transition from existing systems.

Thus the model holds that any entity can hold an *Association* relationship with any other, however these have not been included in Figure 3 for reasons of visual clarity. Association relationships have three sub-types:

Influence

The *Influence* relationship type associates Corporeal and Discorporate Agent entities with any other entity type.

An influence relationship indicates that a Corporeal or Discorporate Agent affects (or attempts to effect) affects the state of another entity.

Examples are: an agency owns a series; a person created a document; a family controls a story; in Figure 4 is the *Creates* relationship;

Reference

The *Reference* relationship type associates Substantial and Performance entities (records) with any other entity type.

A Reference relationship indicates that a Substantial or Performance entity makes reference to another entity.

Examples are: a document refers to its author; the Prato girdle ritual refers to Saint Thomas the Apostle.

Sanction

The *Sanction* relationship type associates Substantial and Performance entities (records), and Corporeal and Discorporate Agent entities with any other entity type; as well as Mandate –Substantial.

A Sanction relationship indicates that a mandate, a record, or an agent authorises a change in state of another entity.

Examples are: the Magna Carta authorized a suite of individual rights; the 'Residence Act' approved a capital district on the Ptomac River; the President of the United States enacted an individual mandate for health insurance.

Representation relationships

It should be clear by now that the meta-model does not have a *Record* entity, nor does it explicitly define aggregations of records such as fonds, sub-fonds, series, record-groups, or files etc. This may be surprising as the record is ostensibly the core focus of recordkeeping informatics; indeed many recordkeeping metadata schemas comprise detailed modelling of records and their aggregation as a core concern. However, as stated above, a record may be a Substantial artefact or a Performance. Differing domain ontologies may confer 'record-ness' to all sorts of constructs and may define meaning to aggregations of records at arbitrary levels of granularity.

In any case, **a record is always the representation of a Performance**, possibly involved in other Performances, and certainly subject to recordkeeping Performances. It is the existence of Representation (and the association Reference) relationships that imbues 'record-ness' to a Substantial or Performance entity. As long as Representation or Reference relationships are maintained, interoperable systems can identify records, discern the represented Performances, and identify agents and other contextual entities from the documentation. This is perhaps the hallmark of an ontological approach; moving from record-centric to activity-centric documentation. Here, the very definition of 'record-ness' is not mandated by individual record-holder authorities but created by the sense-making of participants in records (Shirky, 2005).

This model is also agnostic to the different understandings of a record in a continuum sense — for example, a single record that comprises an accretion all of the metadata due to 'recordkeeping business' from creation onward; as an original created record together with a set of other records describing its ongoing provenance; as different records having undergone recordkeeping processes such as accession into an archival system or digitisation; as a single record that has undergone change due to these processes; or as an aggregation of records. All of these understandings of record can be articulated using this conceptual model.

For example, in Figure 4, the series *Aboriginal Boys' Training Home, Kinchela, Case Papers* as well as the *Bringing them home oral history project [sound recording]* are documented as Representations of the Process of an individual's time at the Kinchela facility.

Boundary objects and interoperability

While records may be considered as representations of activity, it is the participants' conceptualisation of what these activities are, and what they mean, that gives rise to the plurality of record contexts. In this sense, entities may be used as boundary objects (Yeo, 2008) as they may constitute a "common representation in diverse intersecting social worlds" (Star and Griesemer, 1989). Any meta-model entity-type can be used to link disparate societal groupings and their attendant different (and perhaps incommensurable) interpretations of the records in this way. However, Substantial and Performance entities involved in Representation relationships (i.e.records) make particularly significant boundary objects as they may be recognised within diverse world views, even if their context and meaning is contested.

In the Figure 4 example, a theoretical community archive uses the State Records NSW *Series* entity, the National Library *Author* and *Item*, entities, and the Heritage Office *File* entity as boundary objects to provide a different perspective and nomenclature for these records. For this to work in practice, it must be assumed that the schemas in all systems confirm to the meta-model and that each system also provides some sort of published and accessible Application Programming Interface (API) for networked access to the respective system resources. Note that, beyond such a commitment to interoperability, none of the institutional systems in Figure 4 have a direct role in the linking. All of the created associations with boundary objects lie within the community archive. In fact, the institutional systems in this example may be unaware of the existence of the community

archive. Note too that the meta-model approach allows for modelling by each participating archive at arbitrary levels of granularity. As long as the meta-model relationships are respected, the network of entities can be navigated and understood.

If associated in this way, a network of systems, records, and metadata is created that can be queried using the terminology and perspectives of any of the participating systems. The results of such a query comprises the meshing of multiple sources of documentation for records if they exist. Figure 6 shows an example of such interleaving of results based on the display of the Sate Records NSW Agency entity from the example in Figure 4. The records potentially associated with this agency are found by following the Manifestation and Representation links around the network.

Access control

The meta-model supports authorisation control of recordkeeping activity through the modelling the actions, agents, and target objects in terms of the meta-model constructs. In this way authorisation control can be self-hosting and based on the recordkeeping documentation itself. This is particularly important when designing for the granular and flexible access control required for participatory recordkeeping where access to records that are representations of some activity needs to be granted to agents that enacted, or were involved in that activity. For example, access to records of time in Care, or complex role-based access rules in relation to Indigenous records — all of which may be documented as part of the record context.

Evaluation & discussion

While the production of artefacts such as the meta-model are a core outcome of design-science research, evaluation of such outputs is central to the rigour of the methodology (Hevner et al., 2004; March and Smith, 1995; Venable et al., 2012). Evaluation of the meta-model proceeded on two fronts: laboratory-based evaluation as well as empirical, field evaluation. Whilst this may appear to be a linear process, design-science research naturally takes a highly iterative form with analysis, design, instantiation of artefacts, and evaluation all informing each-other (Evans and Rouche, 2006). For the purposes of this article, three of the evaluation activities will be described: the creation of a proof-of-concept system; the mapping of existing schemas and standards to the meta-model; and empirical testing with domain experts.

The PaRIty proof-of-concept system

Evaluation was facilitated through the development of a proof-of-concept recordkeeping documentation system that implemented the meta-model. The resultant Participatory Recordkeeping Infrastructure or PaRIty software allows the creation of multiple schemas per instance. Each schema supports arbitrary super/sub-type hierarchies of entities and associated relationships that conform to the meta-model, all of which can have arbitrary attributes of a wide variety of data-

types. PaRIty is highly configurable and data-driven, with schema, entity, and relationship definitions as well as data elements having globally unique identifiers.

A PaRIty ontology supports the linking and discovery of these elements via documentation in the form of semantic web documents. Such documents are exposed via a RESTful API (Battle and Benson, 2008) for discovery and drag-and-drop user interface components for linking elements. The current version of PaRIty is not a functional recordkeeping or archival system (for example, it lacks recordkeeping workflow functionality; it exposes far too much diagnostic information and meta-model structure), but one that enables the meta-model to be exercised in a variety of ways within a documentation system. A screen shot of PaRIty is shown in Figure 6.
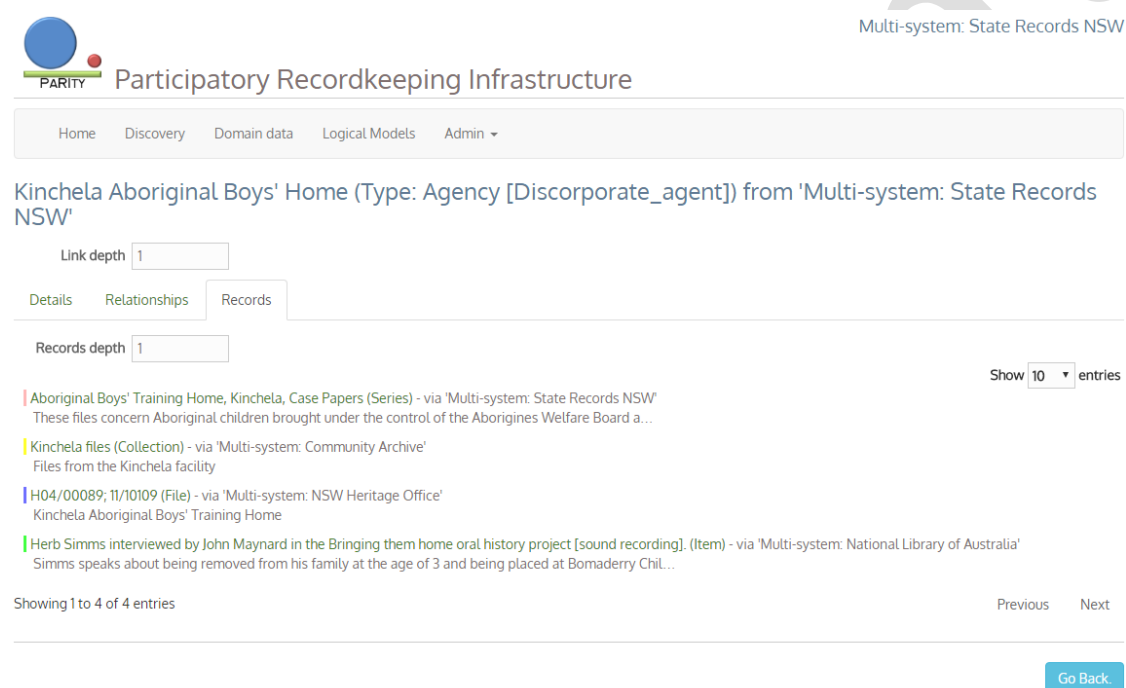
Figure 6. PaRIty screen shot showing records from multiple sources

Schema mapping

One method of evaluating the meta-model was the mapping of existing recordkeeping-related metadata schemas and standards to the meta-model constructs. The following schemas and standards were implemented within the PaRIty system:

- The ABC Harmony ontology (an Australian attempt to harmonise cultural heritage metadata schemas and an early adopter of Event entities)
- The Australian Government Recordkeeping Metadata Standard (AGRkMS)
- The Australian Trade Union Archive (ATUA) schema (interesting because of Performance entity types such as *Industrial action* and *Strike* currently modelled as Australian Series System functions)
- The CNEDA (Spanish) metadata standard

- Dublin Core (with collections profile)
- The Europeana Data Model
- The Finnish Conceptual Model for Archival Description
- The ICA Standards – ISAD-G, ISAAR (CPF), ISDF, ISDIAH (ICA)
- The ICA EGAD Records In Context model (RIC)
- The State Records NSW (SRNSW) Archives Investigator schema (interesting due to unique *Ministry* and *Portfolio* entity types)
- The W3 Provenance Ontology (PROV-DM)

This schema-mapping was undertaken to verify backward-compatibility with previous metadata development (i.e. to double check that the ontological approach had not omitted anything); to demonstrate the interoperability of disparate schemas; to demonstrate a transitional path to the third stage; and to understand the gap between existing recordkeeping schemas and standards and the meta-model. As an example, the mapping of the State Records New South Wales Archive Investigator schema is shown in Table 1. In particular, this mapping is a good example of the prevalence of Association relationship types in extant schemas.

Entities		Relationships	
Element	Mapping	Element	Mapping
Function	Activity	Comprising	Structural
Activity	Activity (sub-type)	Preceding/Succeeding	Temporal
Organisation	Discorporate Agent	Exercising	Enactment
Ministry	Discorporate Agent	Documented	Representation
Portfolio	Non-concrete	Subordinating	Structural
Agency	Discorporate Agent	Controlling	Association (Influence)
Person	Corporeal Agent	Creation	Association (Influence)
Record Series	Substantial	Creation (Mandated)	Authorisation
Record Item	Substantial	Abolition (Mandated)	Authorisation
Access Direction	Mandate	Administrating	Association (Influence)
Image	Substantial	Appointment	Affiliation
Mandate	Mandate	Has image	Association (reference)
Location	Setting	Related	Association
		Responsibility	Association (Influence)
		Authorisation	Association (Influence)
		Location	Situation
		Is/has copy	Manifestation

Table 1: Mapping of the SRNSW Archives Investigator Schema

All of the recordkeeping metadata schemas and standards above were able to be mapped successfully; some requiring minor adjustments such as the splitting of agents into ontologically separate Corporeal and Discorporate types. Another major outcome of the mapping exercise was the recognition of the need for the Association relationships described in the previous section. In this way the potential for backwards-compatibility with existing documentation was demonstrated, along with a transition path from earlier stages to stage three documentation.

Empirical testing with Domain Experts

A test interoperability scenario was created that comprised documentation in four ostensibly incommensurate schemas, similar to that shown in Figure 4. This scenario employed multiple PaRIty instances: one with a schema based on the Australian Government Recordkeeping Metadata Standard, one based on Dublin Core, one based on the ICA family of standards, and a new custom schema. The scenario demonstrated that, via the meta-model and the PaRIty API, the four schemas could be linked using the boundary object approach described above and queried in an interoperable, instance-independent manner. The scenario was presented to a range of Australian and U.S. Domain experts in recordkeeping systems design and use, in both on-on-one interview and focus group settings.

Early results from the Domain Expert interviews and focus groups suggest that the meta-model approach is a significant step forward in recordkeeping design. In particular, many participants identified the meta-model's ability to enable interoperability, not only between widely disparate communities, but even between differing recordkeeping cultures within a single organisation. Of particular interest was the potential of the meta-model to support 'recordkeeping business' workflow and documentation (McKemmish et al., 1999) as well as being able to self-host authorisation data as explained above. The proof-of-concept PaRIty systems demonstrated that a transition from legacy recordkeeping schemas was possible and that such a tool could be useful for analysis and diagnosis in recordkeeping. By creating contextual documentation in terms of occurrents and their representations in the domain of interest, requirements for, or omissions within, the record could be identified.

Conclusion & next steps

If interoperability is a core requirement for modern recordkeeping, then suitable recordkeeping metadata design lies at its heart. An infrastructural approach means that metadata design needs to transcend topographical approaches to recordkeeping schema design and embrace a topological approach that can accommodate the ontological incommensurability of disparate world views. The meta-model for recordkeeping metadata facilitates the development of recordkeeping systems that possess interoperability-by-design (Evans et al., 2009). It privileges human activity, providing rigorous ontological support for Substantial and Non-concrete continuant entities and agents, as well as occurrent Activities, Processes and Events. In particular, the model carefully defines relationships between entities with specific semantics that enable the development of interoperable domain schemas. This meta-model is distinguished by both the *Representation* relationship type that moves the focus of documentation from consideration of records as physical artefacts (Acland, 1992) towards understanding of the activities, agents, and affected parties thus recorded; and the *Involvement* relationship type that explicitly identifies stakeholders that are not typically recognised in contemporary recordkeeping schemas.

This approach opens up possibilities for *participatory recordkeeping* that embraces multiple participants, a diversity of perspectives, and an inclusiveness of engagement (Huvila, 2015). Beyond solving today's operational problems, a participatory approach to recordkeeping could begin to address the disenfranchisement of stakeholders and their perspectives in records that is increasingly being exposed though activism (for example: Evans et al., 2015; Ferris and Allard, 2016; Flinn, 2011), governmental inquiry (Eberhard, 2015; Harris, 2001; Ketelaar, 2012), and analysis from a human rights perspective (Gilliland and McKemmish, 2014; Iacovino, 2015). While some of these issues have be solved by the creation of 'safe' spaces for community recordkeeping, (Flinn, 2011), true participation requires interoperable infrastructure for the accommodation of participant perspectives in all records (Huvila, 2008).

If the meta-model entity type and relationship constraints are followed, then records as representations of occurrents may be used to ensure the interoperability of recordkeeping systems, regardless of institution or location. However, having opened up this possibility, there is still much to be understood beyond the meta-model approach. How should networked federated access be optimised? How should the merged recordkeeping metadata results from a plurality of sources be visualised? Further investigation is needed to explore issues of trust and the role of authoritative sources in a semantic network; how should end-users locate, identify, and evaluate the veracity of sources of recordkeeping documentation? The same goes for issues of reproducibility and determinism in resource discovery — particularly when faced with the impermanence of internet resources. Distributed authentication and authorisation regimes impacting at the Schema, Entity, Record, and Attribute level need to be worked through in detail. And, of course, the meta-model and interoperability approaches need to be embodied in standards. We may be now well positioned to move forward, towards interoperable recordkeeping systems, but we need to take the next steps.

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Conclusion

The relationship of the conceptual model to the other design science elements is shown in Figure 6.1 where, again, the solid black lines show the rough order of influence between the various design outputs. The meta-requirements were a precursor, primarily to the functional model, but also to the conceptual model. The functional model not only directly articulates and addresses these requirements, but was also an input into the development of the conceptual model that, in turn, addresses the meta-requirements and supports the functional model.

The ontological approach to conceptual design was the key to a consistent and powerful meta-model that, not only was accepted in peer review, but has remained robust in the face of a variety of evaluation challenges as described in Chapter 7. Along with the functional model presented in the previous chapter, the meta-model addresses my second research question:

2) *Can infrastructural and participatory approaches to recordkeeping be addressed through transformative design?*

By addressing a broad range of requirements described in Chapter 4, this model demonstrates that such transformational design is feasible and provides additional evidence that addresses the fifth sub-question:

v. *Can conceptual and other models be developed that express the characteristics and affordances of a meta-solution?*

The meta-model, with its ability to interconnect ontologically incommensurate contexts of records, seems straightforward to me now, however the process of its development was a long one. The model did not simply 'fall out' of the requirements, but required a transformational approach — not only to design but on a personal level as well as I came to understand the problem domain. As a Stage-3 conceptual model it contains some constructs that eluded me for some time and remain challenging to others. While it emerged as a stable and transformational conceptual model, there were periods where I agonised over some of its constructs, finally breaking through my preconceptions, and coming to peace with challenges of a new paradigm.

Ontology

Originally I tossed around various ideas for an underlying ontology based on existing recordkeeping modelling constructs. An early example of such work is shown in Figure 6.2 that depicts a number of alternative starting points. It was actually from such work that I realised the necessity of discarding conventional recordkeeping modelling constructs for the time be-

Kernel Theories (Recordkeeping,
Modelling, Ontology, Data Design)

Empirical Data
(Literature, Interviews, and Existing
Systems)

Meta-Requirements

Addresses

Functional Model

Addresses

Supports
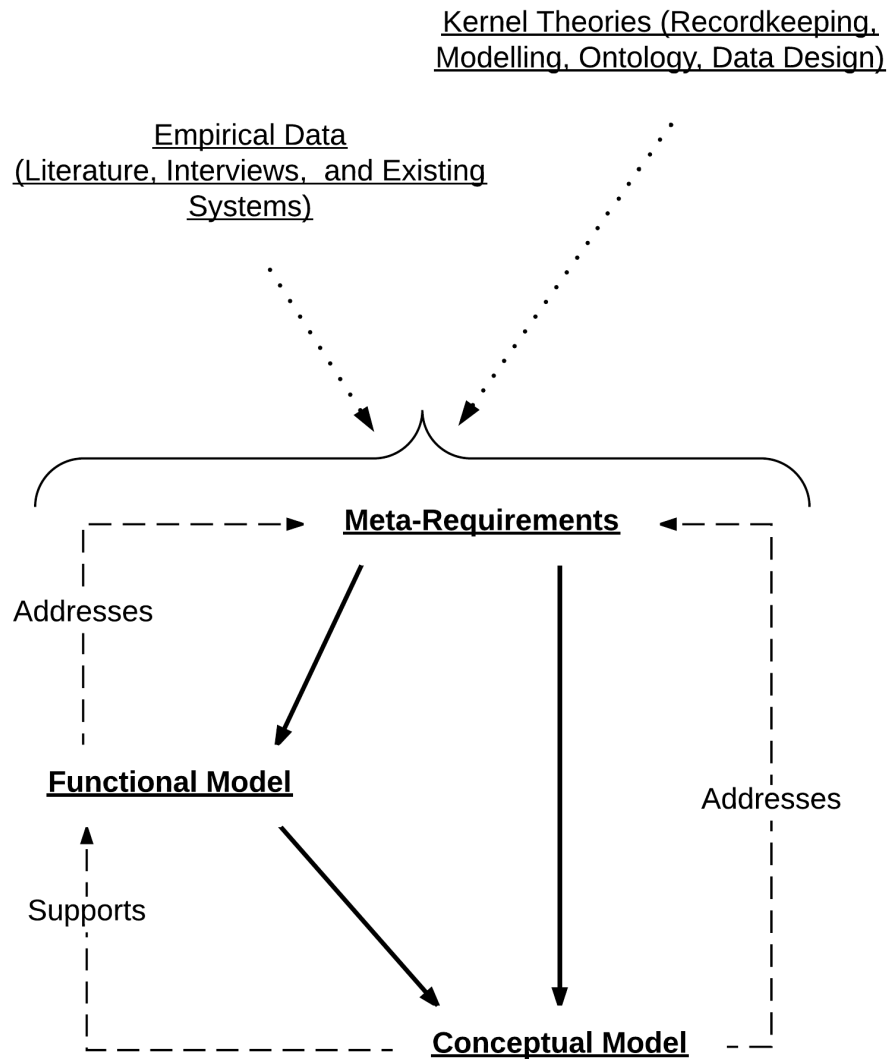
Conceptual Model

Figure 6.1: Relationships between design outputs and activities — conceptual model

ing, and going back to ontological basics — albeit with a recordkeeping purposefulness. I soon found that the Smith and Grenon SNAP/SPAN ontological taxonomies (2004) provided a suitable framework for the activity-based modelling needed for Stage-3, with one major exception: the treatment of non-substantial entities within the SNAP taxonomy. Due to the geo-spatial orientation of Smith and Grenon's framework, the only non-substantial entities they consider are those dependent upon material substances (i.e. properties of things). Within the SNAP taxonomy, continuants are classified as either substantial entities, dependent entities, or spatial regions.

On the other hand, the recordkeeping domain deals with a variety of other types of non-substantial entities (for example, organisations, mandates, actors etc.). To address this deficiency, I drew upon the work of conceptual (Margolis & Laurence, 2007) and social (Ferraris, 2006; Searle, 1995; B. Smith, 2012) ontologists to form the basis of recordkeeping constructs in the continuant/occurrent framework. I ended up settling on the term 'Non-concrete' for these social and abstract types as neither 'non-substantial nor 'insubstantial' sounded correct to me. Note that, by using this terminology, I am not claiming ontological equivalence of 'conceptual', 'non-concrete' and 'social' in arbitrary domains. Rather, I am guided by the teleology of the recordkeeping design that particularly embraces the significant role of records on speech- and document- acts that realise social objects[31]. Similarly, I do not believe that it is within scope of recordkeeping schemas to model arbitrary ideals such as 'red-ness', 'honesty', or 'energy' — however, I am happy to be proved wrong.

Importantly, this approach provided me with clarity in appreciating the way that occurrents and continuants (or endurants and purdurants) are treated by recordkeeping theorists; for example, it figures prominently in some of the continuum theory literature (Upward et al., 2011). However, I think there is often some confusion about how these terms apply to recordkeeping constructs, particularly if considered from an ontological perspective. True, I did have a 'eureka' moment when I realised that, as records are representations of occurrents (that unfold through time), they are necessarily "always in a process of becoming" (McKemmish, 1994). However, this does not mean that records themselves are occurrents that perdure. I will return to this topic in the Chapter 8 discussion.

One criticism I received regarding this model was that, by merging concepts from both taxonomies, I was violating some sort of ontological boundary between the two. It can be argued,

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[31]Indeed, in the case of these social objects that "exist only because we believe them to exist" (Searle, 1995), such belief is expressed through the conventions of such instruments. Those who have no knowledge, or recognition of such instruments or speech/document acts may not necessarily believe in the existence of such entites.

Figure 6.2: Early ontological doodles, April 2015[32]

though, that while it is correct that Smith and Grenon make a clear distinction between their continuant taxonomy (SNAP) and occurrent taxonomy (SPAN), the point of their work is to support frameworks in which both may coexist. In fact, my approach involves the creation of "…relations which can traverse the divides between distinct ontological perspectives. Thus, they are those types of relations which […] can traverse the SNAP-SPAN divide (relations which glue SNAP and SPAN entities together)" (B. Smith & Grenon, 2004, p. 286).

This ontological approach is a point of departure from previous recordkeeping modelling initiatives, and one that presents difficulties when considered from a Stage-2 perspective. For example, another piece of feedback that I received suggested that I should just have records,

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[32]This is actually a scan of a napkin upon which I scribbled while out with my wife for breakfast one weekend. I suppose this gave her an inkling of my preoccupation with design matters and foreshadowed what the next few years would be like…

aggregations, and creators as first-class continuant entities (because those — according to the feedback — were the important constructs). It is conceivable that, within their material taxonomy, Smith and Grenon would situate records, aggregations, and creators as continuants. However, were they to move beyond their geo-spatial scope and consider the case of records — that can be either performative or artefactual — then I am sure that they would not categorise 'record' as a higher-order universal, constrained to either the SNAP or SPAN taxonomies. The same thing goes for 'creator' which, like 'record', is not a higher-order universal type. Even so, it took me a some time to come to this realisation myself.

Records and Record-sets

Once I made progress in the ontological analysis, the rough shape of the meta-model quickly became apparent. However, its form changed as the design iterated, reflecting my increasing understanding of the problem domain (Conklin et al., 2007). Perhaps the most significant step-change in the design, was the removal of the *Record* entity in favour of the primacy of the *Representation* relationship described in the article. I had posited a Record entity type (that was a bearer of a Representation relationship) from the beginning (see Figure 6.3) and it was still present in versions of the model almost a year later[33].

From my research journal, it was during the European domain expert interviews — particularly after those with Bill and Jaana; mulling over their views on discipline convergence — that I understood the need to "turn around record relationships [so that] rather than a record ISA artefact and performance, certain artefacts and performances serve as records; and records represent performances". Thus I made the leap from record-as-entity-type to 'record-ness' imbued by an entity's role in representing activities. This is significant because it not only cleaned up the model (removing an awkward, explicit, mutually-exclusive, multiple-inheritance ISA (or subtype) relationship between Records and Substantials/Performances — see Johansson (2005)), but greatly enhanced the meta-model's affordances for hospitality and interoperability, simultaneously increasing its parsimony and explanatory power (Weber, 2012).

Nonetheless, it is probably worth asking the question: are records always representations of occurrents? While this seems intuitive to me, others may contend that it may not be obvious in all transactional circumstances. For example, Bearman has asserted that records may be the carriers — not just products and/or documentation — of transactions (Bearman, 1994). This argument, in other words, is that the transaction *is* the record, not a representation, for example the change in state of a computer system that is the transfer of funds. The counter argument

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[33]This version of the model also maintained a dependent entity type as a vestige from the Smith and Grenon approach.

follows from speech (Searle, 1995) and document (Ferraris, 2006; B. Smith, 2012) acts; that irrespective of the physicality of instruments associated with a transaction, the transaction itself is a separate, social, occurrent.

To give another example, consider a wedding that establishes a marriage. In this case, some could consider the ceremony to be the record of marriage, others would require a certificate of marriage as evidence. A deconstruction of this could proceed as follows:

1. Parters exchange vows, say "I do" etc. At this point, some may consider the partners to be married (as with the Gaelic 'jumping swords' ceremony). Yet the utterance of the phrases are not the record — the memory of the spouses and any witnesses are. The memories are inscriptions that are separate from the transaction. Recounting of the memories at a later stage, for example as oral evidence, may also be performative records.

2. Similarly, the officiator saying "I now pronounce you..." or somesuch, is also an event that some may consider to be the transaction that creates the marriage. This is the same situation as the above; the utterance is not the record; the memory of the utterance is.

3. Finally, the partners, the officiator, and witnesses may sign a marriage document. This too may be considered a record of the marriage.

All three of these, the memory of the vows, the memory of the pronouncement, and the signed marriage document are all different representations of the marriage. Similarly — to return to the earlier example — the inscription of a document, the flipping of some bits in a computer's storage, notches on a stick, knots in a cord, or a handshake and a firm look in each-other's eye could all be records of the transfer of funds from one account to another. And all of these are representations of the social occurrent 'transfer funds'.

Of course, in dispensing with the *Record* entity type, the meta-model has no special *Record Set* entity type either; eschewing any distinction between records and sets of records as I foreshadowed in Chapter 4. Another comment regarding the model concerned my categorising record aggregations as Substantial entities, as one would expect such aggregations to be to be considered as some sort of logical entity. In actuality, I did agonise over this point for some time but ultimately sided with Grenon and Smith (2004), who hold that arbitrary aggregations of Substantial entities are also Substantial. This fits well with the hospitality goal whereby a record from one perspective may be considered as a record-set from another. Additionally, a Non-concrete record-set entity type would also make the model more complex. It would require a special sub-type of Non-concrete for record-set with all of the attendant relationships. From the ontological implications of the hospitality perspective, it seems semantically inconsistent

to say that a Non-concrete entity is a record. Similarly, for the purposes of interoperability, you would need to be able to say that a (Substantial) record in one context is a manifestation of a (Non-concrete) aggregation in another. To me this stretches the meaning of the Manifestation relationship and exposes the arbitrary distinction between records and sets of records as explored in Chapter 4.

Interestingly, it was this implication of the Representation relationship that was the most worrisome for some of those with early exposure to the model, and (to risk stealing the thunder from Chapter 7) some involved in the evaluation activities. Again, this may be a manifestation of the entrenchment of recordkeeping professionals in Stage-2 concepts that I explore in Chapter 4.

Relationship Optimisations

An important aspect of the meta-model concerns the optimisations that I have termed *Convenience* and *Association* relationships. As I explain in the article, I originally introduced *Convenience* relationships such as *Spatial* and *Temporal* as an optimisation mechanism for queries, especially those associated with visualisation and traversal of large sets of records. Although these relationships could be derived from attributes of entities — for example, dates of existence — it is computationally easier (at the risk of some redundancy) to make these relationships explicit. This similar to the rationale for de-normalising of relational databases in order to avoid referencing large numbers of records for the derivation of common facts; trading model purity for clarity and performance (Sanders & Shin, 2001).

As the design progressed, however, additional justifications for such relationships appeared and the need for *Association* relationships grew in significance. As described in the article, these were originally intended for modelling where knowledge of an existing relationship is fuzzy or incomplete as well as to allow interoperability between systems with differing levels of documentation granularity. However, what became apparent from the requirements interviews was the need for a mechanism that enables transition between legacy systems on one hand (perhaps under-documented in relation to activity modelling) and participation in a broader conceptual network on the other. The Association relationships provide such as mechanisms as well as a graceful way to provide hospitable and interoperable documentation models in the face of the resource constraints reported in Chapter 4.

Application

Another point that bears emphasising is that the meta-model satisfies a number of different requirements described in the Chapter 4 in, perhaps, non-obvious ways. As well as its primary role of being able to document records as representations of activities from a variety of perspectives, the meta-model can also be used (a) to document access control constructs such as authentication principals and authorisation roles and resources (Birrell, Lampson, Needham, & Schroeder, 1986); (b) to document the provenance of assertions — for example, the evidence that a given relationship exists; and (c) to document the 'recordkeeping-business' (McKemmish, Acland, Ward, & Reed, 1999), i.e. the activities related to manipulation of the records and documentation itself.

By enabling the documentation constructs themselves to be the target of relationships, the meta-model can be considered to be *recursive*, and it is this recursion that allows the complex requirements to be satisfied in an interoperable way. I touched upon this recursive nature in terms of access control within the article and in Chapter 7, I discuss how a very rudimentary example of 'recordkeeping-business' was implemented in the proof-of-concept instantiation. However, as this recursion is an important aspect of practical implementation, I cover it in more detail in the Chapter 8 discussion along with an illustrative example.
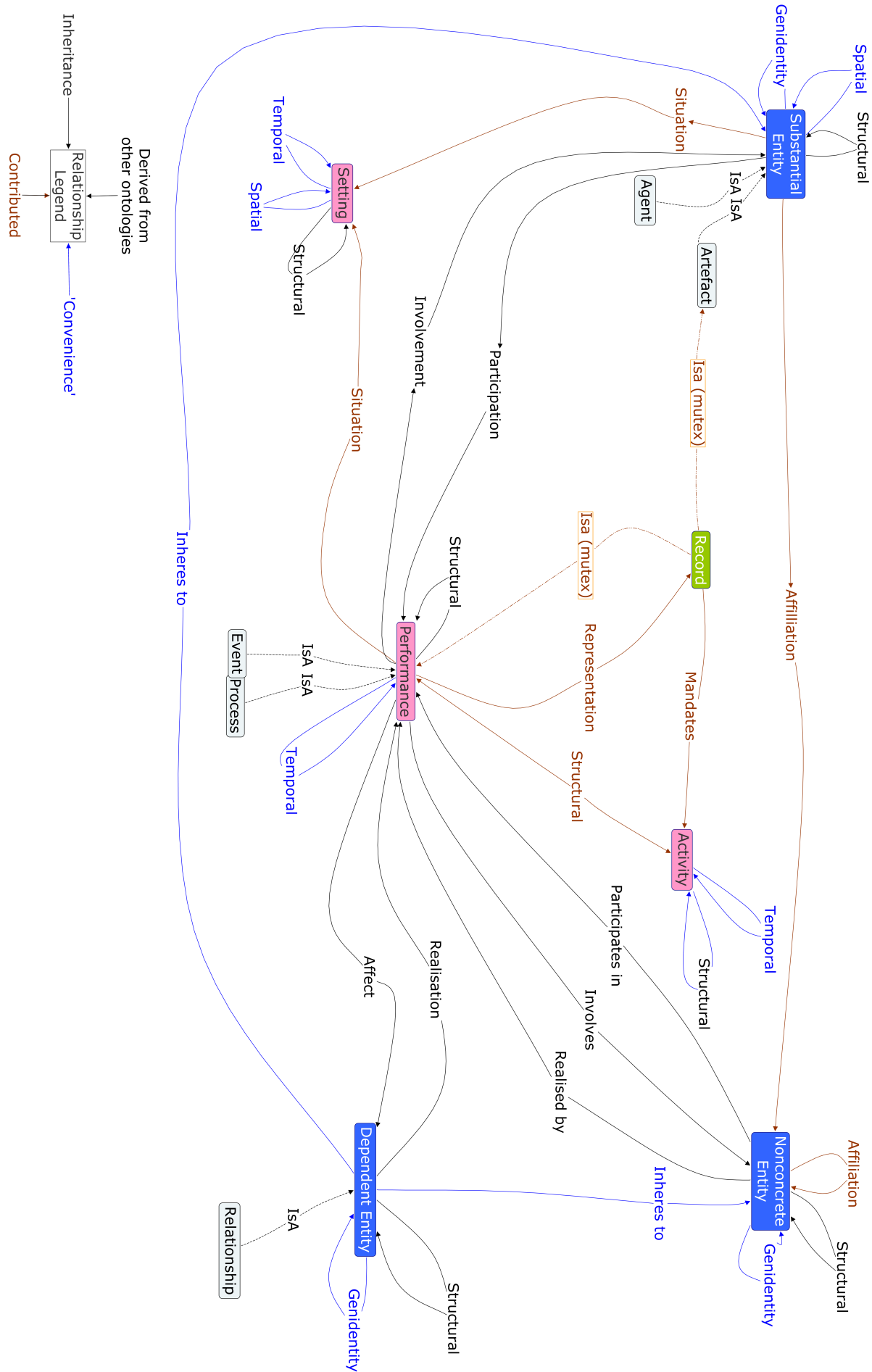
Figure 6.3: Earliest conceptual design, June 2015

Concluding remarks for Part 2

As I foreshadowed in the introduction to this part, the three artefacts described in Part 2 correspond to the research outputs from the concept building and design activities shown in the upper right of the methodology diagram of Figure 2.2 in Chapter 2. These artefacts are contextualised in Figure P2.1 that shows the circular relationship between the artefacts and the recordkeeping body of knowledge — the design science kernel theories (Venable, 2006).

The statement of requirements together with the two models articulate how participatory recordkeeping can address issues of disenfranchisement and participation. They suggests that the problem of participatory recordkeeping is tractable and that the transformative design for participatory recordkeeping systems is feasible. Significantly, the modelling that is central to this design provides "an important instrument whereby recordkeeping research can inform theory and practice" (Hofman, 2017, p. 641). In particular, the sociomaterial Participatory Recordkeeping Continuum Model not only is a contribution to recordkeeping theory, but can be used directly in practice as a reference model that informs recordkeeping-related functional analyses. I will return to this topic in Chapter 8.

The sense that, in fact, the research problem is tractable arose from the iterative interplay between the requirements elicitation and modelling (as well as the development of the instantiation described in Chapter 7) as "a continuous process of appraising what is relevant and what is not" (Hofman, 2017, p. 639). It demonstrates the power of a design science methodology in that, only by exploring the affordances, blockages, and accommodations arising from this interplay, "the problem formulation evolves and emerges in parallel with the solution formulation" (Conklin et al., 2007). In this way the two models simultaneously explicate and address the requirements, and provide a transitional path from previous stages to Stage-3 conceptualisation

Kernel Theories (Recordkeeping,
Modelling, Ontology, Data Design)

Empirical Data
(Literature, Interviews, and Existing
Systems)

Contributes

Design Artefacts

Meta-Requirements

Addresses

Functional Model

Supports

Addresses

Conceptual Model
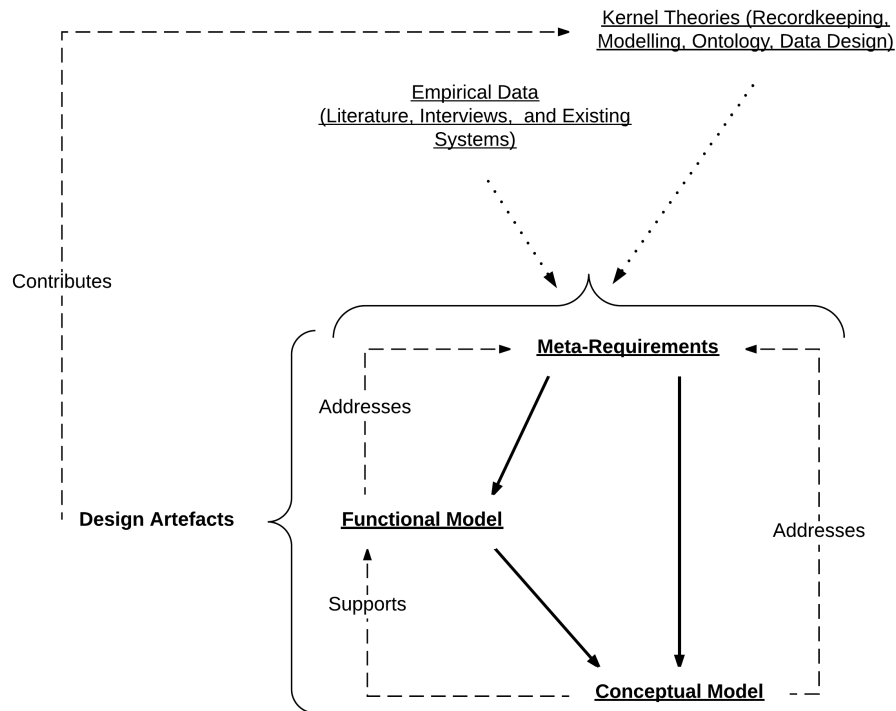
Figure P2.1: Relationships between design outputs and activities — design science artefacts

and design.

A summary of the ways in which the design artefacts, in an of themselves address my research questions is shown in Table P2.1 which shows direct support for the first three. Although the process of defining meta-requirements play a significant role in transformative design science — a theme I will explore further in the Chapter 8 discussion — the fourth, emergent research question (how design science can be applied to wicked problems that require transformative design) is largely a question of the scope and mechanisms of design and especially evaluation. Therefore I leave discussion of support for the fourth research question to Part 3 and, in particular, Chapter 7.

Table P2.1: Mapping between research questions and design artefacts

Research Question	Statement of Requirements	Functional Model	Conceptual Model
Q1. Understanding of participatory recordkeeping	Demonstrates that meta-requirements for participatory recordkeeping can be articulated; provides coherent set of requirements		
Q2. Possibity of transformational design		Demonstrates that the problem is tractable; evidence that problem space can be modelled	Demonstrates that the problem is tractable; evidence that problem space can be modelled
Q3. Impact of the design — theory, practice, transition	Lays foundation for model of participatory recordkeeping; identifies barriers to transformation	Contribution to continuum-based theory; design theory for participatory recordkeeping; reference model for analysis	Design theory for participatory recordkeeping; reference model for analysis
Q4. Design science and transformational design	Provides example of statement of requirements as a design artefact (important when dealing with wicked problems)		

Part III

Transformative Design

Following my framing of the research project in Part 1, in Part 2 I introduced and discussed the three design science artefact: the statement of meta-requirements for participatory recordkeeping, the Participatory Recordkeeping Continuum Model that expresses participants' agency in records, and the Meta-model for Recordkeeping Metadata conceptual model. In this final Part 3, I discuss the evaluation of these artefacts and their implications for recordkeeping. It is this evaluation and reflection activity that imparts rigour to the design science process and distinguishes it as research, as opposed to a (mere) design and development exercise.

Chapter 7 covers the evaluation activities that form the last part of a design science macro-iteration described in Chapter 2. I begin Chapter 7 with a detailed description of the proof-of-concept instantiation of the design and the manner in which it was used throughout the design process. While an overview of this instantiation was presented in Chapter 6 article, Chapter 7 covers its construction and use in far more detail — particularly with respect to its role in the systems development method. Following the introduction of the proof-of-concept instantiation, I describe the various evaluation activities that I employed in order to provide evidence of the design's efficacy and usefulness.

Chapter 8 comprises a discussion of the implications of the design for theory and practice, including some observations concerning standards-setting in the recordkeeping field. In Chapter 8 I also reflect on my experience with the use of the design science methodology in attempting to develop a transformative design.

Finally, in Chapter 9, I draw together the various threads of my project, explaining how I have addressed my research questions, and describing the contributions arising from this research. I then conclude by indicating some possible directions for future research arising from this work.

Chapter 7: Evaluation

Design science is a stony road, not a primrose path.
Wastell, Sauer, and Schmeink; *Time for a "design turn" in IS*
innovation research?

In this chapter I describe the evaluations I conducted in order to validate the design artefacts described in Part 2: the statement of meta-requirements for participatory recordkeeping (Chapter 4), the Participatory Recordkeeping Continuum Model that expresses participants' agency in records (Chapter 5), and the Meta-model for Recordkeeping Metadata conceptual model (Chapter 6). As I explained in the concluding remarks to Part 2, the requirements informed the functional model, and both of these provided the foundation of the conceptual model (See Figure P2.1). I employed a number of evaluation techniques that exercised both models and their support for the requirements; many of which centred on a proof of-concept instantiation that implemented the conceptual model.

I begin by discussing the proof-of-concept instantiation and its role in the systems development method for developing and validating design artefacts (Burstein, 2002; J. Evans & Rouche, 2006; Nunamaker et al., 1991) as well as subsequent laboratory evaluations. I then describe a series of interviews and focus groups that I conducted with domain experts, in order to provide an external evaluation of the design. Where the design artefacts described in Part 2 suggest support for my research questions, the evaluations provide evidence that the design actually achieves its objectives. As I foreshadowed in Chapter 1, these activities also led to findings about the design science methodology itself in terms of the evaluation of transformative design.

In Chapter 2, I explained how the rigour of design science research derives from careful evaluation of the design outputs (Shrestha, Cater-Steel, & Toleman, 2014). Although the publication

of the two models represents a degree of their acceptance by the peer community[34] and hence of their validity (Burke, 1997), successful publication alone does not confer sufficient proof of their veracity. What is also required is an evaluation of the artefacts that provides evidence that the design artefact "achieves the purpose for which is was designed" (Venable et al., 2012). However, writing about evaluation as a distinct phase of the methodology is somewhat problematic as many of the evaluation activities, to a greater or lesser extent, occurred in parallel with the design itself. The iterative nature of design science research and, in particular, the use of a systems development method, means that these evaluation activities can be performed in both *formative* and *summative* contexts (Nielsen, 2010, p.170; Venable et al., 2012). Formative evaluation takes place as part of the micro-iterations of the design process and is used to ensure that the design product incrementally achieves the design objectives (Wiliam & Black, 1996). Summative evaluation often takes place after a design is 'complete' in order to judge its efficacy or to compare it with other designs (Venable, Pries-Heje, & Baskerville, 2016).

Even so, the distinction between formative and summative evaluation is easily blurred. In once sense, the cumulative effect of successive formative evaluations can be considered to have summative qualities, given that the evaluated artefact then clears some sort of design threshold (Venable et al., 2016). Moreover, the various design outputs themselves — the artefacts and the proof-of-concept instantiation — have evaluative functions with respect to each other. For example, the functional model validates the consistency of the requirements; the proof-of-concept instantiation validates the implementability of the conceptual model. In fact (to appropriate McKemmish's seminal trueism), a design is 'always in a process of becoming' as every evaluation, both formative and summative, can provide learning that informs future development micro-iterations, methodological design iterations, or design projects.

The methodology-relationships diagram can now be extended to include the proof-of-concept instantiation. Figure 7.1 shows the interaction between the conceptual model and the proof-of-concept instantiation as the development of each influenced the other. This 'double hermeneutic' (Giddens, 1993, p. 9) is a core characteristic of the micro-iterative systems development method for design science. It is through such iterations that an instantiation can serve as a means of both informing (via learning about the problem domain through creating and exercising the instantiation) and verifying the design (J. Evans & Rouche, 2006); all the while exposing the "extensibility, limits, and conditions" of the design inputs, assumptions, and outputs (Kuechler & Vaishnavi, 2008).

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[34]And, arguably, an implicit acknowledgement of their underlying requirements — even if in only a general sense in terms of the propositions of participatory recordkeeping.
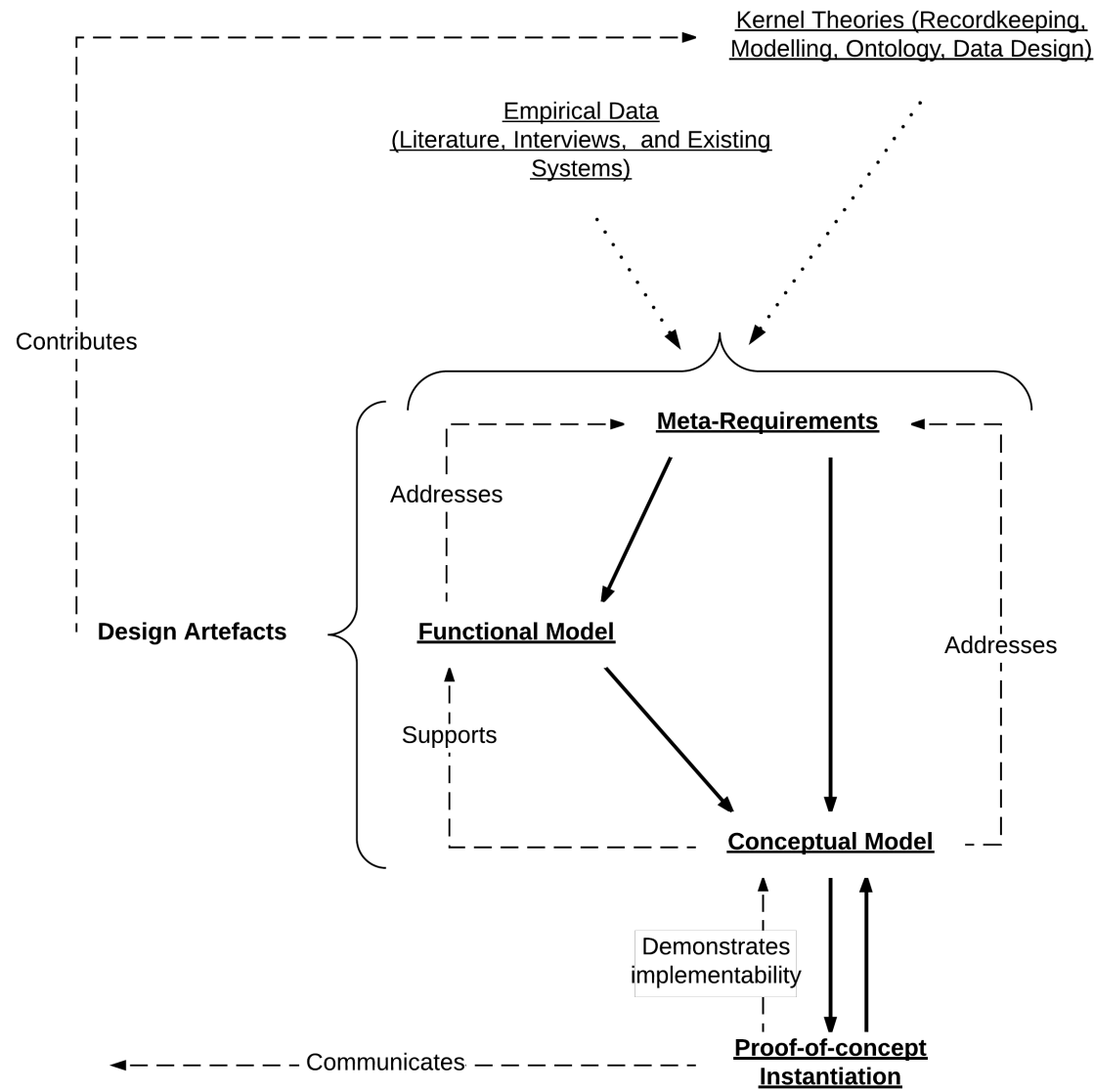
Figure 7.1: Relationships between design outputs and activities — the proof-of-concept instantiation

I should emphasise that, while there is a common concern in the literature with technical instantiations as design artefacts (Venable, 2010), it is difficult to reconcile this goal of design science of producing "IT meta-artefacts that support building concrete IT artefacts" with the argument that "instantiations are only secondary DSR outcomes" (Iivari, 2015). For me, the use of systems development to explore and iteratively improve the design (Nunamaker et al., 1991), meant that the instantiation-as-artefact was indeed a secondary design output. Significantly, it is not likely to be carried forward into future real-world design scenarios in it's current form, nor was is constructed as a component that can be incorporated into future software development. Rather, the instantiation "represents a concrete realization of a construct, model, or method. It demonstrates feasibility and enables researchers to actually test their concepts under real world conditions and learn more about the real world" (Cleven et al., 2009). It is for these reasons that I don't consider the instantiation to be a design artefact per se; and why I did not incorporate this discussion of the instantiation in Part 2, but instead chose to include it in the context of evaluations and findings in this final part of the thesis.

7.1 The proof-of-concept instantiation

One of the uses of the instantiation within the summative evaluations was as a communication tool that I could use to demonstrate the new design concepts to an unfamiliar audience. The importance of instantiated systems as vehicles for the communication of novel concepts or designs was explored in Chapter 4 in which I found that such concrete examples are necessary to overcome pedagogical barriers to the adoption of transformative recordkeeping paradigms. Having a system that could explicate aspects of the conceptual model, was a core feature of the external evaluation process. Nonetheless, the system was not a simple instantiation of the conceptual model, but an iteratively evolving tool that impacted not only the design but the scope and very nature of the evaluation process. Although I did discuss the proof-of-concept instantiation to some degree in the Chapter 6 article, I now present it here in more detail.

7.1.1 Scope

From the earliest days of this research project, I envisaged the construction of a proof-of-concept instantiation that could be used to demonstrate interoperable participatory recordkeeping concepts. While I was under no illusion that it would be a comprehensive recordkeeping system, I originally thought it may have enough breadth to support comparison (even if only of some limited functions) with existing recordkeeping systems. From the outset, my plan was to engage a cohort of end users in some sort of usability study as a way of evaluating the efficacy of the design. In fact I even went as far as sounding out a number of different communities that had

had poor experiences with recordkeeping systems and a demonstrable need for participatory support of their needs in records, and obtaining research ethics clearance for work with one such vulnerable community.

However, as the breadth of requirements became apparent and the functional model emerged, it became clear that, in terms of the resources and time available to me in a doctoral project, such a development and evaluation would not be feasible. Significantly, it was the functional model that explicated the dimensions through which aspects of participatory recordkeeping would need to be supported in order to provide any kind of meaningful end-user evaluation. Such complexity was not only impossible to develop in the available time, but it's evaluation would have been also impractical. I will return to these issues in the Evaluation section below and in the Chapter 8 discussion where I examine the of role of design science instantiations and evaluation in pursuing transformative design.

With a broad design comprising three artefacts, I was faced with the problems of what to build and how it should be evaluated. In the end, I decided that the most important aspect of the design to exercise would be the conceptual model. My reasoning was that, as seen from Figure 7.1, the conceptual model was not only reflective of the interoperability requirements of the design but was also necessary to support the functional model. If I could not demonstrate the efficacy of the conceptual model to support the interoperability of incommensurate recordkeeping perspectives, then despite articulating the requirements for participatory recordkeeping and codifying them in a functional model, I would not be able to claim a successful Stage-3 transformative design. I therefore reoriented my development effort and evaluation design (including a reconfigured ethics approval) for a narrower instantiation that could be verified by domain experts as described in the evaluation section below. In Appendix D I have documented the functionality that I deemed out-of-scope for the proof-of-concept instantiation. In fact, this list expanded during the construction and evaluation activities as my understanding of the needed complexity of the system increased. I found that I needed to focus on the evaluation task at hand, and set aside questions that arose about aspects of the design and implementation as subjects for future research. I discuss these further in the Chapter 9 conclusion of this thesis.

Setting out to build a networked and interoperable platform for creating and connecting arbitrary recordkeeping metadata schemas, I named the proof-of-concept system *Participatory Recordkeeping Infrastructure* or *PaRIty* for short. As it was to be used (a) by me to iteratively validate the model and perform laboratory evaluations and (b) by domain experts to evaluate the design, I did not concern myself overly with the aesthetics of the user interface or the detail

of usability concerns; I was not testing the usability of the application per-se. The one exception to this was when implementing novel recordkeeping functionality, I spent some time working through different interface options in order to clearly explicate the concepts without the user interface itself confounding the evaluations. A good example of this was the Relationship-related functionality described below where it was a bit of a struggle to strike a balance between flexibility (sub-typing relationships from the conceptual model, naming forward and reverse versions of these, and defining roles) and simplicity of use. In actuality the PaRIty user interface probably exposes too much of the underlying conceptual model to be of practical use as an end-user system, but this was necessary, I think, for its use as a pedagogical and evaluation tool.

7.1.2 Technology

The choice of technology for PaRIty was important as it needed to support server, user-interface, and Application Programming Interface (API) components. Furthermore I needed to be able to rapidly update both the underlying database and the application code for all of these elements in an agile manner in line with the micro-iterations as the development progressed. I elected to build PaRIty as a web application to take advantage of existing networking and interoperability frameworks. In order to be able to focus on the application logic, I opted to employ an Agile Web Development Framework (Jazayeri, 2007) that provided *Scaffolding* (the automatic generation of boilerplate code), a *Model-View-Controller* (MVC) architecture (that cleanly separates database access, 'business' logic, and interface concerns), an *Active Record* paradigm (whereby application data structures are automatically mapped to database constructs, and the developer does not directly interact with the database; changes to the code automatically result in changes to the underlying database), and built-in support for interoperability features (such as APIs and payload serialisation/de-serialisation). There are many such frameworks available, most of which are open source or free to use (Clavijo, 2014).

I eventually selected the Grails (2017) framework as, from my perspective, Grails provided a number of benefits over other choices. Grails is derivative of the seminal Ruby-on-Rails project (Jazayeri, 2007) ported to the Groovy language. Groovy is a dynamic language that is based on Java – it may be compiled to Java bytecode, runs on the Java Virtual machine, and interoperates with other Java code and libraries. While I had familiarity with a number of programming languages and web frameworks, I am very comfortable with Java and the Java Enterprise Edition eco-system. Groovy is optionally typed which means that it provides the flexibility of a scripting language, but also supports Java static typing and annotations. Groovy also supports a number of modern meta-programming language features (Štuikys &

Damaševičius, 2012, p. 24) which were attractive from a flexibility perspective. I chose the open-source and industry standard Tomcat web application server as a Servlet container for the PaRIty Instances. Finally, I selected fairly pedestrian user interface technologies such as the industry standard Bootstrap and JQuery for my front end environment, as again, I wasn't trying to do anything complex enough to warrant a full MVC environment running on the client-side.

In terms of data storage, I originally imagined that there could be an interoperability benefit in using a flexible document-oriented database that would not impose an a-priori schema on record documentation. I reviewed a number of such NoSQL (Kuznetsov & Poskonin, 2014) databases such as Mongo and Couchbase but came to the conclusion that any benefits over a conventional Relational Database Management System (RDBMS) were outweighed by limitations in terms of key support; attribute identification, validation and rendering; and support for complex queries. Similarly, given the formalisation of relationships in the conceptual model, I also looked at graph databases such as Neo4J with their capability to directly store *Node* and *Edge* elements and perform graph-oriented operations such as traversal, graph-oriented search etc. (Angles & Gutierrez, 2008). Again, while these affordances appeared to suit a data analytics context, they did not appear to provide any benefit over a conventional RDMS for recordkeeping applications. I finally settled on the MySQL RDBMS as I was looking for simple and quick SQL support and did not require any advanced features of other RDBMS systems such as distributed transactions.

PaRIty was built to easily scale to multiple instances and be networked in an interoperable manner. This was achieved though the combination of the Grails Active Record architecture (facilitating automatic creation of the database structure) together with the compilation and packaging of PaRIty as a *Web Archive* or *WAR* file. To set up a PaRIty instance then, a Servlet container (such as Apache Tomcat) and MySQL database would be configured and the PaRIty WAR would be copied to the container's *webapps* folder. The PaRIty instance would then auto-configure, create the necessary database structures, and be ready to run.

7.1.3 Functionality

PaRIty was conceived to explore the creation of recordkeeping schemas compliant with the Meta-model for Recordkeeping metadata described in Chapter 6, and to investigate the interoperability between such schemas.

Figure 7.2: PaRIty Instance Landing Page (Fig. E.1)

Each PaRIty instance comprises four sub-systems:

- Schema management;
- Domain data management;
- Discovery; and
- Interoperability API;

As can be seen from Figure 7.2, the first three of these can be accessed from the PaRIty landing page whereas the API, of course, is not normally visible to end-users. Note that larger versions of all of the screen shots have been reproduced in Appendix E.

These four subsystems are described as follows:

Schema Management

The schema management subsystem enables the creation of an arbitrary number of distinct domain schemas that comply with the meta-model. This involves creating entity and allowable relationships types (as subtypes of the meta-model entities and relationships) as well as defining their attributes. In a production environment, this sort of activity would typically be performed once upon initial configuration by recordkeeping domain expert to create a domain schema and then again only rarely if the domain schema needed to be adjusted. In contrast, I used this feature to simultaneously explore a variety of schemas and to continually make changes as the design progressed.
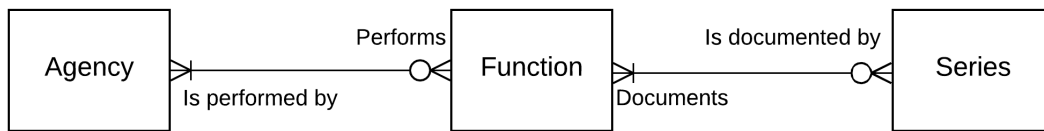
Figure 7.3: Simple partial schema example
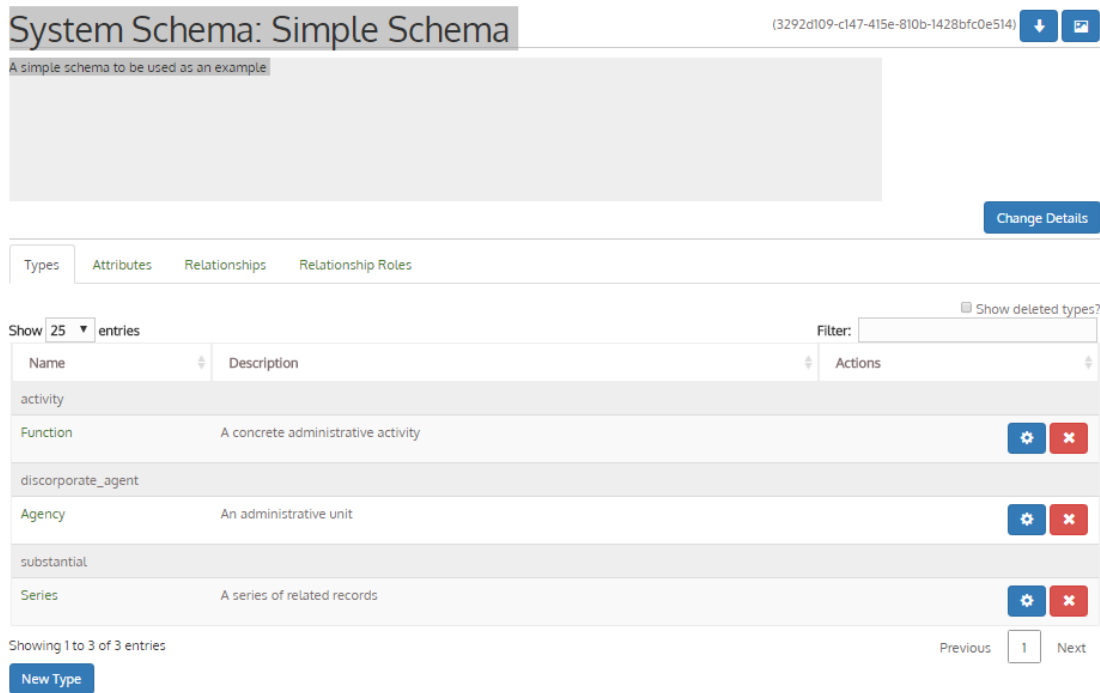
Figure 7.4: Simple partial schema entities in PaRIty (Fig. E.2)

As an example, consider the familiar following partial metadata schema: An *Agency* performs a *Function*; a *Series* of records documents the *Function* as shown in Figure 7.3:

A PARIty implementation of this partial schema (with reference to the meta-model described in Chapter 6) could be created as follows:

- Creation of an *Agency* entity type as a sub-type of *Discorporate Agent* with attributes: Name, Description, Creation Date, and Termination Date.
- Creation of a *Function* entity type as a sub-type of *Activity* with attributes: Name, Description, Creation Date, and Termination Date.
- Creation of a *Series* entity type as a sub-type of *Substantial* with attributes: Name, ID, Description, First Accumulation Date, and Last Accumulation Date.

A screen-shot of these entities defined in PaRIty is shown in Figure 7.4 and one of the Series entity attributes is shown in Figure 7.5.

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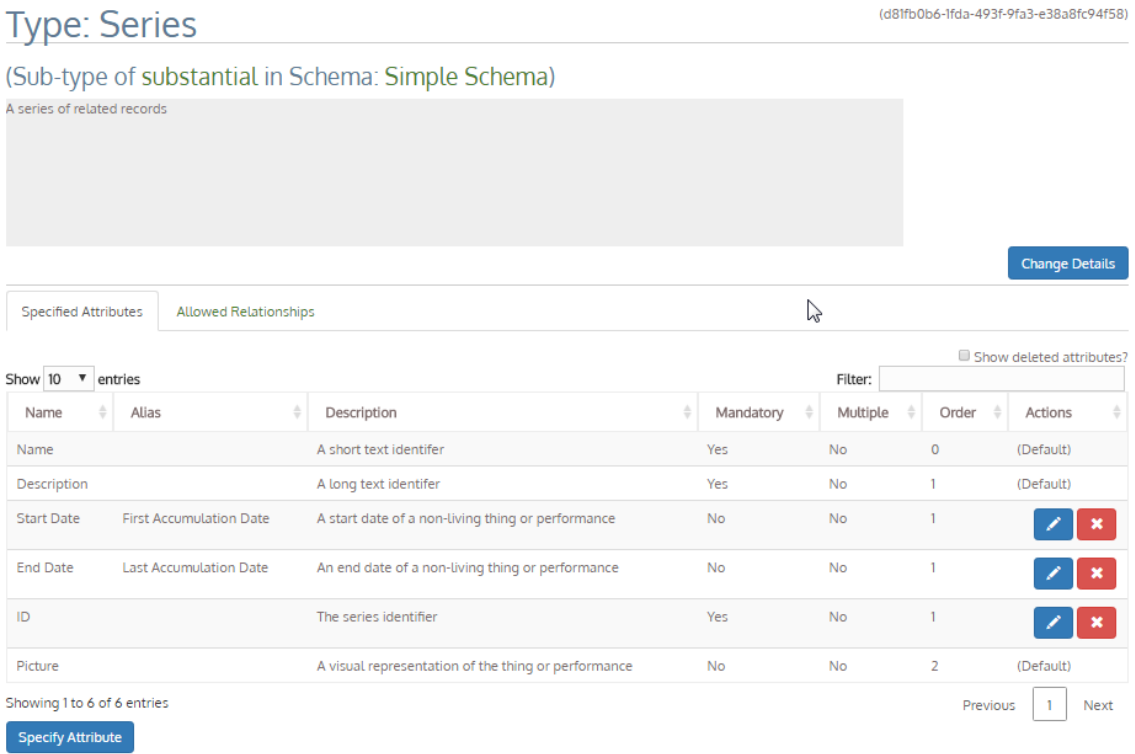
Figure 7.5: 'Series' entity attributes in PaRIty (Fig. E.3)

Note that, as a demonstration of commonly held attributes for most entity types, PaRIty automatically provides *Name* and *Description* attributes for all entity types (including Relationships). Non-Relationship entities also have a 'built-in' *Picture* attribute.

Following the creation of the entity types, allowed relationship types could be created as follows:

- Creation of a *Performs* relationship type as a sub-type of *Enactment* with attributes: Description, Start date, and End date. Agency (in the role of 'Executive Unit') 'performs' Function; Function (in the role of 'function') 'is performed by' Agency.
- Creation of a *Documents* relationship type as a sub-type of *Representation* with attributes: Description, Start date, and End date. Function (in the role of 'Business Activity') 'is documented by' Series; Series (in the role of 'Business Records') 'documents' Function.

A screen-shot of the creation of the second of these allowed relationship types is shown in Figure 7.6. I elected to employ a wizard format to simplify the relationship creation functions and guide the user through the various cognitive steps. The first step is to select the relationship super-type. In step two, in this case after selecting a Representation relationship, the list of entities to be related is constrained to those allowed by the meta-model. As this partial schema only comprises the entity types Discorporate Agent (i.e. Agency), Performance (Function),

(a)

Create Allowed Relationship in schema 'Simple Schema'

1. Relationship type	2. Related types	3. Relationship Roles

Select the type of this relationship:

Relationship
Type: Representation (A record represents a performance) ▼

- Select a relationship type -
Structural (Structural relationships e.g. is part of)
Temporal (Time-based relationships e.g. follows)
Genidentity (Origin relationships e.g comes from)
Spatial (Space-based relationships e.g. is near)
Affiliation (Association-based relationships e.g. is member)
Enactment (Active relationship with a performance e.g. witness to)
Involvement (Passive relationship with a performance e.g. victim of)
Situation (Spacetime relationship with setting e.g. occurred during)
Manifestation (Denotes a transformation e.g. digitised copy of)
Authorisation (Sanctions a performance e.g. legalises)
Representation (A record represents a performance)
Reference (Referred to in a record)
Influence (Agent influences another entity e.g. owns, controls etc.)
Sanction (One entity mandates another entity e.g. allows)

(b)

1. Relationship type	2. Related types	3. Relationship Roles

Select the types to be related in a 'Representation (A record represents a performance)' relationship

Types involved: 'Series' -> 'Representation' -> 'Function' ▼

-Choose a combination-
'Series' -> 'Representation' -> 'Function'
'Function' -> 'Representation' -> 'Function'

(C)

1. Relationship type	2. Related types	3. Relationship Roles

Select the relationship between Series and Function

Series		Function	
Role	-Choose a role- ▼ ➕	Role	Business Activity ▼ ➕
	-Choose a role-		
Simple Name	Business Activity	Simple Name	is documented by

Figure 7.6: PaRIty Allowed relationship creation wizard (Figs. E.4, E.5, E.6)
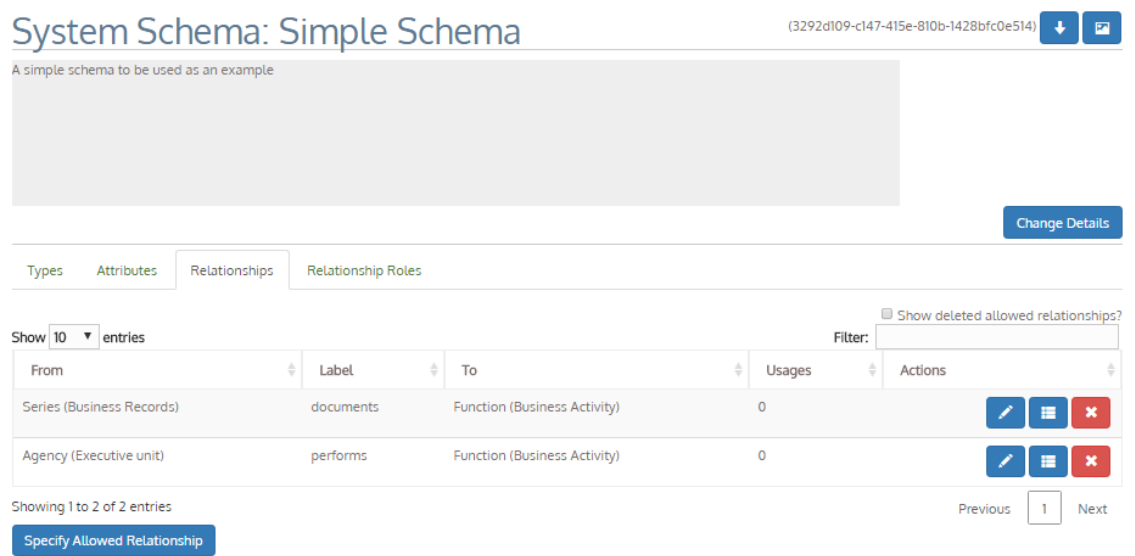
Figure 7.7: Simple schema relationships in PaRIty (Fig. E.7)

and Substantial (Series), the only possible relationship allowed by the meta-model would be 'Substantial is a Representation of a Performance' i.e. Series is a Representation of a Function (to refer to the domain schema elements). In this way the PaRIty system enforces the semantics of the meta-model providing the basis for semantic interoperability between PaRIty instances. In step three, the role names for the related entities are selected/created and a simple, meaningful name for the relationship (in both directions) is entered.

A tabular listing of the simple example schema's allowable relationship types is shown in Figure 7.7. Note that relationships are implemented as first-class entities in their own right, and the definition of relationship type attributes (not shown here) are managed in exactly the same way as entity type attributes. Finally, the PaRIty visualisation of this simple example schema is shown in Figure 7.8. It should be noted that a number of features relating to such schema definition — for example, validation rules for entity and relationship attributes, enforcement of the relationship cardinalities[35] etc. — were not implemented as part of the PaRIty system. As this sort of detail was not required to evaluate interoperability concerns per se, I considered it out of scope for the proof-of-concept instantiation (See Appendix D for more information).

To aid in schema development, I also created the ability to export and import Schema definitions to/from Comma Separated Value (CSV) text files. In this way I could not only save schemas to be recalled at a later date, but the CSV format turned out to be a quick way to create schemas from scratch using a spreadsheet application. An example showing the first page of the Dublin

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[35]i.e. An Agency may perform one or more Functions; a Function must be performed by at least one Agency (hopefully, if more than one, then one at a time!); an Agency may record one or more Series, a Series must be recorded by one or more Agencies (again, serially).
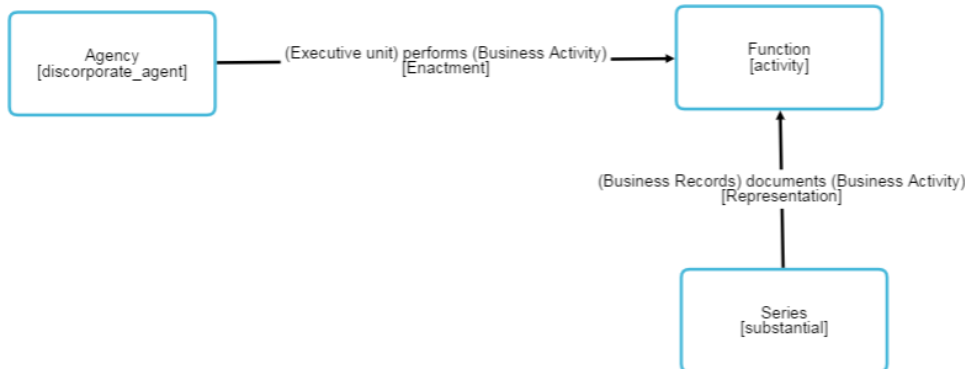
Figure 7.8: PaRIty visualisation of the simple schema (Fig. E.8)

Core Collection Schema is presented in Appendix G. From this example it can be seen how a domain expert, responsible for the creation of domain schemas, could easily use such a facility to create meta-model compliant schemas.

Domain data management

The Domain data management feature allows participants to manage distinct sets of domain-specific recordkeeping metadata corresponding to one or more local domain schemas previously defined as described above. This included the ability to:

- select a schema in which to work from a list of local schemas.
- list, create, view, update, and delete instances of schema entities — to continue the above example, consider *Child Welfare* (as an instance of the entity type Function); and *Case Files* (as an instance of the entity type Series) and associated attributes. Figure 7.9 shows an example of (a) listing entity types, (b) creating a domain Series entity — Case Files, and (c) listing the domain schema entities for a given type.

- link schema entity instances with each other via schema allowable relationships — for example: Case Files *Documents* Child Welfare. Figure 7.10 shows the creation of this relationship.
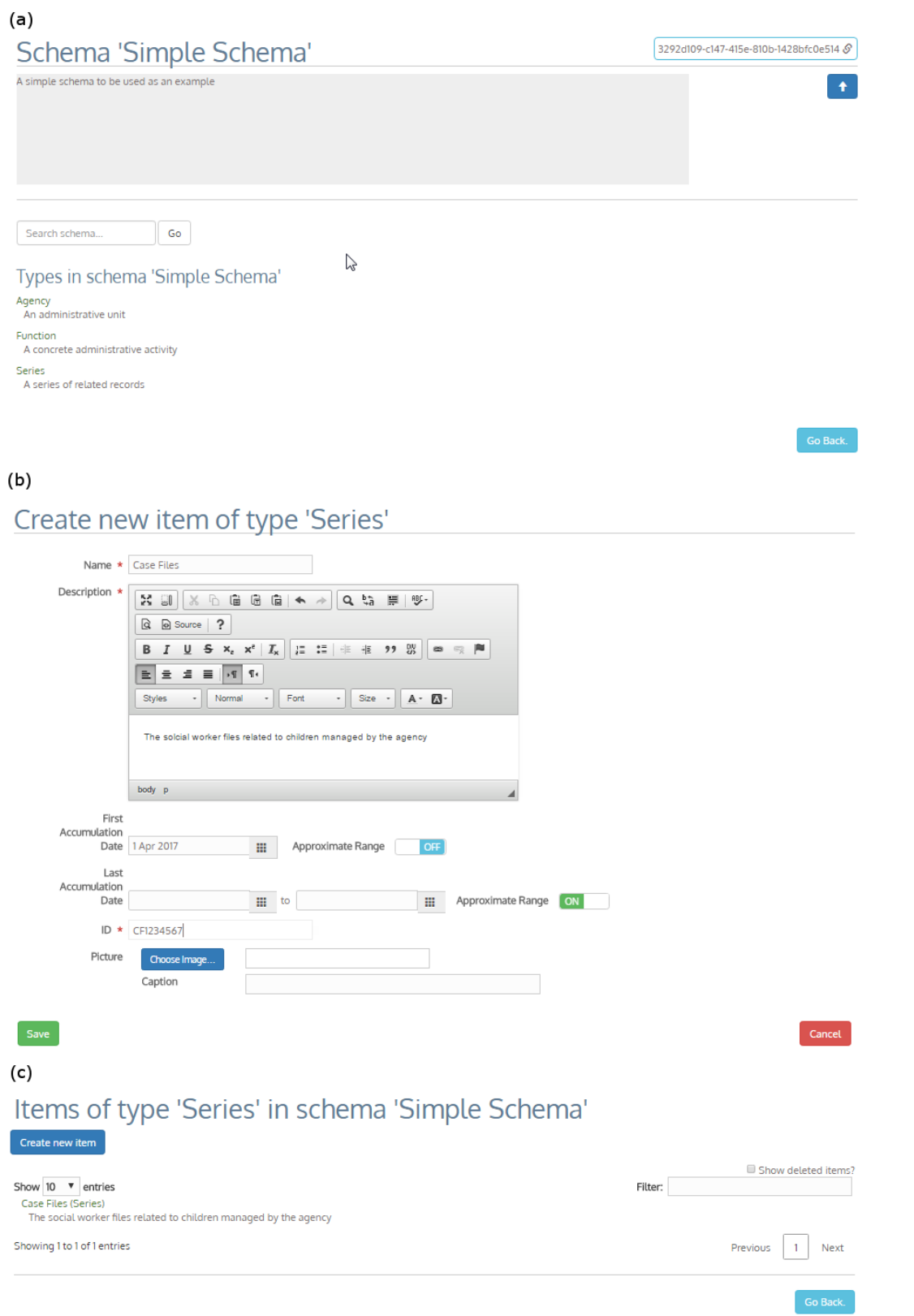
Figure 7.9: List, create, and view entity type in simple example schema (Figs. E.9, E.10, E.11)
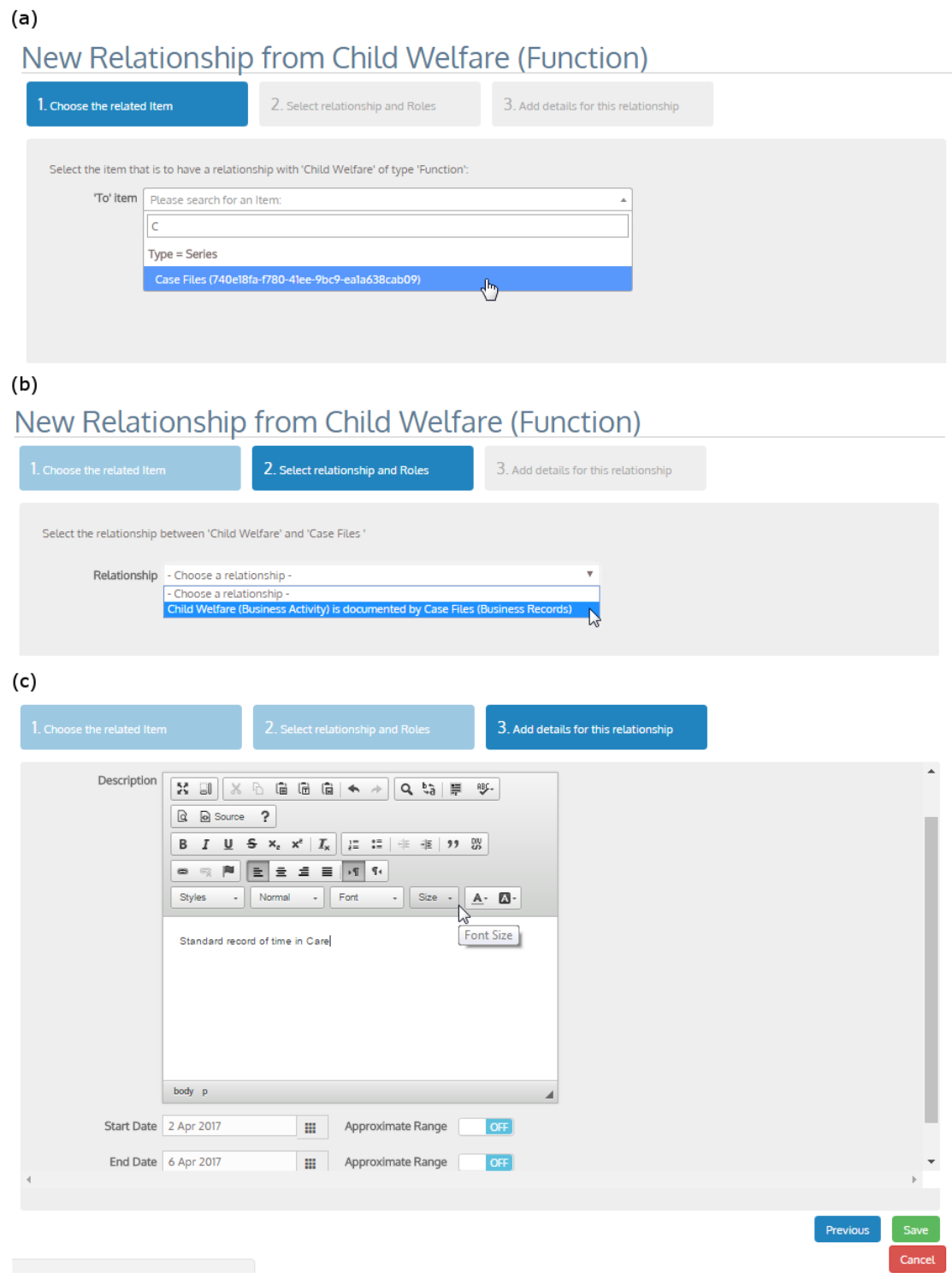
Figure 7.10: Creating a domain relationship (Figs. E.12, E.13, E.14)

As with schema management, the PaRIty domain relationship management was implemented using a wizard. Given that, in this example, we are creating a relationship from the Child Welfare entity, we first search for any other entity in the domain to which we can form an allowed relationship. In this case, our schema only allows Function entities to form a Documents relationship with Series entities, so the wizard only presents Series entities that match the search string. In this case there is only one, the Case Files entity.

Next the list of allowable relationship types between Child Welfare and Series is presented, and when one is selected then the attributes of the relationship may be entered.

The complete entry for the Child Welfare entity is shown in Figure 7.11.

The four tabs of the entity documentation are as follows:

- **Details**: the attributes of the entity
- **Relationships**: a list of all of the relationships of this entity with other, local (to this schema) entities. This view is probably too complex for general use as it exposes all sorts of internal and meta-model-related information (that is nonetheless useful for development and evaluation) including:
    - The role of each entity in the relationship (Business Activity/Business records/Executive Unit);
    - The schema entity type of each entity (Function/Agency/Series);
    - The meta-model super-type of each relationship (Representation/Enactment);
    - The simple relationship name from the perspective of the entity being displayed (is documented by/is performed by); and
    - The attributes of the relationship (accessed by the information (i) icon).
- **Records**: In the case of Performance entity sub-types, any local entities (subtypes of the meta-model Substantial and Performance entity types) with a Representation relationships with the entity being viewed — i.e. a record of that Performance.
- **History** An audit trail of recordkeeping activities relating to this entity as discussed below.

As with the schema management, I developed an import/export facility for domain data using CSV files. Again this made for easy restoration of domain environments for testing as well as the rapid creation of domain data using a spreadsheet.

PaRIty domain data management also facilitates the creation of *Manifestation* relationships between local entity instances and those in other schemas (perhaps on remote PaRIty systems).

(a)

Child Welfare

36569bf5-8d54-4ce2-8d8f-412391dc5e13 🔗

Item of type 'Function' in schema 'Simple Schema'

| Details | Relationships | Records | History |

Name: Child Welfare

Description: State-run provision for children in need of care

Start Date: 27 Mar 2017
End Date:
Picture:

Go Back.

(b)

Child Welfare

36569bf5-8d54-4ce2-8d8f-412391dc5e13 🔗

Item of type 'Function' in schema 'Simple Schema'

| Details | Relationships | Records | History |

☐ Show deleted relationships?
Show 10 ▼ entries

As 'Business Activity'   Representation ⓘ
                         is documented by   Case Files (Series) as Business Records
                         02 Apr 2017 - 06 Apr 2017 740e18fa-f780-41ee-9bc9-ea1a638cab09

As 'Business Activity'   Enactment ⓘ
                         is performed by   Department of Human Services (Agency) as Executive unit
                         -                         9b174e3e-03a4-4e11-aa7a-975b3e4fb213

Showing 1 to 2 of 2 entries   Previous 1 Next

Go Back.

(c)

Child Welfare

36569bf5-8d54-4ce2-8d8f-412391dc5e13 🔗

Item of type 'Function' in schema 'Simple Schema'

| Details | Relationships | Records | History |

Search depth 1   ☐ Show deleted records?
                                                  Show 10 ▼ entries

Case Files (Series)
  The social worker files related to children manag...

Showing 1 to 1 of 1 entries   Previous 1 Next

Go Back.

(d)

Child Welfare

36569bf5-8d54-4ce2-8d8f-412391dc5e13 🔗

Item of type 'Function' in schema 'Simple Schema'

| Details | Relationships | Records | History |

Timestamp	Action	Details
15 Apr 2017 09:01	Item created	"Function: Child Welfare ..."
15 Apr 2017 09:12	Item changed	"Function: Child Welfare ..."
15 Apr 2017 09:28	Item changed	"Function: Child Welfare ..."

Go Back.

Figure 7.11: Complete entity documentation in PaRIty (Figs. E.15, E.16, E.17. E.18)

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(a)

(b)

Figure 7.12: Remote PaRIty Manifestation Link (Figs. E.19, E.20)

To continue the simple example, imagine there is a remote schema with a *Record Set* of records having an *is evidence of* relationship with the Activity *Out Of Home Care*. Thus a Record Set instance, *Personal Files*, on a remote system may be considered to have an equivalence with the local Case Files entity instance. Note that the remote instance takes no part in this linking save that it has implemented interoperability features that are based on the meta-model; the Manifestation link with the remote entity is created on the local schema only.

As shown in Figure 7.12, such a link involves the following information:

- The Uniform Remote Identifier (URI) of the remote entity — typically a remote ReSTful API URL (see below);

- The meta-model entity super-type of the entity (defined in terms of the PaRITY ontology described below) — in this case:

  `http://edu.monash.parity.ontology/substantial`

- The label to be used locally for this entity (typically obtained from the remote entity Name attribute); and

- The remote entity type as defined in the remote schema.

Within PaRity, this linking was assisted via a drag'n'drop interface that allows easy linking between PaRIty schemas. For example, Figure 7.11 shows the entity ID with a link symbol that is the drag'n'dop anchor used to link entities. When dragged onto another entity instance, the link is created. Figure 7.13 shows this two step process: the remote details are dragged, or entered into the local instance context, and a Manifestation link is created from the local instance to the remote instance.

Note that this is a manual process and obviously does not scale for the wholesale creation of cross-schema Manifestation links. On the other hand, as demonstrated below, it may be that a few judicially selected links may be all that is necessary to allow discovery of key elements across the network, and that may lead to browsing in remote schemas. Note, too, that it is in the interest of, say, a community archive to provide links of its material back into the institutional archive, and the incremental effort in doing this when creating metadata entries may not be so great. Additionally, as argued in Chapter 4, the sheer volume of material within the Archival Multiverse may require the use of technological assists, and it is conceivable that machine learning tools may come to be used to identify such links — though it is difficult to see, in the short term, how this would work for incommensurate schemas.

The history information is provided by the PaRIty audit feature. It is an example of the self–hosted 'recordkeeping business' described in Chapter 6, in that a schema based upon the meta–model can be used to manage records of recordkeeping activity itself.

```
{
    "uri":          "http://localhost:8080/api/items/42f41c17-4eb2-40ab-bd6e-4324ca625694",
    "objectClass":  "http://edu.monash.parity.ontology/substantial",
    "label":        "Personal Files",
    "remoteType":   "Record Set"
}
```
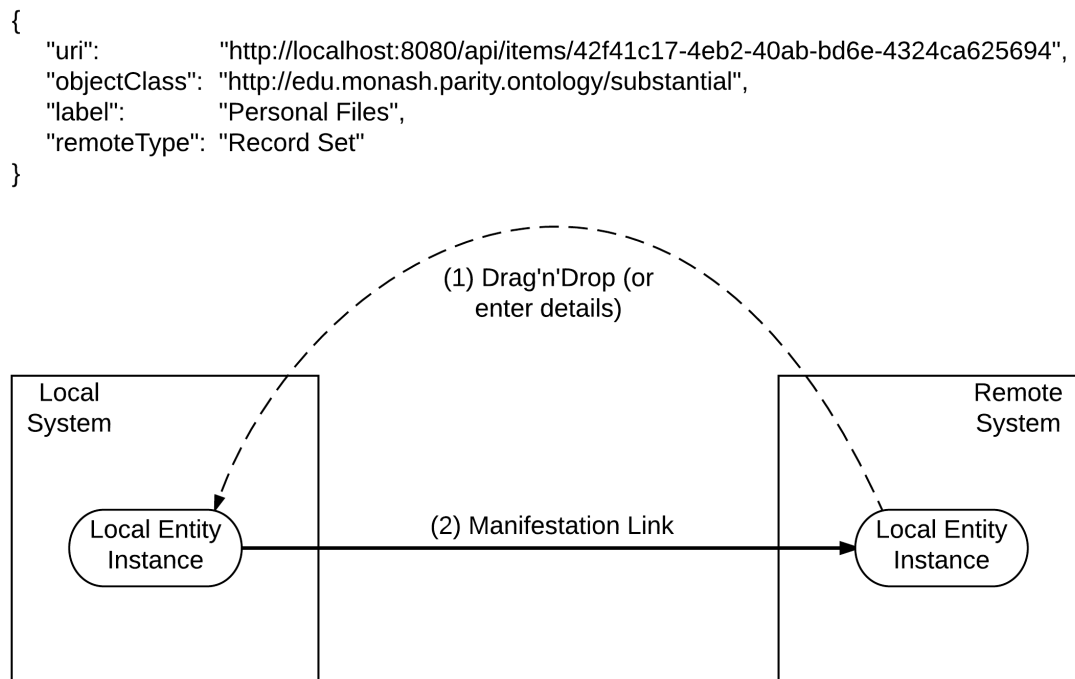

Figure 7.13: Creaing manifestation link from remote link details

In the case of the Audit function, the schema is used to store details of:

- The Corporeal Agent (e.g. a system administrator) who performed an action;

- The Event (i.e the create, import, update, or delete action involving domain entities);

- The Entity(s) involved in the action Event;

- A Substantial entity that is the Record of the action

- A Representation relationship linking the Event to the Record;

- An Enactment relationship linking the Agent to the Event; and

- An Involvement relationship linking the affected entity to the Event.

As can be seen from Figure 7.14, the administrator interface shows the details of Records of recordkeeping actions (i.e. before and after status and/or attributed of the affected entity) and the Involvement relationship to allow navigation to the affected entity. In this example, the Child Welfare entity was changed due to an *Admin_Edit* event.

Discovery

The PaRIty Discovery interface is used to nominate one or more schemas from local and/or networked PaRIty instances, and to perform federated and interlinked browsing and searching across these instances. The Discovery interface does not privilege local schemas; in fact, it does

(a)

Child Welfare   36569bf5-8d54-4ce2-8d8f-412391dc5e13 🔗

Item of type 'Function' in schema 'Simple Schema'

Details	Relationships	Records	History

Timestamp	Action	Details
15 Apr 2017 09:01	Item created	"Function: Child Welfare ..."
15 Apr 2017 09:12	Item changed	"Function: Child Welfare ..."
15 Apr 2017 09:28	Item changed	"Function: Child Welfare ..."

Go Back.

(b)

Item changed   ad69bf72-155b-4714-a487-a2fa5dfbb4fc 🔗

Item of type 'admin_edit' in schema 'Audit'

Details	Relationships

Name: Item changed

Description: Function: Child Welfare

Before: {"http://edu.monash.parity.ontology/api/attributes":
[{"http://edu.monash.parity.ontology/api/type":"http://edu.monash.parity.ontology/Text","http://edu.monash.parity.ontology/api/s
["Child Welfare"],"http://edu.monash.parity.ontology/api/label":"Name"},
{"http://edu.monash.parity.ontology/api/type":"http://edu.monash.parity.ontology/LongText","http://edu.monash.parity.ontology/:

Picture:

Start Date: 15 Apr 2017

Start Time: 09:12

Go Back.

(c)

Item changed   ad69bf72-155b-4714-a487-a2fa5dfbb4fc 🔗

Item of type 'admin_edit' in schema 'Audit'

Details	Relationships

☐ Show deleted relationships?

Show 10 ▼ entries

As 'Administrative function'   Involvement
                                  Edited   Child Welfare (Function) as Managed item
                                  15 Apr 2017 -   36569bf5-8d54-4ce2-8d8f-412391dc5e13

Showing 1 to 1 of 1 entries   Previous 1 Next

Go Back.

Figure 7.14: Details of PaRIty audit records (Figs E.21. E.22, E.23)

not even require a local schema to be defined. In this way, PaRIty assumes networked and interoperable sources of recordkeeping documentation with which the record-seeking participant may choose to interact. A useful analogy here (up to a point) is a social networking service such as Twitter, whereby end-users select which sources they wish to 'follow'.

In the case of Parity, the end-user nominates and queries one or more sources of recordkeeping documentation and PaRIty resolves and follows any intra- and inter- schema links, using the interoperability features described below. Of course, if a system other than PaRIty were to support the meta-model and ontology via an API, it could also participate in this network. Note that, within PaRIty, all schemas are treated equally; neither the PaRIty system, nor the supporting ontology (see below) provide for the weighting of sources based on trust or authoritativeness. This is a significant issue for transition into an open world (Hustadt, 1994) networked paradigm and one that I cover in more detail in the Chapter 8 discussion.

As shown in Figure 7.15, Schemas are added by providing a local label, the URI of the source's API index page (see ontology below), and an optional colour that is used in an indicator sidebar to distinguish discovery results. Again, like the remote linking facility in Domain data management, the creation of discovery schemas in PaRIty is assisted via a drag'n'drop interface that allows easy linking between PaRIty schemas. In this case the drag'n'drop anchor is the globally unique ID of the schema in the Domain data management feature — for example as shown in Figure 7.9 (a). Once schemas are added, they may be individually selected and deselected from the discovery interface as shown in Figure 7.15 (c). By default, the discovery interface provides a navigation list of all of the entity types available in the currently selected schemas.

Using the Discovery feature, participants can browse and search across these schemas, with the results highlighted using the previously selected schema colours. Searching the schemas, for example, may return a number of hits from one or more schemas as shown in Figure 7.16 (a). Selecting one of these results displays its details and if the item is involved in one or more cross-schema Manifestation relationships, then details from all manifestations are shown. Remember again that, in our simple example, the manifestation link was created in the local system without participation (or even the knowledge) of the remote system. In Figure 7.16 (b), the entity selected is from the remote schema, but still displays the details from both sides of the manifestation link. PaRIty is able to use the semantics of the meta-model to understand and resolve links between disparate sources.

(a)

Create Record Source

Label *	Multi-system - Remote Simple Schem
URI *	http://localhost:8080/api/schemas/b
Colour	# 57ff57

Basic Colors	Saved Colors	Advanced
□ white		
■ red		
■ orange		
□ yellow		
■ green		
■ blue		
■ purple		
■ black		

Or

Drag and drop a schema from another system.

🔗 Drop remote schema here

Save   **Cancel**

(b)

Record sources

Show 10 ▼ entries   Filter: [   ]

Name ▲	URL	colour	Actions
Multi-system - Remote Simple Schema	http://localhost:8080/api/schemas/b233c12d-b6d1-4433-b3f4-64bb8ec8b653		✏ ✖
Multi-system - Simple Schema	http://localhost:8080/api/schemas/3292d109-c147-415e-810b-1428bfc0e514		✏ ✖

Showing 1 to 2 of 2 entries   Previous 1 Next

New Record Source

Go Back.

(c)

Record discovery

[search...]   **Go**   Record Sources × Multi-system - Remote Simple Schema   ⚙
                                                       × Multi-system - Simple Schema

Types

Agency
An administrative unit

Function
A concrete administrative activity

Out of home Care
Types of DCare provided by government and non-government agencies

Record Set
Sets of documentaiton relating to the provision of out of home Care

Series
A series of related records

Figure 7.15: Schema specification in PaRIty discovery (Figs E.24. E.25, E.26)

(a)

Search results.

| rela | | Go |

Record Sources   ×Multi-system - Remote Simple Schema
                 ×Multi-system - Simple Schema

Retrieve up to 10 ▼ records at a time from each source.

Case Files (Series)
[1.23] The social worker files related to children managed by the agency

Personal Files (Record Set)
[1.23] Files relating to individuals

Showing page 1 of 1 (filtered from 4 total entries)   Previous   Next

Go Back.

(b)

Personal Files (Type: Record Set [Substantial]) from 'Multi-system: Remote Simple Schema'

Link depth 1

| Details | Relationships | Records |

Details from remote site 'Multi-system: Remote Simple Schema'   http://localhost:8080/api/items/42f41c17-4eb2-40ab-bd6e-4324ca625694

Name: Personal Files

Description: Files relating to individuals

See in original context 🔗   History 🕐

Details from remote site 'Multi-system: Simple Schema'   http://localhost:8080/api/items/740e18fa-f780-41ee-9bc9-ea1a638cab09

Name: Case Files

Description: The social worker files related to children managed by the agency

First
Accumulation
Date: 01 Apr 2017

ID: CFI234567

This remote item has additional information from other linked remote sites. See in original context 🔗   History 🕐

Figure 7.16: Search results in PaRIty discovery (Figs E.27. E.28, E.29)

226

Figure 7.17: Records in PaRIty discovery (Fig. E.30)

This autonomous linking between disparate schemas is a core interoperability affordance of the meta-model demonstrated by the PaRIty system. It is especially applicable when considering Performance entity types that may have representations (i.e. records) across multiple disparate schemas. For example, as shown in Figure 7.17, the Activity *Greg Rolan Foster* in the remote schema is shown to have associated records in both schemas. Again, the instance in the remote system has no knowledge of, or link to the local system, yet by resolving links around the network, records from both systems may be associated with that Activity.

I should mention here that one issue that arose when working on this discovery feature is the problem of 'link depth': how many 'hops' within a system or around the network should the system take in order to resolve links and seek records. The problem is that increasing the link depth leads to an exponentially increased workload, the potential for multiple, redundant results, and, in all likelihood, loops in the graph of followed relationships. As can be seen from the various discovery screen-shots, PaRIty provides a simple decrementing counter to allow participating systems to manage the number of links followed[36]. However this is a blunt tool; while limiting the workload, it does not optimise search paths, provide protection against redundant results, or prevent the following of loops in the graph. I considered a detailed treatment of graph-oriented computing (a research domain in its own right) as out of scope for this instantiation, however, as it is important aspect of networked recordkeeping, I discuss the implications of this in more detail in Chapter 8.

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[36]Upon receiving a discovery request — that includes the current link-depth counter — a participating system will decrement the counter before performing its own discovery activities, passing on the decremented counter to subsequent systems in the graph. Eventually the counter will reach zero, and the PaRIty instance will not forward the request to other systems.

Interoperability API

The networked interoperability of PaRIty derives from its API service along with some additional supporting features. The API itself is a Representative State Transfer (ReST) interface (Fielding, 2000); the ReST paradigm chosen for its simplicity and expressibility (Battle & Benson, 2008). The ReST paradigm is an industry standard (ProgrammableWeb, 2017) and consequently the many web services frameworks described in the *Technology* section above provide ReST support as a built-in interface service, mapping ReST URIs to system transactions — Grails included. Examples of ReSTful APIs and their use may be found at Trove (National Library of Australia, 2017) the UK National Archives (UK National Archives, 2017), and in Tim Sherrat's work on client-side tools (Sherratt, 2017).

ReSTful transactions return response documents that usually contain URIs or details of one or more resources that result from the action requested — for example: a 'query' transaction may return a list of URIs or the details of one or more elements, a 'delete' transaction may return a confirmation including the details of the deleted element. The ReST principle of Hypertext As The Engine Of Application State (HATEOAS) (Fielding, 2000) means that within a response document, paths to related elements and actions are represented by URIs. Such response documents are typically encoded in Java Script Object Notation (JSON) and contain URIs of elements and other related API functions. Because the ReSTful URIs themselves, as well as the resource descriptions contained within response documents, are inherently navigable, ReST API consumer implementations are not tightly coupled to the provider's interface. There is no requirement for additional out-of-band structural knowledge about the application such as the domain schema or the implementation-specific syntax of API functions. These URIs, coupled with knowledge about the meta-model expressed through the PaRITY ontology (see below) provide for the semantic interoperability of conforming systems.

The API functions provided by the PaRIty API are shown in Table 7.1. Note that only read-only transactions are supported by the API. While this was sufficient to exercise the interoperability features of PaRIty, obviously, the full access-controlled read/write features need to be explored in the context of supporting the functional model. This is discussed further in Chapter 9.

```
{
    "http://edu.monash.parity.ontology/api/index":           "http://localhost:8080/api/index",
    "http://edu.monash.parity.ontology/api/schemas":         "http://localhost:8080/api/schemas",
    "http://edu.monash.parity.ontology/api/presentation":    "http://localhost:8080/domain/index",
    "http://edu.monash.parity.ontology/api/schema":          "http://localhost:8080/api/schemas/3292d109-c147-415e-810b-1428bfc0e514",
    "http://edu.monash.parity.ontology/api/types":
        [
            {
                "http://edu.monash.parity.ontology/api/uuid":           "d81fb0b6-1fda-493f-9fa3-e38a8fc94f58",
                "http://edu.monash.parity.ontology/api/label":          "Series",
                "http://edu.monash.parity.ontology/api/description":    "A series of related records",
                "http://edu.monash.parity.ontology/api/resolved_type":  "http://edu.monash.parity.ontology/substantial",
                "http://edu.monash.parity.ontology/api/items":          "http://localhost:8080/api/types/d81fb0b6-1fda-493f-9fa3-e38a8fc94f58/items"
            },
            {
                "http://edu.monash.parity.ontology/api/uuid":           "c18f70a2-d3dd-4ab6-807b-eea152214db3",
                "http://edu.monash.parity.ontology/api/label":          "Agency",
                "http://edu.monash.parity.ontology/api/description":    "An administrative unit",
                "http://edu.monash.parity.ontology/api/resolved_type":  "http://edu.monash.parity.ontology/discorporate_agent",
                "http://edu.monash.parity.ontology/api/items":          "http://localhost:8080/api/types/c18f70a2-d3dd-4ab6-807b-eea152214db3/items"
            },
            {
                "http://edu.monash.parity.ontology/api/uuid":           "32533a36-1ae2-4b7b-ab81-1f74fcd8dedb",
                "http://edu.monash.parity.ontology/api/label":          "Function",
                "http://edu.monash.parity.ontology/api/description":    "A concrete administrative activity",
                "http://edu.monash.parity.ontology/api/resolved_type":  "http://edu.monash.parity.ontology/activity",
                "http://edu.monash.parity.ontology/api/items":          "http://localhost:8080/api/types/32533a36-1ae2-4b7b-ab81-1f74fcd8dedb/items"
            }
        ]
}
```

Figure 7.18: PaRIty API response document

Table 7.1: PaRIty API functions.

Function	PaRIty API URI
showSchema	/api/schemas/$uuid
showTypesForSchema	/api/schemas/$uuid/types
showItemsForSchema	/api/schemas/$uuid/items
showItemsForType	/api/types/$uuid/items
item	/api/items/$uuid
showRelationshipsForItem	/api/items/$uuid/relationships
showRecordsForItem	/api/items/$uuid/records
showHistoryForItem	/api/items/$uuid/history
showItemsForRemote	/api/schemas/$uuid/remotes

An example of a part of a response document from the transaction 'showTypesForSchema' from the simple scheme example above — e.g. from quueriying /api/schemas/3292d109-c147-415e-810b-1428bfc0e514/types — is shown in Figure 7.18.

The PaRIty response documents are LOD-like, corresponding to JSON Linked Data (JSON-LD) documents (Sporny, Longley, Kellogg, Lanthaler, & Lindström, 2013), but lacking the necessary name-space definitions for translation into formal LOD expressions[37]. These response

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[37]Due to time constraints more than anything else. Full compatibility with Linked Open data was not a design

documents were served by both the API service and the drag'n'drop features of the user interface. In this way PaRIty provided a consistent, ontology-compliant mechanism for sharing data.

The API is supported by an ontology that provides the terms that may be used to express the meta-model semantics as well as some additional housekeeping terms. In the example shown in Figure 7.18 above the *index* term is the URI of the navigation starting point provided by the API, the *presentation* term is the URI of a human–readable version of the document being presented, the *uuid* term is the global unique identity of the element being listed; and the *items* term is the collection of entity instances that match whatever query is being serviced. The complete PaRIty ontology is shown in Appendix F.

Finally, it can be seen from the screen-shots and examples above that PaRIty URIs are supported by a system of unique global identifiers. I used the Java-based Universal Unique Identifier (UUID) system to uniquely identify all entities and relationships — remembering that, within PaRIty, relationships are themselves first-class entities. This use of persistent, unique identifiers supports the readiness and interoperability requirements identified in Chapter 4.

7.1.4 Data design

PaRIty was developed over a period of about 8 months with an intense period of development lasting about 5 months[38]. As described above, I focussed on implementing the meta-model as a primary way of demonstrating the potential for interoperable participatory recordkeeping systems. The most complex aspect of the PaRIty development was that of the data storage and the interplay between the Grails Active Record paradigm and the underlying relational database services. This manifested itself in a number of ways, compounding the complexity of database query code, and giving rise to some challenging performance issues.

The complexity of the data storage layer results from the requirements to support arbitrary schemas (i.e. comprising entities and relationships) that, while confirming to the meta-model, could be bearers of arbitrary attributes. This meant that the Active Record objects needed to work at a meta level, representing 'Entity', 'Relationship' and 'Attribute' rather than 'Person' and 'Activity' etc. Both the meta-model schema and domain schema definitions therefore needed to be stored in the database, while my code needed to generically create domain schemas on the fly from this dynamic data and then manage the domain data corresponding to these schemas. In other words, at all times there were three layers of data abstraction that required

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requirement of this instantiation, however it would not be a major effort to code and test the creation of fully compliant JSON-LD documents as API responses.

[38]Dates were determined from the version control 'commit' logs.

modelling, expression in the database, and support by the PaRIty code:

1. The physical database schema implemented as a relational database;

2. A logical schema that expressed the meta-model of entity and relationship types (e.g. Substantial, Performance etc.); and

3. One or more domain schemas that implement the meta-model, defining entities and relationships constrained by the meta-model entity sub-types and allowable relationships, and their attribute definitions (e.g. Agency, Function, Series etc.).

This continual moving between three conceptual layers was taxing at times and pushed the boundaries of Grails Active Record functionality. However it did force me to clearly separate the various data management concerns in the PaRIty code, arguably leading to a more logical code-base.

Entity Attribute Value/Classes and Relationships model

Unlike the PaRIty environment, most database implementations have the data elements fixed early on, i.e. as an 'early-bound' conceptual data model that defines the domain elements and implemented (with some optimisation) in physical database schemas (Panneerselvam, 2011). This is the sort of scenario for which most data-oriented techniques, including the Active Record paradigm are designed. However, there fortunately is a body of work that addresses the requirement for relational database schemas that support arbitrary, dynamic entities, relationships, and attributes. This work is found in relation to large, complex, data-rich management environments, most typically in electronic medical records and analytics systems (Dinu & Nadkarni, 2007; Marenco et al., 2003).

One can imagine the huge differences in information capture needed to describe even just medical tests. For example, the entities and attributes used to describe an X-ray (beyond simplistic ID and Description fields) may be vastly different from those needed to describe a blood test. In this scenario, conventional data modelling would result in a 'Medical Test' table with a superset collection of attributes represented by, perhaps, hundreds or thousands of columns, the vast majority of which would be empty for any given database record.

In order to improve the efficiency of such databases, a pattern termed *Entity Attribute Value* (EAV) modelling was developed that, instead of modelling database records as single rows in database tables, separates out individual entities and attributes into entries in Entity, Attribute, and Attribute Value tables (Nadkarni et al., 1999). The extension of EAV databases into object-oriented modelling is termed EAV *Classes and Relationships* or EAV/CR. While leading to far

more efficient storage of data, it does increase the complexity of database access code as described below. In my case, I was less concerned with the efficiency of data storage, but had the requirement for arbitrary entities, relationships and attributes that could be satisfied by adopting an EAV/CR approach.

The final physical data model that I developed to support the PaRIty EAV/CR requirements is shown in Figure 7.23 at the end of this chapter. Most of the model, save for the five entity types on the top left-hand-side, corresponds to schema definition and construction. These entities allow the definition of schemas in terms of the meta-model and domain schema Entity and Relationship class hierarchies and the ability to constrain relationships to be between specific entity types. They also allow the specification of attributes for domain schema Entities and Relationships. The five remaining constructs correspond to the instances of items in the various schemas; Entities and Relationship instances together with their attributes and attribute values. Note that the Entity Named *ValueXXX* in the model actually corresponds to a number of entities; one for each value type. This is because, not only are different native database column types are needed to store the various attribute types (for example: text, numbers etc.), but the Parity code needed to be able to distinguish between types in order to perform validation and/or pre/post processing of values. The attribute value types supported by Parity are shown in Table 7.2. Thus the ValueXXX table in the EAV/CR model is, in fact, thirteen separate tables — each with a foreign-key relationship with the ItemAttribute table.

Table 7.2: PaRIty Attribute types.

Type	Description
audio	An audio clip
date	A date value or range
decimal	An arbitrary-precision signed decimal number
document	A document
embed	A cloud-based media item
geotag	A geographical identifier
image	An Image
integer	A whole number
link	An internet Uniform Resource Identifier
longtext	Long, descriptive text
text	Short text
time	A time value or range
video	A video clip

One characteristic of EAV/CR databases is that ostensibly simple queries (or, at least, queries that would be simple in conventional relational datbases) involve joins acrosss multiple tables, and those that use query constructs such as ORDERBY or LIKE involve extremely complex data manipulation. The Grails environment allows for five levels of abstraction of database access; three using the Active Object framework, one using the middle-ware Object-Relational adapter *Hibernate*'s own query language (HQL) and, finally, the ability to use native, database-specific SQL. These levels are:

1. Grails *Dynamic finders*

   For example:

   ```
   def b = Book.findByTitle("The Shining")
   b = Book.findByAuthorInList(["Douglas Adams", "Hunter S. Thompson"])
   ```

2. Grails *Where* statements

   For example:

   ```
   def query = Person.where {
   (lastName != "Simpson" && firstName != "Fred") || (firstName == "Bart" && age > 9)
   }
   def results = query.list(sort:"firstName")
   ```

3. Grails *Criteria* queries

   For example:

   ```
   def c = Account.createCriteria()
   def results = c.list (max: 10, offset: 10) {
   like("holderFirstName", "Fred%")
   and {
       between("balance", 500, 1000)
       eq("branch", "London")
   }
   order("holderLastName", "desc")
   }
   ```

4. Hibernate Query Language statements

   For example:

   ```
   def results = Book.findAll("from Book as b where b.title like 'Lord of the%'")
   ```

5. Native SQL

   For example:

   ```
   def sqlQuery = new Sql(dataSource)
   def sql = """
       SELECT...
   """
   def rows = sqlQuery.rows(sql)
   ```

Much of the PaRIty code employed the first three Active Record mechanisms to create, update, list, view, and delete schema and domain elements. However, searching the data required the use of native SQL to perform complex joins, unions, and sorts of the underlying EAV/CR tables.

These large queries — some individual queries stretching to almost 200 lines of SQL code due to the need to individually query each attribute type table and merge the results — not only slowed development, but made debugging difficult. Nevertheless, I should stress that this complexity derives from the absolute flexibility of PaRIty as a development and exploratory platform. In production environments, there may well be less need for such flexibility (particularly in bespoke or generated applications) and so production versions of this functionality should be simpler to produce.

Lastly, this complexity of the data access layer also manifested as a performance issue — particularly when performing the import of data from CSV files. While the import of a simple record (For example, Person with a number of attributes) into a conventional relational database may involve adding a single row into a table, the corresponding action in the PaRIty database involves the referencing of a number of meta-model tables to determine allowed attributes and relationships and the creation of rows in the Item, Item-Attribute, and ValueXXX tables. Nonetheless, I performed some performance analysis and through the use of database indexes, tweaking of middle-ware caching, and implementing my own write-through caches for critical data (such as Schema-related constraint data) I managed to significantly improve the import performance. Again, this flexibility-related performance issue has a good chance of being mitigated in a production environment where there is better scope of optimising the database for particular schemas. I will return to the prognosis for translation of PaRIty to production contexts in the Chapter 8 discussion.

7.2 Evaluation

The development of the PaRIty system facilitated the iterative and formative design activities described in the introduction to this chapter. As expected, the systems development method exposed design issues in attempting to achieve the conceptual support and interoperability necessary for participatory recordkeeping which, in turn led to refinements of the design artefacts. However, as described above, beyond the formative evaluation activities of the design process, lies the summative evaluations necessary to provide the "greatest rigour in the evaluation and hence the reliability of the knowledge developed" (Venable et al., 2016).

Strategies for the evaluation of design science outputs abound and are typically described in terms of typologies of choices between *naturalistic* and *artificial* approaches and between *Ex Ante* (before or during artefact creation) or *Ex Post* (instantiated) designs[39]. While these cate-

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[39]In fact, the Ex Ante/Ex Post terminology is ambiguous: some literature uses it in the context of instantiations (Pries-Heje, Baskerville, & Venable, 2008), while others consider its applicability to all design artefacts (Sonnenberg & vom Brocke, 2011).

gorisations may be deconstructed and/or combined in various ways (and with various episte-
mological and methodological assumptions) (Cleven et al., 2009; Sonnenberg & vom Brocke,
2012; Venable et al., 2012), the various permutations ultimately reflect the degree of interaction
with and between "real users, real problems, and real systems" (Sun & Kantor, 2006).

Note though, that rigid evaluation taxonomies of this sort can pose a problem for transfor-
mative designers in that it may be impractical to deal with actual users, complete systems, or
whole problems in the context of designing for a slice of a wicked problem. For example, Son-
nenberg and vom Brocke (2012) argue that, in the absence of a 'real' in-situ evaluation of an
information system, the best that can be achieved in an artificial setting is assurance of an arte-
fact's applicability — but, crucially, no assurance of its utility. Similarly Iivari (2015) argues that
"New innovative meta-artefacts follow the epistemology of utility rather than the epistemology
of truth", claiming that "real system implementation" is necessary for "new innovative design
principles"! On the other hand, Gleasure (2014) maintains that valid — and, more importantly,
useful — design science research can deliver "relevant and innovative contributions that pre-
empt significant industrial developments" even in the case where "instantiation and evaluation
is not feasible". Similarly, Heusinger (2013) and Carlsson, Henningsson, Hrastinski, and Keller
(2011) are critical of a perspective that insists on evaluation in practical settings as the only
means of justifying a design.

Nonetheless, despite where the boundary between artificial and naturalistic evaluation is drawn
in terms of the number and degree of the Sun and Kantor 'reals' they embody, both approaches
have their drawbacks. Naturalistic evaluation may be vulnerable to threats to instantiation
validity such as those identified by Lukyanenko, Evermann, and Parsons (2015). Such threats
include: a large implementation space (i.e. specific, even minor differences in user interface
design, for example, can have major effects on the perceived utility of instantiations); artefact
complexity (of 'real system' instantiations); and the confounding effect of emergent properties
of instantiations. On the other hand, artificial settings are, to some degree, 'distant' from
real-world contexts, and so may be vulnerable to disputes over applicability and generalisation
(Lukyanenko et al., 2015).

In my case, I needed to evaluate both broad conceptual artefacts (i.e the models) and a compar-
atively narrow instantiation (if compared to real-world recordkeeping systems). Evaluation of
the models in terms of their in-situ use informing real-world recordkeeping-related functional
analyses or schema design (Hofman, 2017, p. 639) was premature and logistically difficult given
the constraints of doctoral research. And, as I explained above, end-user evaluation of the in-

stantiation — even in a highly constrained artificial setting, let alone in situ — was impractical and subject to the confounding affects of instantiation validity threats. I found myself in the situation that Gleasure (2014) describes: having developed "genuinely novel artefacts" from a rich theorising and design process and that potentially represented significant contributions in their own right. How then to negotiate this epistemological quagmire and be able to make a claim of rigour and artefact utility?

I settled on a variety of summative evaluation activities in order to maximise the confidence in the utility of the artefacts (Pries-Heje et al., 2008) within the constraints of my doctoral research. They all concerned the real problems germane to participatory recordkeeping design; substituting peers and domain experts for real users where appropriate; and acknowledging that, while PaRIty exhibited novel characteristics that were not to be found in extant recordkeeping systems, it was not a real system per-se. These evaluation activities are summarised in Table 7.3. I hesitate to categorise them in terms of one of the published evaluation taxonomies as these are still contested. For example, Sonnenberg and vom Brocke (2012) would categorise my focus group walkthroughs as artificial, while Venable et al. (2012) would class them as naturalistic; Pries-Heje et al. (2008) uses the Ex Ante/Ex Post terms in the context of instantiations, while Sonnenberg and vom Brocke (2012) use it in relation to all design artefacts. In the end, I don't believe that such labelling necessarily adds value to the evaluation outcome, although one should remain aware of the implications for validity of particular evaluation techniques. As I have mentioned earlier, I do acknowledge that future research should take evaluation of these artefacts into in-situ settings for further validation; and I will discuss this further in Chapters 8 and 9.

Table 7.3: Evaluation activities.

Artefact	Techniques of Evaluation
Requirements	Articulation in Functional Model, Conceptual model, and expression in instantiation
Functional Model	Systems Development; Peer review; Domain expert walkthrough
Conceptual Model	Systems Development; Peer review; Schema mapping via the instantiation; Domain expert walkthrough
Instantiation	Domain expert demonstration and walkthrough

The use of the systems development method in the formative evaluation of the design has been covered above. Similarly, I have already discussed the requirements articulation and the role and impact of peer reviews in Part 2. In the following sections I will cover the role of the schema mapping and domain expert walkthrough evaluations in more detail.

7.2.1 Schema Mapping

Although I briefly discussed the schema mapping evaluation in the Chapter 6 article, I'll cover it in more detail here. This evaluation involved taking a number of different recordkeeping-related schemas as described in various standards or implemented in existing systems, and reproducing them as expressed in terms of subtypes of the meta-model elements. These schemas, listed in Chapter 6, are reproduced here in Table 7.4. This range included bibliographic schemas, those used for "retrospective description" within traditional archives (Eveleigh, 2015), those used for more general recordkeeping, and some others of academic or practical interest.

This schema mapping had a number of purposes. At first, a few simple schema definitions were used for testing during PaRIty system development to ensure that it was faithfully implementing the meta-model and subjecting domain schemas to the meta-model constraints. Once confidence in this functionality of the PaRIty system was established, then each schema in the set was mapped in a formative context using Parity in order to verify the meta-model itself. This was a three way exercise: changes in either the meta-model or PaRIty may have resulted in a change to the other, and either meant that all of the schema mapping would have to be revisited in order to re-verify the mapping in light of new learning as a kind of regression-test (G. J. Myers, Sandler, & Badgett, 2011, p. 147) evaluation. As both the meta-model and the PaRIty system achieved stability, the fact that all of the schemas could be expressed in terms of meta-model elements provided summative evidence of the efficacy of the meta-model in enabling the modelling of recordkeeping concerns.

Moreover, these mapped schemas were used to verify that PaRIty-based interoperability could be established between arbitrary domain schemas of the various types shown in Table 7.4: i.e. between bibliographic, archival, and general recordkeeping schemas. A brief example of such interoperability has already given in Chapter 6 and a further example is given in the section below as the scenario used for domain expert evaluation.

Table 7.4: Mapped schemas.

Type	Schema
Bibliographic	
	Dublin Core (with collections profile)
	The Europeana Data Model
Archival	
	The ICA Standards – ISAD-G, ISAAR (CPF), ISDF, ISDIAH (ICA)
	The ICA EGAD Records In Contexts model (RIC)
	The CNEDA (Spanish) metadata standard
Recordkeeping	
	The Australian Government Recordkeeping Metadata Standard (AGRkMS)
	The Australian Trade Union Archive (ATUA) schema (interesting because of Performance entity types such as Industrial action and Strike currently modelled as Australian Series System functions)
	The Finnish Conceptual Model for Archival Description
	The State Records NSW (SRNSW) Archives Investigator schema (interesting due to unique Ministry and Portfolio entity types)
Other	
	The ABC Harmony ontology (an Australian attempt to harmonise cultural heritage metadata schemas and an early adopter of Event entities)
	The W3 Provenance Ontology (PROV-DM)

Finally, this successful mapping meant that the meta-model was backward compatible with existing practice. As was discussed in Chapter 4, the acceptance of new paradigms is dependent on the ability to provide concrete implementations that demonstrate transitional paths between conceptual stages. The PaRIty system is an example of such implementation. Given that legacy schemas can be implemented in PaRIty, an automated approach could be used to present existing recordkeeping documentation within a third-stage, interoperable network. I address the nature and implications of such an automated approach in more detail in Chapter 8.

(a)

(b)

(c)
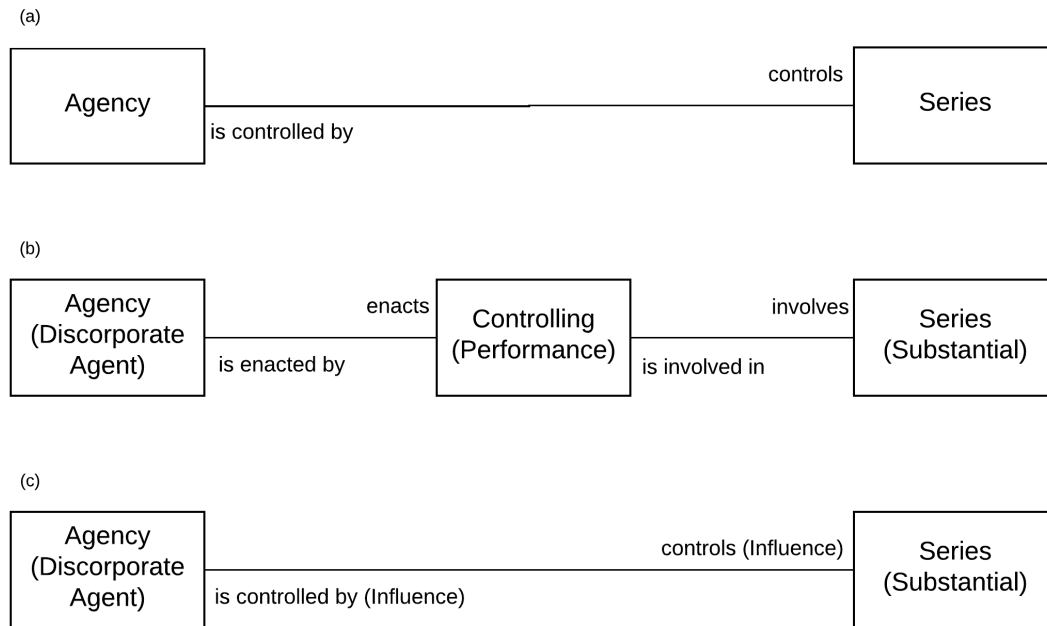
Figure 7.19: Example of schema mapping

As mentioned above, as the meta-model matured the mappings were iteratively bre-visited to ensure compatibility and this often resulted in greater alignment and simpler mapped schemas. For example, mapping schemas to early versions of the meta-model often necessitated the creation of complex relationship structures that included intermediate performance entities. An example of this is shown in Figure 7.19. In this example, the construct *Agency Controls Series* (Figure 7.19 a) needed to be mapped using intermediate *Controlling* Performance entity (Figure 7.19 b) as there was no direct allowable meta-model relationship that expressed this construct. Increasing the complexity of mapped schemas in this way impacted the utility of the meta-model by requiring additional effort to create and maintain commonly used recordkeeping constructs — with the attendant negative consequences discussed in Chapter 4. Similarly, by requiring the creation of additional entities and relationships in order to express otherwise simple constructs, such mapping was inherently manual in nature, requiring human intervention in the otherwise automatic adaptation of existing recordkeeping documentation for exploration in the PaRIty system.

However, once the set of *Association* relationships was added to the meta model, as described in Chapter 6, this construct could be directly mapped as an *Influence* Association relationship (Figure 7.19 c). A couple of other anomalies that I identified with the mapping process are also worth mentioning. For example, the separation in the meta-model between Corporeal and Discorporate agents is one that is not found in any contemporary schema or system. This didn't

prove to be much of a problem, but is something that would need to be taken into account if migrating documentation to a meta-model schema. While mapping People and Organisational elements is straightforward, it is possible that the mapping of delegates (e.g. software systems) may require more detailed consideration and/or manual processing. Similarly, the References Association relationship is important when an entity (typically a person) is associated with a record. In this case, the References relationship suffices. However, in the case of bibliographic schemas, the concept of a *subject* maps to almost every kind of entity in the schema. So while the References relationship can be used to map bibliographic resources to subjects, the separation of subjects into the various entity types could turn out to be a non-trivial task.

Nonetheless, in general, as the model increased in power, the level of manual intervention needed to interpret and map domain schemas decreased, improving the prognosis for backward compatibility described above. I discuss the implications of this mapping further in Chapter 8.

7.2.2 Domain expert walkthroughs

As described in the Scope section above, my approach to summative evaluation necessarily changed from end-user usability testing to more narrowly focussed walkthroughs of the design and instantiation with domain experts. One way of explaining the difference in focus and emphasis between these approaches is via the taxonomy of *Fit* described by Davern (2007) and shown in Figure 7.20. The original plan for the evaluation of the design through the instantiation was to have been through the perceptions of end users. From this perspective, what I was interested in is the *Tool-Reality fit* (i.e. the ability of a participatory recordkeeping system to accord with users' experiences and expectations of recordkeeping) and, indirectly, the *User-Representation fit* (i.e. the ability of the design to express the users' "world being documented" as described by Bearman (1992)). Of course, as described above, one of the risks in such an evaluation is that these aspects of fit are easily swamped by issues with *User-Tool fit* (i.e. HCI concerns) (Lukyanenko et al., 2015) and the sociomateriality of usability (Riemer & Vehring, 2010).

On the other hand, the walkthroughs were more suited to domain expert scrutiny of *Representation-Reality* fit (i.e. how well the design supports the requirements of participatory recordkeeping) and, perhaps, *Tool Representation* fit as a measure of the implementability of the design and the construction of an interoperable network of participatory recordkeeping systems. While my choice of this approach was appropriate for the revised scope of the system under evaluation, I remain cognisant of its limitations described earlier, as well as the delay in confronting usability and other technical questions (Boehm, 1984) until further research can be performed. These
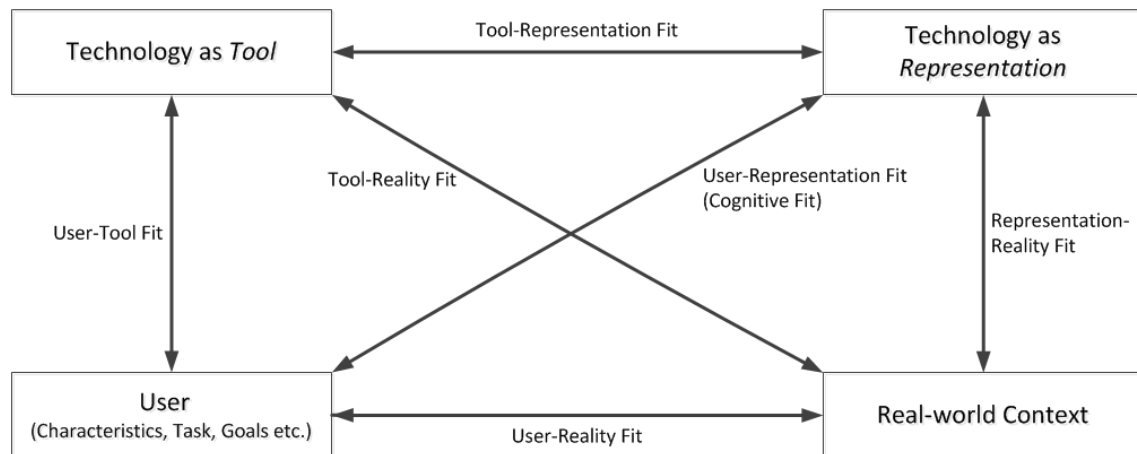
Figure 7.20: Taxonomy of fit (from Davern, 2007)

limitations are similar to the ones I identified in Chapter 4 requirements elicitation. The approach I took with domain expert walkthroughs, while valuable, is nonetheless some 'distance' from actual system participants and so there remains the possibility that some issues in my design went undetected. I discuss evaluation issues in more detail below and in Chapter 8; and identify the need for future work to address these in Chapter 9.

Methodological approach

The use of walkthroughs as a means of evaluating information systems is a well established practice (Boehm, 1984; Desurvire, Kondziela, & Atwood, 1992; Nielsen, 1992) and one that has been used to investigate metadata (J. Evans, Manaszewicz, & Xie, 2009) and recordkeeping (Gilliland et al., 2006; Lehane, 2012) systems design. Similarly, one form of walkthrough — the focus group — is well established as a means by which qualitative data can be gathered in a group setting. The group context is important as it "benefits from the interaction among participants, which can reveal shared ideas, reactions, and opinions on the topic of the study" (Belanger, 2012).

The use of walkthroughs in a focus group setting has also been established as a technique for design science evaluation (Janzen, Kowatsch, & Maass, 2010; Lukyanenko et al., 2015; Venable et al., 2012). Tremblay et al. (2010), in particular, note that focus group reviews can be used in both exploratory (i.e. formative) and confirmatory (i.e. summative) contexts, with the latter used to "demonstrate the utility of the design". In agreement with Belanger (2012), they argue that one benefit of the focus group approach is that the direct interaction between participants in a group setting may lead to "the emergence of ideas or opinions that are not usually uncovered in individual interviews".

The tone of the walkthrough focus groups that I conducted took a similar conversational approach as the requirements elicitation interviews described in Chapter 4. However the mechanics of the walkthroughs differed in that they were structured to ensure that the conversations remained focussed on the evaluation of the design artefacts. Additionally the explication of the design via the instantiation meant that a particular modelling scenario was used to guide the evaluation and expose all of the salient features of the design as well as its expression as affordances of the instantiation. Following the route suggested by Tremblay et al. (2010), a 'script' was followed that introduced the motivation behind the design; explained the details of the models; described the scenario to be explored; and walked through the concrete scenario example using the instantiation. The evaluation instrument containing the open questions used in the focus groups is shown in Appendix A.

Choice of participants

As with the domain expert interviews that I had previously conducted for requirements-elicitation, I decided to engage with domain experts from a variety of backgrounds. Following a pilot focus group of mainly doctoral students currently performing recordkeeping research, I conducted a total of three focus group sessions and two individual semi-structured interviews as shown in Table 7.5.

The three focus groups were held in Australia: in Melbourne, Sydney and Brisbane. The participants were drawn from a variety of practitioner contexts and roles, from records management through to traditional archiving. Many of the participants were also concerned with the ongoing development of recordkeeping theory and practice, for example through association with the Records Continuum Research Group[40]. These Australian participants were selected as they are familiar with the Stage-2 conceptualisations associated with contemporary implementations of the Australian Series System. As domain experts in such conceptualisations — including an appreciation of the limitations of Stage-2 with respect to supporting interoperability and participatory recordkeeping — they were well placed to perform a constructive evaluation of my Stage-3 design artefacts.

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[40]The Records Continuum Research Group is an informal collective of practitioners, academics and other individuals interested in the development and dissemination of records-continuum related theory, practice, research, and education. See www.recordscontinuum.info for more information.

Table 7.5: Walkthrough participants.

Type	Description
Focus Group	
	University of Melbourne, eScholarship Research Centre: Rachel Tropea; Cate O'Neill; Elizabeth Daniels; Annelie de Villiers; Nicola Laurent; Jack Roberts
	City of Sydney, Records and Information Management: Kate Cumming, Michael Smith, Cathy Boyd; State Records NSW: Richard Lehane
	Queensland State Archives: Digital Archives Program: Adrian Cunningham, Rosemary Dixon-Ward, Marcus Burke, David Bromage; Government Recordkeeping: Troy Pullen, Andrea Metcalf
Individual	
	Daniel Pitti: Associate Director, Institute for Advanced Technology in the Humanities, University of Virginia; Chair ICA Expert Group on Archival Description; Project Director Social network and Archival Context project (SNAC); chief technical architect of EAD and EAC-CPF encoding standards
	Mark Matienzo: Director of Technology, Digital Public Library of America

In addition to the Australian focus groups, I conducted several individual walkthroughs while in the U.S.A.. As well as widening the jurisdictional scope of the evaluations to include a North American perspective, I wanted to include some individuals with specific skills in interoperability and conceptual modelling. The two participants that I ended up interviewing (as organising a focus group in this instance proved to be too difficult) both had deep expertise in this area as shown in Table 7.5. Note though that due to timing and technical issues, I was not able to perform a demonstration of PaRIty during these interviews, instead focussing on a detailed walkthough of the models.

Walkthrough scenario

Shifting from an end-user to a domain expert evaluation had the side-effect of reducing the like-lihood of the walkthroughs being confounded by extraneous user interface issues of the type described by Lukyanenko et al. (2015). Nonetheless, when creating the walkthrough scenario, I was concerned with avoiding similar confounding affects of subject matter affect or expertise
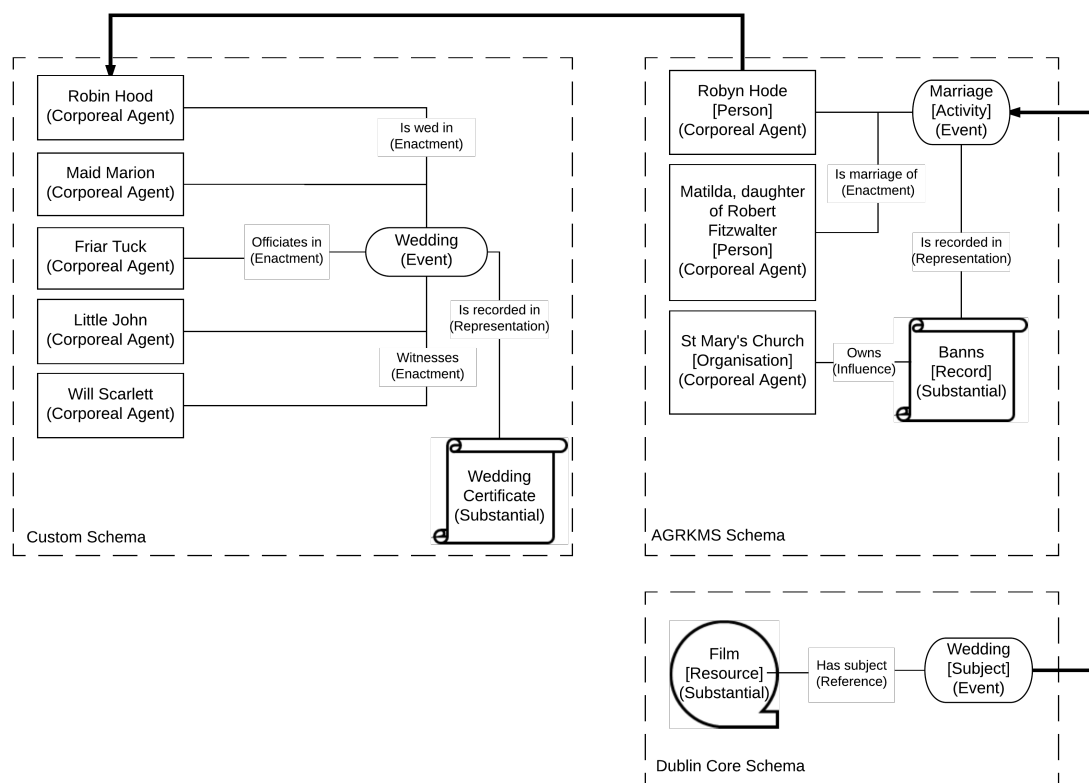
Figure 7.21: Scenario used for walkthrough evaluation (Fig. E.31)

that could possibly surface during the sessions. I therefore sought a scenario that was both emotionally neutral and one that was not likely to fall within any organisation's or individual expertise. I eventually settled on a mythical set of records and documentation concerning the marriage of Robin Hood to Maid Marion in Ye Olde Merrie England; and created the three recordkeeping schemas shown in Figure 7.21: one based on an Australian Government Record-keeping Metadata Standard mapping, one based on a Dublin Core mapping, and a custom schema based on 'pure' meta-model constructs.

I introduced the scenario, with the three schemas running on separate PaRIty instances. The custom schema described all of the participants in the Wedding, that is evidenced by a Wedding Certificate. The AGRKMS schema only documented the spouses wedded in a Marriage that is evidenced by the Banns notice, in turn, 'owned' by the Church in question. Lastly, the Dublin Core schema described a film that depicted the wedding[41]. I explained the structures of the schemas and stepped through the recordkeeping documentation stored in each instance. I then demonstrated the use of the discovery interface to locate the various elements in the schemas across the systems. For example, searching for 'Robin Hood' returned elements in the custom schema,; searches for 'Robyn Hode' returned AGRKMS elements etc. I used these steps to

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[41]The 1922 movie Robin Hood starring Douglas Fairbanks. See https://www.youtube.com/watch?v=nlZcQ5t0m1k.

prompt discussion around some of the PaRIty interoperability features such as its API.

I then demonstrated the interoperability between disparate schemas via the creation of several Manifestation links between the schemas as shown in Figure 7.21. I created these links using the PaRIty drag'n'drop facilities described above and used this linking as an opportunity to re-visit the meta-model with the participants and to discuss schema mapping in a more concrete way. The custom 'Robin Hood' entity was identified as a manifestation of the AGRKMS 'Robyn Hode' entity. Similarly the AGRKMS 'Marriage' entity was identified as a manifestation of the Dublin Core Wedding subject. The discovery interface was then used again to locate records associated with various elements. However, with the Manifestation links in place, a search for 'Robin Hood' not only returned the custom schema elements, but the documentation from other schemas — e.g. the 'Robyn Hode' details, the Banns record etc. I used this example, to discuss the interoperability between disparate schemas. Finally I showed the audit logs as an example of the capturing of 'recordkeeping business' documentation using the meta-model.

Findings

Each of the walkthroughs was audio-recorded and subsequently transcribed. Similar to the literature warrant analysis described in Chapter 4, I used the QSR NVivo11 application to apply a lightweight coding or indexing to the transcriptions (Bertrand et al., 1992; Stewart, Shamdasani, & Rook, 2011) in order to "throw light on substantive issues" (Frankland & Bloor, 2011) arising from the walkthroughs. The codes emerged somewhat more organically than those used for literature warrant analysis described in Chapter 4. The analysis codes are shown in Table 7.6. Along with some obvious observations, for example, support or scepticism of the models, other codes reflected the articulation of issues reported in Chapter 4, for example, those relating to perceived barriers to adoption. Coding of the transcripts proceeded iteratively with earlier coding revisited in the light of newer, emergent codes (Frankland & Bloor, 2011).

The power of the focus group derives from the "candour and spontaneity" of a group setting that leads to increased validity. However this validity is also subject to the threats of (self-) censoring and conforming that may occur in such social contexts (Carey & Smith, 1994, p.124). Similarly, an individual's comments are likely to be uttered within the context of the ongoing group conversation that may well involve over-talking one-another or finishing others' sentences. For these reasons I have attempted to capture dissenting views within groups as well as those that may be at odds with my conceptualisations. I have also attributed the quotations below to the group session where applicable and not to any particular individual.

Table 7.6: Evaluation focus group analysis codes.

Code (Sub-codes)
Authority & Trust
Diagnostic Reference Model
Instantiation (as pedagogical tool)
Linking
Overhead
Recordkeeping business
Rights
Tracing & History
Transformative design
Transition
Unanswered questions
Validation of conceptual model (Counter view, Association Relationships)
Validation of functional model (Counter view)

Participatory Recordkeeping and the Functional Model

The first part of each walkthrough involved me briefly explaining the rationale for, and requirements of, participatory recordkeeping, followed by an overview of the functional model. By and large there was an understanding of the necessity for participatory approaches to recordkeeping and support for my functional model in determining the recordkeeping needs of different types of participants.

> "Just the fact that you've managed to identify the massive problem with existing systems is a huge contribution and it shows why these practical applications that we'd like to see aren't happening." (eSRC)

"What we want to do is give people a voice in things and to give them... if they can't control it, they can influence it. It's an ethical shift is what it is. And it's particularly important... well it's important in a wide variety of areas." (Daniel)

"I love this, because this is the model that we operate in. I have people tell me all the time, when I'm saying 'you've got to keep your records like this', 'I don't want to, that's my record I think I should be doing this with it'. So yeah it's such a useful looking model." (Sydney)

One participant, in particular, was very taken by the potential to formalise annotations as part of recordkeeping, and the intersection of this with web-based annotation frameworks.

"One possibility would be to model any additions as an annotation, and the other would be to essentially model everything as an annotation. Conceptually, the value of that from the perspective of the work going on in the open annotation collaboration, is the conceptual understanding that there's almost this spatial aspect to an annotation that can be separated from one another" (Mark)

And yet there was some ambivalence here; seeing a need to temper the basic tenets of participatory approaches in favour of the authoritative voice of the archive.

"Archivists as professionals may become more editors than authors. Which is to say that multiple voices are commenting on someone, but you do have someone with editorial oversight and control of the whole thing or to monitor quality and such." (Daniel)

"...the immediate response from the [business unit] was 'that's our corporate information, we can't release that'. Well, it's not. [And yet,] even for me there's a... some community group telling me how we should keep archives. I know how I want to keep archives (laughs)." (Sydney)

One possible interpretation of this is that an emancipatory notion of participatory recordkeeping faces the sort of issues with entrenchment of conceptualisations in professionals identified in Chapter 4.

"There's quite a huge cultural shift in this. And I don't think it's just amongst recordkeepers but it's amongst other people in organisations as well." (Sydney)

The Meta-model

The next part of the walkthrough involved stepping through the meta-model and explaining its elements — particularly in terms of its departures from existing metadata models and standards. Again there was consistent support for the flexibility of the meta-model conceptual approach, and its recognition of participants in records.

> "The foundational question is: [...] is there an agreement about the nature of these things as existing things. So, I get the sense that there is, or the meta-model is abstract enough to allow it. [Secondly,] how do you best define relationships or relations between those entities if there's a lack of agreement about some sort of fundamental aspect of their existence? [...] So if there's a conflicting viewpoint [...] I think there's the space for that in that model but this is sort of like the space of reconciliation [that] becomes a little more challenging." (Mark)

> "...we have so many issues with some of our [data], that I could see that model would resolve — I know not everything — but there's just little things that I think just... ah we keep kind of going round in circles because we can't do what we need to do with [our current system]." (eSRC)

> "...there's things that happen and then [...] there will be evidence that's produced when these things are happening. That evidence can be interpreted in a variety of ways." (Daniel)

> "Well-related data empowers the use of the information that's supported. And that sort of framework is going to empower the use of all of that data." (QSA)

> "For me the most significant thing about this is that it doesn't preference or give authority to one over the other." (eSRC)

There was also understanding and support of various meta-model elements, particularly the emphasis on the documentation of activities and their relationships with agents. Again, this supports a Stage-3 perspective understanding of recordkeeping.

> "...even with something as basic as a role or a position within an organisation is not reflected in the Australian Series System; and the same for Event..." (Sydney)

> "It's just the metadata documenting whatever the activity is. That is documenting the record. Sometimes I look at the physical manifestation, but often it will just be this." (Sydney)

"I like 'Involvement' as the first one, and 'Enactment' too because Enact sounds active... the act of doing something; it's intentional and involved. [...] I write you an email message. I send it to you. You receive it. [...] You are an agent in the composition of that because it would not exist except for the fact that both of us exist and I send you an email as such." (Daniel)

"The event orientation of this is something I like and something I've always thought in a lot [about in] our metadata and archival description standards. [...] But the events themselves are often absent from our models. They're inferred but not there explicitly. So one of the things that I like about it is that the event is there in that big box called performance. So I think that's potentially very interesting." (QSA)

Some participants from the Sydney focus group also identified the meta-model as one that could be used as a reference model (Hofman, 2017, p. 639) to inform appraisal or to perform retrospective analysis of existing systems:

"And that should make appraisal easier too, because you're actually looking at it from that perspective of events and activities" (Sydney)

"I think the potential of this sort of model is that it also identifies where you don't have a record. So here you've got this event or activity or whatever - why don't we have any record?" (Sydney)

Most of the participants felt that existing notions of record-ness were too limiting and appreciated the introduction of the Representation relationship.

"What I find exciting [...] the entities aren't defined by their attributes they are defined by the relationships and that is what makes them so flexible I think. And that's why you can have someone saying this is a series, no this is an item because it's not defined by some transient definition of what a series is. It's defined by the way it interacts with the other elements." (eSRC)

"Most of the definitions of 'Record' I found didn't define 'Record' as such a thing, they defined it in some strange roundabout way. And they placed constraints on being a record or not a record that had to do with its evaluation — how it was appraised and how it was kept. And I booted all that out the window because I said, well, whatever we end up... in the filing cabinet that I need to deal with, whether it was intentionally kept or accidentally kept, doesn't matter; and it's evidence regardless." (Daniel)

> "I love the fact that there is no record in it because one of the issues that we confront just day in day out is just this fixed notion in people's heads what a record is and we continually find ourselves managing the wrong thing or failing to adequately explain to people what it is that we should be managing." (Sydney)

However, there were some misgivings regarding the implications of abandoning Record as a first-class entity within the model, and, in particular, the implications for interoperability between multiple perspectives.

> "Well that's abstracting it pretty far... [...] What is the trace? What is the substantive thing that remains behind? I mean, I don't see the word record here." (Daniel)

> "That scares me. Just the lack of curation, the lack of, the chaos, the wacky... yeah. Just thinking of things like you know when you're in ancestry.com and you get all those tips like, you know, this person might be related to you and suddenly there's this whole network of errors." (eSRC)

Similarly, while most felt comfortable with the inclusion of Performative records, a few expressed problems with this idea from an archive perspective.

> "Thinking about, for example, what is the record and, I think, very wisely it can be this substantial entity which is manifested as a physical piece of paper or a series of magnetic fluctuations on media or what have you; or a performance." (Mark)

> "Though it would have to be captured in order to become a record [...] The members of EGAD are rather adamant about this. If it doesn't persist in some recoverable form, it's not a record." (Daniel)

This second, archive perspective is at odds with a more nuanced and holistic understanding of recordkeeping. Having said that, while the model opens the door for a recordkeeping documentation system that refers to performative records, this is far outside the realms of traditional archive practice, for example, as described by Duranti (1996).

As discussed in Chapter 4, the perennial issue of the overhead of complex documentation creation was raised in a couple of the sessions, however the role of technology was also recognised as providing potential assistance in this area.

> "You should also be wary of Events — not that they're intellectually incorrect — but the uptake of them is such because they do create more overhead." (Daniel)

> "I mean the whole issue of interoperability and the steeper the climb is — the more you have to know in order to create all the data, and the more work you have to do to create the data — is that you get a diminishing quality at a certain point. So there is an argument to be made if you can get a whole bunch of people to do a few simple things and do them consistently and well you will advance the cause." (Daniel)

> "Because, as much as we always say about metadata, the more metadata you provide, the richer the context etcetera. But in the front-line [it's all about workflow]" (QSA)

> "But also the challenge, the social side of it challenge, can be ameliorated by the technology." (Daniel)

For the most part, most participants saw that the creation of more comprehensive recordkeeping documentation would address more issues that any added richness would cause.

Interoperability and Linking

A number of respondents appreciated the ability of the model to provide semantic linking between disparate domain schemas.

> "Actually, what I really like about it is the idea that you can have these domain specific languages for recordkeeping. And that the, perhaps the gain of greatest utility wouldn't be to link like big organisational systems together [...] but actually within the [Organisation's] different business units with their own recordkeeping ontologies [...] That's where I'd attack. It's that kind of integration." (Sydney)

> "People have trouble wrapping their heads around that, but it is. I've put it as it's one, vast global social document network connecting the past into the present, leading into the future. So it's all global and it has been." (Daniel)

> "So, I'm interested in something like this and especially through the application of something like a REST API as a way to introduce linked data in the context of archives in a slightly less politicised [way]." (Mark)

> "An obvious use-case for this is linking up the discovery systems of the various government archives that use the series system. For example, Queensland once upon a time was part of New South Wales [...] Functions have moved around between state and commonwealth governments so there's obvious connections there." (QSA)

Of course, the linking itself is an implementation issue and not part of the meta-model, but the interoperability suggested by the meta-model, prompted discussion about the nature of linking. A number of participants expressed reservations about the transience of links and the inherent mutability of linked data in an open world model. In these cases there was some discussion about ameliorating such issues either by the use of simple time-stamps on links (to help pinpoint, at least, when something had changed) up to more sophisticated mechanisms such as the Memento protocol[42].

> "I'm unsure how it would really work in practice [as] people do change URLs and they don't care because they don't think about it. So the relationships would get broken and things would get lost and how would you know that that was once there and now it's not." (eSRC)

> "It is mutable? Are those entities...? If you made a link to my system, and I perversely decided to just rename that entity and give it a new purpose in life. It's a version control thing - whether you point to an ID or whether you point to a kind of a hash of that object. Like that new internet protocol that uses a hash of the content rather than an ID." (Sydney)

This issue of deterministic documentation in an open and interlinked paradigm is significant and one to which I will return in the Chapter 8 discussion.

Authority and Trust

Some participants were concerned about the shift from a closed world paradigm of 'trusted' information silos to a distributed open world paradigm.

> "I think that would be, like more context or information about these systems [...] that you can go to say: I want something authoritative or whatever, and it shows you which systems you should search." (eSRC)

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[42]The intention of the Memento protocol is to facilitate the access of a version of a web resource as it existed at some date in the past. See http://mementoweb.org/about.

"I think I'm much more hung up on ideas of authority and just scholarly... its trust really." (eSRC)

"How to you as an external user know that these different systems exist? [...] I'm just thinking of the use case where you've got a user who thinks 'Something has got to be out there somewhere that's going to help me with my need but I've got no idea where'. I've got this neat discovery engine, I'll use that." But you've got to know where to point the discovery engine and you don't know where to point it to." (QSA)

"And there is a missing piece in there too which is also the issue of certainty. The certainty with which you've established it really exists or not." (Daniel)

Perhaps provenance becomes more about the evidence of recordkeeping business itself; for example, an audit log of documentation changes. To this end, a number of participants appreciated the ability of the meta-model to self-host such recordkeeping-business documentation as described in Chapter 6.

"Or look at the edit history. If you really want to try and decide, where all these sources have come from." (eSRC)

"So using this meta model to document the activity of archives is that essentially should be the goal of our description; the products of our description as a result of our business processes. If we want to do all these things like provide better insight into our activities, we need to think about documenting them in a different way. Maybe that means a difference of practice; maybe that means a difference in systems; maybe that means a difference in standards. But what we have is not fit for purpose. We can put in a series of stop-gap measures to improve that but there's not really a great answer in the meantime." (Mark)

Instantiation

While there was obvious agreement and discussion regarding my presentation of the two models, the discussions really opened up when I presented the PaRITY scenario. All of the focus group participants recognised and appreciated the role of the instantiation as the kind of pedagogical tool described in Chapter 4 that explicates a new conceptual paradigm.

"I think it helps us because before, it was all quite theoretical and people struggled to understand that; and now you've got something that you can show to support that it can be done and that's really important." (eSRC)

"I like how easy it is to understand and how un-complicated it is. [...] Because
I've seen a lot of systems where it is just so complicated; very cumbersome; very
hard to try and maneuver from system to another just to find just the simplest of
records." (Sydney)

"So I'm a very practical person, so I'd love to actually have a go at putting our stuff
in." (eSRC)

From a methodological perspective, most participants understood the role of the proof-of-
concept system in facilitating evaluation of the design. However, as expected (Gordon & Bie-
man, 1995), others pressed to have access to the PaRIty code to explore further. For me, this
highlights the efficacy of the instantiation as participants saw this as a useful tool that prompted
further examination.

"For you the most important bit is your model, is that right? Rather than [the
instantiation]?" (eSRC)

You don't happen to have this on GitHub do you? You Do? Oh, we might have a
play with this (laughter)." (QSA)

Moreover, several participants identified PaRIty as demonstrating the practicability of transi-
tional tools to aid in the movement of data from legacy systems and paradigms to newer ones,
in effect, moving between conceptual stages.

"And it seems fairly... it doesn't seem all that onerous just to, if you wanted to
create a different type of relationship to create a stub in your system." (Sydney)

"That gives you that transition too. The transition from the existing data into the
new world. So that the existing data doesn't have to be re-worked completely to
be utilised in that empowered group of data that they can use for reporting and
knowledge." (QSA)

<div align="center">* * *</div>

These walkthrough results confirm that this design not only addresses gaps in existing record-
keeping standards and systems, but presents a useful and practical solution to the issues of par-
ticipatory recordkeeping. Of course there were some misgivings about particular aspects from
individual focus-group participants and, indeed, some of the issues raised are areas that require
further research — for example, how to resolve issues of authority and trust in a distributed
paradigm, or how to design practical workflow systems based on the meta-model. I will return

to these in the Chapter 8 discussion.

> "The description standards that we have in place don't actually allow us to do that. They don't allow us to, you know, either in a machine-readable or a human-readable way. Archival description requires a lot of interpretation and nuance, rather than looking at [an] inherent structure that can be easily re-purposed or perused." (Mark)

> "But that's the thing, what you've proven is that it's technically and theoretically completely possible and what's in the way is the systemic way of thinking and entrenched ideas and whatever." (eSRC)

> "It's, I guess, as with any model, the acid test is what extent does it get accepted and the level of uptake in the profession and community and the extent to which it can be reflected in standardisation efforts of one kind or another." (QSA)

However, it is safe to say that this focus group exercise was a successful summative evaluation of the design that complements and reinforces the findings of the other evaluation activities.

Conclusion

In this chapter I have presented the proof-of-concept instantiation, the development of which not only formed an integral part of the design process itself, but also served to demonstrate the implementability of the design and as a vehicle for its explication and evaluation (Offermann, Blom, Schönherr, & Bub, 2010). The methodology-relationships diagram that has been developed throughout the last four chapters can now be completed, showing the round-trip of recordkeeping conceptualisation in design science: from kernel theories, though design and evaluation, and back to the body of knowledge that may be enhanced through new design knowledge, confirmed and situated by the evaluation activities. This is depicted in Figure 7.22, where the evaluation activities (publication peer reviews, laboratory testing, and domain expert reviews) served to validate the design as well as situate it within the existing body of recordkeeping knowledge (Kuechler & Vaishnavi, 2008).

The PaRIty system instantiation demonstrated the implementability of the conceptual model and its ability to support the constructs required by the requirements and functional model in an interoperable manner. Moreover, the interrelationships and the interdependencies of the design artefacts mean that the successful evaluations provide evidence of the efficacy of the whole design in terms of its implementability and utility.

Kernel Theories (Recordkeeping, Modelling, Ontology, Data Design)

Empirical Data (Literature, Interviews, and Existing Systems)

Situates learning

Contributes

Evaluation

Meta-Requirements

Addresses

Design Artefacts

Publication Peer Review

Functional Model

Addresses

Supports

Conceptual Model

Publication Peer Review

Demonstrates implementability

Domain Expert Review

Communicates

Proof-of-concept Instantiation

Laboratory testing

Figure 7.22: Complete relationships between design outputs and activities

In doing so, the development of the PaRIty instantiation and its subsequent successful evalua-
tion address my second research question posed in Chapter 1:

2) *Can infrastructural and participatory approaches to recordkeeping be addressed through trans-*
formative design?

The support of the requirements documented in Chapter 4 within a concrete instantiation
means that the requirements themselves are consistent and addressable. The subsequent valida-
tion of my design in the evaluation focus groups suggests that the set of requirements are a valid
articulation of participatory recordkeeping; addressing my fourth research sub-question:

iv. *To what extent can the detailed requirements and goals for such a system design be articulated?*

Similarly, while previous chapters established that models could be created that embody these
requirements, the evaluations demonstrated that they were efficacious and useful. In this way,
I have addressed my fifth research sub-question to confirm that such a design is feasible and
useful.

v. *Can conceptual and other models be developed that express the characteristics and affordances*
of a meta-solution?

Although not a complete recordkeeping system, the PaRIty instantiation demonstrated that the
design is implementable and, in doing so, addresses my sixth research sub-question about the
implementability of the design.

vi. *Can such a design be implemented?*

Finally, the instantiation demonstrated that the core requirements of participatory recordkeep-
ing, including the interoperability of multiple schemas, the documentation of pluralistic prove-
nance, and the ability to recursively model recordkeeping business. This is important too in
terms of the pedagogical value of model instantiation as described in Chapter 4. Thus the
PaRIty system and evaluations also address my seventh research sub-question:

vii. *How well can such an implementation fit the requirements for participatory recordkeeping*
design?

Nonetheless, there is further research to be performed on the design in areas that I have been
unable to address, and I discuss these further in Chapter 9. But first I need to discuss the
findings of my research in terms of recordkeeping theory and practice, as well as the design
science research methodology itself, which I will do in Chapter 8.
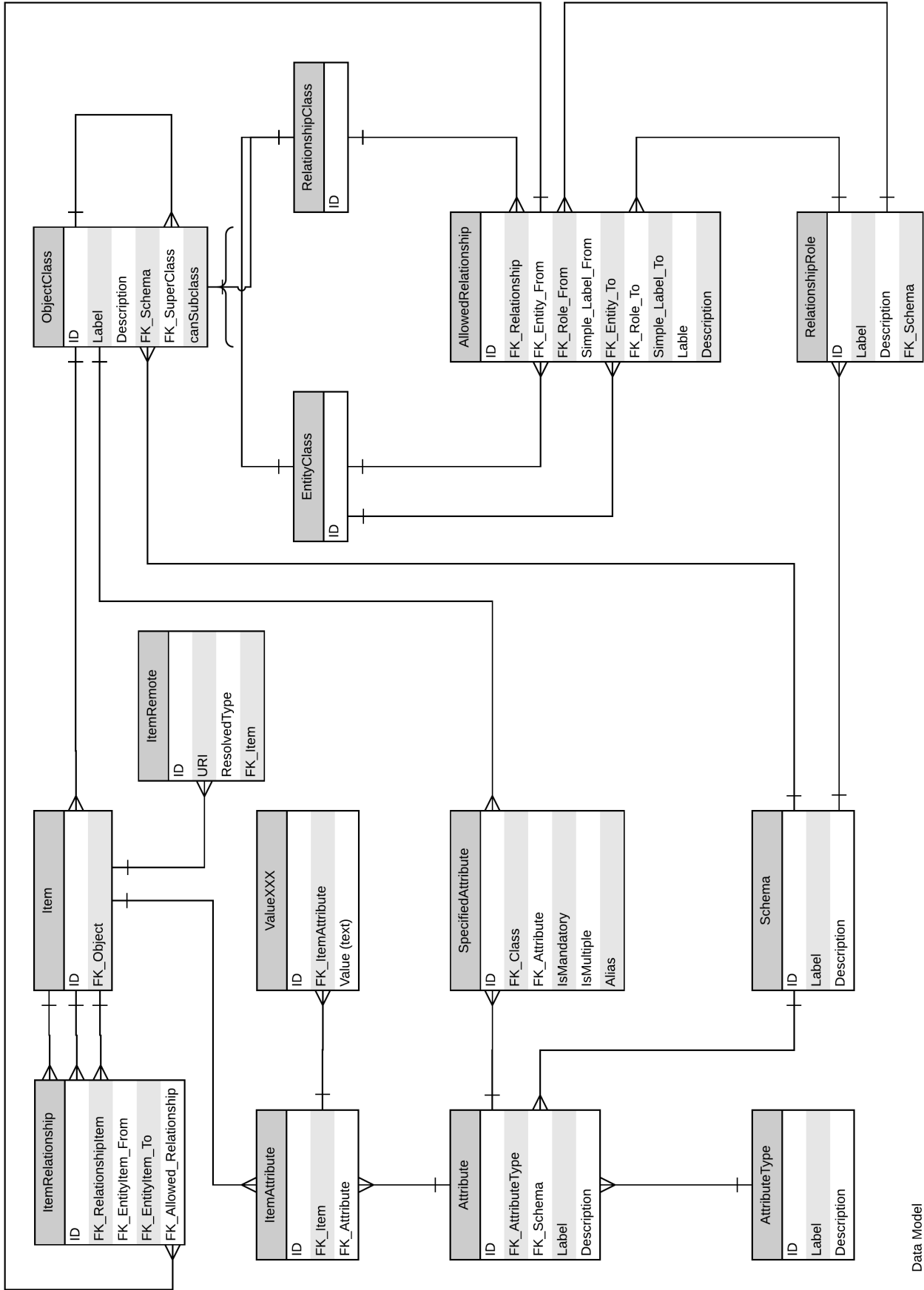
Figure 7.23: PaRIty EAV-CR model

Chapter 8: Discussion

> *In theory, there is no difference between theory and practice. But, in practice, there is.*
>
> <div align="right">Attributed to Jan L. A. van de Snepscheut</div>

In Part 1, I characterised my research approach as one based on a critical interventionist episte-mology, imbued with a "creative spirit of design" (Wastell et al., 2009), in order to address the challenges in participatory recordkeeping. To that end I developed a number of design artefacts described in Part 2 and conducted evaluations to verify their fitness for that purpose as discussed in Chapter 7. Having discussed my design artefacts "that are both object and result of research" (Offermann et al., 2010) in the preceding chapters, I will describe their implications and the broader findings from my research.

Beyond its role as a practice for (meta-) problem solving, the power of design science research derives from its hermeneutic relationship with both design and kernel theories (Kuechler & Vaishnavi, 2008). Not only can design science research lead to prescriptive or design theories, but it can serve to inform kernel theories as well, as shown in the previous chapter's 'artefact relationships' Figure 7.22. Thus, in terms of Gregor's (2006) taxonomy of IS theory, design science research can result in new or refined theories for analysis, explanation, and prediction (types I, II, III, and IV), as well as theories for design and action (type V).

In the case of my research, by unpacking and examining the structures and assumptions of recordkeeping in order to improve its design, I gained insight into both the recordkeeping and archive perspectives. Through the design process I exposed and clarified some of the complex issues described in Chapter 3 and, by designing interoperable infrastructure for participatory recordkeeping, arrived at understandings of theoretical positioning and practice that need to

change in order that such issues can be addressed.

Consequently, in this chapter I will step back a little from the detail of the design and discuss the findings from this research in terms of contributions to theory and practice; and for building and setting standards for recordkeeping systems. In doing so, I address the third research question that I posed in Chapter 1, by specifically considering its three sub-questions:

3) *In what ways does my design impact:*

   viii. *mainstream theories of records, archives, and recordkeeping?*

    ix. *professional practice?*

     x. *transitioning to a participatory paradigm?*

In addition, I will make some comments regarding my experience in using the design science methodology for investigating such transformational design that led to my emergent fourth research question:

4) *How should design science be conducted when addressing a slice of a wicked problem?*

As will be seen below, along with providing a number of theoretical and practical insights, this research has also raised several questions which will require further investigation.

8.1 Theoretical contributions

It should not be unexpected that a design that started from a recordkeeping perspective vindicates such an approach. Nevertheless, this design, grounded in a broad range of literature and subsequently validated via the evaluation activities, is further evidence for the veracity of a pluralistic understanding of recordkeeping. As described above, my research is a completion of a circle: taking the pluralistic recordkeeping approach from a theoretical proposition through to an instantiated design that, in turn, supports and extends the original theory.

My design articulates the rationale, and a mechanism, for differential and granular access and utility for participants in records. Additionally, my findings, in term of recordkeeping theory, include:

- The three-stage taxonomy of recordkeeping conceptualisation maturity described in Chapter 4 (artefact, artefact-actor, and activity oriented conceptualisations);
- The Meta-model for Participatory Recordkeeping as a pluralist ontology for recordkeeping in the continuum — as introduced in Chapter 6;
- The successful modelling and systemisation of record-ness as a manifestation of relationships, rather than as an attribute of an artefact;

- A performative epistemology of recordkeeping that repudiates the one-time intellectual treatment of records;

- A redefinition of the moral defence of records in terms of pluralist recordkeeping;

- A redefinition of the archival threshold in terms of such pluralistic defence;

- The imperative from a open world assumption for pluralistic provenance;

- The Participatory Recordkeeping Continuum Model — introduced in Chapter 5 — that complements the Records Continuum Model in order to address agency in records; and

- Repudiation of the 'Co-create' nomenclature in records continuum theory; distinguishing between identifying the creators of records and attribution of agency.

In the following sub-sections, I will discuss each of these contributions in detail.

8.1.1 A pluralist ontology for recordkeeping

My two models explicate, support, and build out the Records Continuum Model and the records continuum concepts upon which it is based. The central tenet of my conceptual model — that records are representations of activity involving participants of various types (as described in chapters 3, 5, and 6 as building on the work of Upward (1996), Reed (2005c), Yeo (2007), and Lemieux (2014) amongst others) — is a concrete expression of the "records continuum [which] deals with identity, transactionality, (who did what) and the storage of evidence about this in recordkeeping containers" (Upward, 2005a). My conceptual meta-model is therefore an ontology that directly supports a continuum perspective on recordkeeping, enabling the documentation of traces as they manifest through the dimensions of the records continuum.

Significantly, the models are a design for the Recordkeeping Containers axis of the Records Continuum Model and the Pluralisation of records in its fourth dimension — i.e. the pluralisation of identity, evidence, transactionality, and recordkeeping containers throughout the Archival Multiverse. The records themselves are representations of disparate accounts of what was perceived to have transpired. However "every representation, every model of description, is biased because it reflects a particular world-view and is constructed to meet specific purposes [...] The representer's value system, [...] is the final arbitrator on the content of a representation" (Duff & Harris, 2002). Thus, while the Records Continuum Model suggests a potential multiplicity (not just multiple instances, but multiple manifestations and interpretations) of identities, transactionalities, evidences, and recordkeeping containers associated with a given trace, my design not only accounts for why this must be so, but also explains how it may be expressed.

As an articulation of postcustodial pluralisation, the models explicitly support the need for differential and granular access and utility for participants in records. They therefore transcend the concepts of the archival commons (S. Anderson & Allen, 2009) or public information space (McCarthy & Evans, 2012) to embrace the breadth of the archiving system conceptualised by Reed (2005a) in order to "imagine and implement a fourth dimensional role for recordkeeping". This is the sort of role that O'Neill et al. (2012) argues is necessary in order to "recast [access and utility] so that it is seen as an 'exchange' between joint stakeholders", who may be currently disenfranchised from their records. Note though, that from a theoretical perspective, some gaps remain in the pluralistic paradigm; particularly with respect to how authority and trust (and therefore provenance) are to be conceptualised from a pluralistic perspective. I will return to this issue later in this section.

8.1.2 Record-ness as relationships

The means by which my conceptual model can express recordkeeping pluralities is due to the shift from Stage-2 to Stage-3 conceptualisations of recordkeeping. This is the shift from modelling a record as a distinct type of thing — as a first-class entity-type in a conceptual model — to the idea that the 'record-ness' of an entity exists by virtue of its relationships with other entities. Remember, the Meta-model for Participatory Recordkeeping does away with Record and Record-Set as first-class entities and, instead, holds that other entities can be considered as records if they serve to represent an activity. It does this through the use of formal Representation relationships that link Performances with the Substantial or Performance entities that represent them.

Thus, for example, a document may be modelled as an object that, from at least one perspective, is a bearer of relationships that give it evidential properties. However, from another perspective, the details, nature, or existence of such relationships may not be recognised; with the implication that the document is not accepted to be evidential. In this way the activity-orientation of a Stage-3 approach makes explicit the need for the pluralistic documentation of records.

This redefinition of 'record-ness' also has interesting ontological implications for recordkeeping and archival theory. Obviously there is a face-value perspective of records in which traces are representations of activity that may be either artefactual continuants[43] (as in the case of documents or other physical inscriptions) or occurrents (for example, as in the case of an oral recounting). Such representations are considered to be separate from both the activities they represent and the individuals that may comprehend them. As such they may be subject to

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[43]To use the continuant/occurrent terminology defined in Chapter 6.

classical recordkeeping practices either in terms of the arrangement, description, preservation, and storage of artefacts; or managed as part of some performative canon. From this perspective, records may be comprehended from a temporal or physical distance as artefacts; "relics" of some historical transaction (Acland, 1992). This is the perspective of 'inventory control' recordkeeping and is found in my conceptual model as Substantial or Performance entities (which may be involved in Representation relationships with the Performances that they represent).

There is also a second perspective of records; one in which they embody communicative, informational, and evidential affordances that, together, we term a 'record' (Yeo, 2010). In a sense, then, this cluster of affordances, the 'record-ness', is a continuant. It may (and will) change over time, but at any point in time it is integral; a complete, constructed, up-to-point-in-time representation. From this perspective, records are also considered to be separate from both the occurrents they describe and the individuals that may comprehend them. This is the perspective of the Representation relationship in my conceptual model that imbues a given Substantial or Performance entity with 'record-ness'.

8.1.3 A performative epistemology of recordkeeping

However, this implication from the model — that the meaning of an entity is derived from bearing relationships (for example, Representation relationships) at a point in time — gives rise to a third perspective: that our experience of records is performative. Obviously experiencing an occurrent record (for example, hearing a story) is performative. More recently, the access and use of digital records has also been recognised as being performative — a 'playing' of the record using an apparatus that reproduces the digital inscription (Heslop, Davis, & Wilson, 2002). Subsequent encounters of the digital record may use different apparatuses and may be subtly (or imperceptibly) different from the prior one.

Moreover, this phenomenon is not limited to digital records. In fact, any experience of a record is performative and subjective; depending on a myriad of factors including previous experiences with the record as well as the current context of experience. The experiential phenomena of interaction with records are occurrents. 'Record-ness', therefore, is not static; it is ephemeral and exists only in the eye of the beholder. In this way, my conceptual model provides an ontological basis for the understanding that individual comprehension of records, while possibly shared with others, is ultimately unique and different for each experience of a particular record (Ketelaar, 2005b).

This performativity doesn't directly affect the design of recordkeeping systems, other than through recognising that "recordkeeping of this kind becomes a dynamic relationship to be

managed across time" (Reed, 2005a), nor does it mean that pluralist recordkeeping theory needs to change in any way (in fact it underpins some of the ideas that have emerged from continuum thinking, for example McKemmish's (1994) "always in a process of becoming" and Upward's (2011) "flicker". It does, however, underscore the temporal nature of the Archival Multiverse and the need for flexible instantiations of the models (i.e. within standards and systems) that can support this variation of meaning through time (or, rather, spacetime). More significantly, though, it undermines 'set-and-forget' mechanisms such as record (disposition) schedules, accession-time description, and other practices oriented around the one-time intellectual treatment of records[44] discussed in Chapter 1. I will return to this in the implications for practice section below.

This issue of one-time intellectual treatment is one consequence of the archive perspective. Similarly, my pluralistic participatory models bring into sharp relief other inadequacies of the archive perspective as a framework for addressing disenfranchisement in records.

8.1.4 Recordkeeping perspectives and pluralism

While my functional model addresses Huvila's (2011) call for "a model of different degrees of participation in archival contexts", it goes much further than that, embracing the full pluralism of a recordkeeping perspective. And, although my work moves us closer to the realisation of a pluralistic participatory recordkeeping infrastructure, it is worth briefly re-visiting the archival/recordkeeping dichotomy in light of my findings. A good example of this is Huvila's (2015) discourse analysis of participatory *archiving* (emphasis mine) that highlights the latest battleground upon which the unitary/pluralistic or archival/recordkeeping perspective skirmishes are being fought.

On the surface, this analysis identifies "antagonistic positions stemm[ing] from differing opinions of the understanding of the notion of participation and the question of the principal stakeholders of the different types of participation" (Huvila, 2015, p. 22). However, it is clear that, from the language of the analysis, the participation discourses are interpreted from an archive perspective. For example "The premiss of participation is to engage users from an archives point of view (archives have users) or users' point of view (archives are a potential resources for users)" (p. 22). Such a juxtaposition mirrors Bearman's (1992, p. 44) distinction between the "world of documentation" and "world being documented" — although Bearman's is arguably a more pluralistic perspective. What we see in Huvila's survey are proponents of an archive perspective trying to grapple with the issues of rights, enfranchisement, and, ultimately, the moral

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[44]This one-time intellectual treatment has also been recognised as an issue from an archival perspective, in terms of records that must persist on millennial time scales (McCarthy & Upshall, 2006).

defence of records.

As I discussed in Chapter 3, a pluralist perspective is at odds with the life-cycle proposition that possession of a record confers sole intellectual or moral authority for its interpretation and management. From Huvila's analysis, an archive perspective on participation in records necessarily relaxes this proposition somewhat in order to admit some hospitality to others. However such hospitality is still predicated on ownership, and the idea of custody and unitary documentation that constitutes a moral defence of the record. Archive-oriented participation, in exploring the "limits of letting others to work as archivists" (Huvila, 2015, p. 22), still maintains all of the custodial constructs, including isolated and hierarchical aggregations of records; and a distinction between archivists, and record owners, subjects, and users as distinct roles in relation to recordkeeping activities (that take place in the context of archives). If the record that ends up in an archive is "a sliver of a sliver" (Harris, 2002), then how much thinner does it become, when its meaning and use are defined from an isolated and single perspective? I would argue that such documentation of an artefact, disconnected from alternative perspectives in the Archival Multiverse, is insufficient defence indeed.

In Chapter 5, I suggested that the archive paradigm has only addressed issues of multiple perspectives in records in two ways: by further fragmentation of records into community archives that provide alternative perspectives to institutions; and employing Archive 2.0 approaches such as commenting, tagging, and annotation to form second-class addenda to 'formal' records (Eveleigh, 2015). This isn't to say that archival theorists do not recognise the limits of these approaches. For example, in an attempt to address social justice concerns through an adoption of an *ethics of care* in archives, Caswell (2016, pp. 33-38) posits that the archivist has responsibilities of care with respect to "First [...] the record creator [...] Second [...] the subject of records [...] Third [the] user [and] Fourth [,] the larger community".

From a recordkeeping perspective, this taxonomy seems artificially constrained, couching the diversity of participant identities, roles, and needs in strict terms drawn from the roles inherent in a custodial paradigm. It is (again) a "semantically brutal" mapping (Lehane, 2014) of participants into creator, owner, subject, and so on that, despite ostensibly reflecting an "ever changing web of responsibility" (Caswell, 2016, p.25) actually appears to ignore the pluralities of the Archival Multiverse; the dimensions of agency that lie at the core of my functional model. Even worse though, this taxonomy appears to privilege the inscriber of the record over other participants in a hierarchy of responsibilities. It is easy to see how this approach could meet with use-cases that defy such categorisation — even if the sorts of activities associated with each

of the responsibilities are appropriate and needed.

I mention this example, not to single it out for criticism (because it is an undeniably important contribution to understanding how recordkeeping activity should be performed) but to demonstrate how the archive paradigm not only constrains discourse around rights in records, but lacks the conceptual constructs that could enable the design of sociomaterial systems that support such rights. Making this criticism, however, opens up the question of the defence of records in a pluralist paradigm. Without custody, or absolute control over the documentation of records, how should the Jenkinsonian duality of physical and moral defence be treated?

8.1.5 The defence of records revisited

My design has little to say about the physical defence of records. Certainly, physical traces need to be able to be preserved and protected against tampering or loss to ensure their reliability and authenticity (Duranti, 1995) — no argument there. And certainly, in order for collection-level documentation to work, there needs to be an assurance that sets of records referenced by documentation remain intact; although, as we increasingly deal with digital material, ordering becomes less of an issue (Bearman, 2007), if, indeed, it had any real meaning at all in the participatory context (Huvila, 2008). It is the moral defence of records, a "defence of the sanctity of evidence" (T. Cook, 1997) that is more interesting.

As I described in Chapter 3, the postcustodial perspective questions the value of evidence derived from analysis from a single, custodial context. For example, McKemmish (1994) observes that "Peter Scott broke the nexus between moral defence, physical arrangement and custody, at least in relation to representing the provenancial and recordkeeping contexts of records", and offers the frameworks of continuum thinking and Australian Series System documentation to be used "as archivists move beyond custody in their moral defence". Thus, beyond mere physical control, "intellectual means of preserving records of continuing value in their contexts of creation using metadata systems" (McKemmish & Upward, 1994) provides for their evidential qualities. However, we need to ask, from a pluralistic perspective, 'evidence of what'? Records, as representations of (perhaps, administrative) activities, are also evidence of "socially assigned roles and related activities and [enable us to] draw conclusions about what records individuals in their personal capacity capture as evidence of these roles and activities - 'evidence of me'" (McKemmish, 1996). Note, too, that Jenkinsonian notions of regularity are not absolute; even irregular records can be of crucial importance depending on circumstances: for example, documentation held by displaced peoples that, in other contexts, may be considered to be of questionable provenance (Gilliland, 2015).

Thus a Stage-3 perspective can provide an updated definition of moral defence — one that ensures pluralistic evidence of activity; richer evidence, not only of the 'business', but of all participants. Such moral defence, then, can be couched not in terms of a single unbroken chain of custody and interpretation (though that may well be a significant strand in the fabric of evidence), but in terms of ensuring sufficiently interoperable sociomaterial systems that facilitate participatory engagement with records. Moral defence then shifts from admonishment (don't be negligent or hasty in arrangement and description) to an imperative for proactive engagement with the Archival Multiverse. This doesn't dispense with whatever arrangement and documentation recordkeepers choose to employ, but ensures that a diversity of perspectives constitute a multiverse-aware version of evidence that is "conscious, explicit and hospitable about their and others' epistemic beliefs and real options" (Huvila, 2015, p. 29). In this way, Harris's sliver becomes an anchor point for thicker documentation from a multiplicity of perspectives; a boundary object that, rather being an end unto itself, is a accretion point for broader personal and societal memory (Iacovino, 2015).

8.1.6 The archival threshold revisited

A related question may also be asked of the nature of the archival threshold in a pluralist paradigm. Given the forgoing, it may seem strange to ask this — at first glance, consideration of the 'archival threshold' may seem out of place in a pluralist, records continuum treatment of recordkeeping. After all, the records continuum is the antithesis of the life-cycle model, bifurcated as it is by such a threshold that, in turn, plays such a central role in the model's conceptualisation. Nonetheless, continuum theorists consistently refer to (a number of) recordkeeping thresholds internal to the Records Continuum Model; even if they have long emphasised the 'fuzziness' or permeability of such thresholds that separate its dimensions (Reed, 2005b). To complicate matters, they have also given various explanations of such thresholds in terms of Foucauldian knowledge (McKemmish et al., 2010), spacetime distanciation (Upward, 2005b), or sociological experience (Upward, 1997).

Consequently, I feel that it is worthwhile to consider the nature of an 'archival threshold' for two reasons. The first is that the idea of crossing such a threshold underscores the deliberate recordkeeping activity that may (or may not) be applied to record traces. As Upward (2005a, p. 91) argues, "the archive will form whether or not it is well organised but the threshold issue here is its conscious organisation without which its spreading in spacetime will be extremely erratic and ad hoc". The second reason is, perhaps, more important. In developing a conceptual mapping from the life-cycle model to the record continuum — for example, through identifying

an analogue for the unitary 'archival threshold' within the records continuum — such an intellectual bridge may reduce the barriers for the uptake of pluralistic conceptualisation by those previously entrenched in an archive perspective.

So, without archival custody, does such a threshold exist; and if so, where is it? Put simply, the archival threshold becomes the point beyond which an independent[45] agent introduces the record into a participatory recordkeeping framework — thus ensuring its pluralistic moral defence. From a continuum perspective, this could very well be the point at which material is captured — be it a trace, or documentation about the trace and so on — but, of course, could be at any contextual point in the continuum. Such defence may not apply until the trace or its documentation[46] is organised or, indeed, pluralised. An implication of this definition is that merely entering into custody, enabling the "role of archival institutions in authenticating records that have been transferred across their boundary" (Upward, 2012), does not itself ensure the pluralistic moral defence of the record.

However, in dispensing with a 'hard' threshold to a custodial repository and an archive perspective on records, we open ourselves to some new challenges. Perhaps, chief amongst these is the shift from 'closed world' logic to that of an 'open world'. In particular, it is interesting to consider what changes if we relinquish a unitary view of records as a primary concern for recordkeeping.

8.1.7 Provenance in an open world

As I described in Chapter 4, many of my interview participants expressed excitement about the prospects for an open and distributed recordkeeping infrastructure. Nonetheless, as I reported in Chapter 7, some evaluation participants — even as they appreciated the power and possibilities of an interoperable infrastructure — expressed discomfort about the contingent nature of trust, authority, and deterministic search within a pluralistic paradigm. The underlying reason for this is the unstated, but crucial, shift in logic that occurs when we move from a unitary paradigm to a pluralistic one.

The archive perspective with its unitary and custodial underpinnings assumes a *closed world* logic (Patel-Schneider & Horrocks, 2007). This is not just 'closed' in the sense of interoperability, but closed in terms of the universe of discourse[47]. With a closed world assumption, if a 'fact' does not exist in a knowledge-base, then a query for the 'fact' returns 'false'. In the case

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[45]Or quasi-independent — is there anything such thing as true independence of/from records?

[46]This definition also allows for the moral defence of missing or imagined records. For example, see Gilliland and Caswell (2016)

[47]In this sub-section I am using terms from formal logic. For example, see Boole (1854, p. 3, 30) etc.

of recordkeeping systems, a 'not found' search result is interpreted as 'does not exist'. This is the logic of literary warrant as used for the construction and justification of bibliographic catalogues (Rodriguez, 1984). The knowledge base, representing the universe of discourse, is the final arbiter of truth within that universe. Within the archive paradigm therefore, the institutional imprimatur ostensibly conveys trust and authority about the existence of records and the completeness of documentation it holds. However, given the nature of the Archival Multiverse, this is patently not the case. Nonetheless, it does, make for somewhat deterministic queries: a search tomorrow should display identical (or, perhaps, more comprehensive) results compared to those obtained yesterday. We expect that the removal of 'facts' from a knowledge-base — i.e. the removal of material or documentation from an archival collection — should be a rare occurrence.

In contrast, if using *open world* logic, there may be 'true' 'facts' that do not exist within the knowledge-base; it being a sub-set of the universe of discourse. With an open world assumption, if a 'fact' does not exist in a knowledge-base, then it is not known (as opposed to being not 'true'). For example:

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Statement: "Greg" "is a student of" "Monash University"
Question: Is Kym a student of Monash University?
Closed world result: (for example, from a database query) No.
Open world result: Unknown.
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In the case of pluralistic recordkeeping systems, a 'not found' search result is interpreted as 'not here'. This corresponds with the continuum and postcustodial logic that permits creating documentation in the absence (perhaps, in advance) of the existence of records. An open world assumption means that there is no single arbiter of 'truth' in the universe of discourse. In fact, "anyone can say anything about anything" (Berners-Lee, 1997) — and such utterances may change across space and through time. While such a pluralist perspective aligns with the concept of the Archival Multiverse, it raises questions about authority, trust, and the deterministic nature of recordkeeping systems. If we redefine moral defence in terms of a plurality of perspectives, how do we judge the veracity of evidence in the face of multiple, and perhaps competing, interpretations? Is provenance contingent?

I would contend that provenance within the Archival Multiverse cannot be absolute. In an open world, meaning is in the eye of the beholder and not a construct of any single information system. As Shirky (2005) argues "the semantics here are in the users, not in the systems". From a pluralistic paradigm, therefore, the attribution of claims (of provenance) is as important as

the claim itself[48] (Cumming, 2007) and I touch upon how this may be achieved in the section on systems design below. Even so, given a variety of provenance contexts — perhaps different contextual documentation for a given trace, or different traces that are claimed to represent a given activity — how does one determine which one(s) to accept? In the absence of absolute notions of authority, we are left needing mechanisms for inferring trust amongst networked actors, such as those described by Kelton, Fleischmann, and Wallace (2008). Similarly, work in related fields, particularly in relation to trust within the semantic web, has identified elements of cryptography as well as social network and graph analysis as having a bearing on the problem (Golbeck, Parsia, & Hendler, 2003). A more complete treatment of this is not possible here, however I do address these issues in my concluding Chapter 9 in terms of future research.

The determinism of query results in an open world may suffer because pluralistic sources of recordkeeping material may change over time. A comparatively simple version of this can be seen even within an archive paradigm: the changing of non-persistent URLs breaks links in other systems that may point to archival system resources (Laurent, 2016). A more complex conceptual issue is that participant perspectives may change, altering the provenance of records over time. Given the performative nature of records, this is actually an expected manifestation of the Archival Universe — even if it jars with traditional archive perspectives (for example, as expressed by some of the evaluation participants). More seriously and less benign, however, is that non-institutional sources, facing financial, resourcing, and other threats, may not be sustainable over the long term. On recordkeeping time-scales, individual systems may be relatively ephemeral (McCarthy & Upshall, 2006). A query tomorrow, may return markedly different results from those obtained yesterday. As with the Memento protocol that one of my evaluation participants identified as reported in Chapter 8, I think that the solutions to such issues are to do more with practice and systems design than with recordkeeping theory per se. However, in my concluding Chapter 9 I do flag this as another area in need of further research.

This pluralistic redefinition of moral defence and provenance brings me to my final implication of my design on recordkeeping theory — the pluralisms implicit in the Records Continuum Model and how they should be addressed.

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[48]Perhaps it always was. An archive paradigm — even with strict chain-of-custody rules — is still open to acts of fraud and forgery that serve to undermine the authority and trust of institutions. For example, see Carter (2007) and Kastenhofer (2015). Moreover, as I stated in Chapter 1, this question of trust is somewhat different to the question of the *authenticity* of a record (see, for example, Reed (2005c, p. 105)), which I do not address in this study. What I am concerned with here is the trustworthiness of documentation which, while it does have some bearing on the authenticity of a record (i.e. that the documentation or contextual description matches the record contents), is not directly related to the integrity of a particular inscription or performance, governed by the context in which it is maintained.

8.1.8 Agency in the records continuum

In recent years there has been an attempt to update the Records Continuum Model with explicit reference to multiple identities, for better alignment with participatory approaches. One manifestation of this has been a shift in nomenclature of the Create dimension, using the term *Co-Create* instead, in order to increase the visibility of actors beyond the inscriber of a trace (McKemmish et al., 2011; McKemmish, 2017; Gibbons, 2015b, p. 241; Soyka, 2015, p. 113). However, I think there are two problems with this approach.

The first issue is one of language. As I have argued earlier, the word 'create' implies purposeful action to bring something into being. The co-create nomenclature does broaden the recognition of actors to include those who may not have actually had a hand in inscribing the trace, but were involved in the activity that it represents. This is laudable from a participatory perspective. However, I think it is a bit of stretch to name such actors co-creators of the trace — particularly if they were unwilling participants or, worse still, unaware that the trace had even been created. To take an extreme view (although it is certainly not what is intended by users of the co-create terminology), it is almost like a Statement of Responsibility in the bibliographic world — akin to setting out who are the co-owners of copyright in a work. Similarly, the "who did what" phrasing in the Upward quote about the records continuum above echoes Hurley's "doers, deeds, and documents" (2008) that I argued in Chapter 4 was the hallmark of Stage-2 conceptualisation. Thus while I think co-create is the language of Stage-2 — implying a focus on actors and the artefacts that they create — continuum thinking should not be so constrained.

Even so, my second objection is more serious; conflating the act of creation of a record with the attribution of rights in that record. As can be seen from my functional model, there exist dimensions of participants beyond those who experienced the represented activity. These are actors who may be separated by space and/or time from the initial transactionality and creation of the trace. They are not creators, but they still have rights to exercise agency in the record. Of course if they (or, indeed, anyone) contributes documentation or additional material to the record, then they are certainly co-creators of the record in the original meaning of the dimension. For example, consider familial, cultural, or intellectual descendants of those who experienced a recorded activity. I find it difficult to consider them creators of the record by virtue of genealogy or community, yet as stakeholders they may need to be able to exercise rights as described by my model.

Ultimately, the Records Continuum Model does not deal directly with agency; the Participatory Recordkeeping Continuum Model does. As I pointed out in Chapter 5 and discuss below,

the two models need to be used together for a continuum treatment of records and agency. Let Create stay as Create; traces are, after all, created. However, we should not conflate the circumstances of creation with the use of records throughout the continuum.

8.2 Contributions to practice

In Chapter 4 I discussed some of the many barriers that recordkeeping professionals face when attempting to incorporate advances in theory within their practice. In particular, new standards and systems are often pre-requisites for any sort of shift in practice, if only for pedagogical reasons. However, putting these aside for the moment (to be addressed in the following section) it is worthwhile considering what could or would change in recordkeeping practice as a result of adopting my design.

A shift towards Stage-3 conceptualisation and participatory modes of recordkeeping will have a transformational effect on recordkeeping practice. The scope and impact of such a transformation for any given individual or organisation is dependent on how far existing practice was from a recordkeeping perspective in the first place — from a custodial archive perspective, this could be a long road indeed. While I am unsure how this would play out in detail, I can make the following speculative observations.

As I argued above, my design can be interpreted as an re-definition of the moral defence of records in terms of the recognition of the multiple participants in records and their ongoing recordkeeping needs. This has an impact across space (as recordkeeping activities broaden to embrace a plurality of participants and contexts) as well as through time (as the performative nature of records means that activities that were once considered 'set-and-forget' are actually required to be perpetually, and iteratively performed).

I will focus on two contributions to practice:

- A participatory framework for recordkeeping analysis; and
- The transition from legacy practices to participatory recordkeeping.

Additionally I surfaced a gap in recordkeeping practice, that has not been methodologically considered until now:

- The need to formally support the negotiation of rights in records.

Firstly, I will discuss the analysis required for the development of sociomaterial recordkeeping systems.

8.2.1 A participatory framework for recordkeeping analysis

By analysis, I mean any of the work that is performed to establish the content and boundaries of recordkeeping or archival systems. From a continuum perspective, this may be appraisal that seeks to identify the activities being recorded, the form and content of the records, the contextual metadata needed to document the records, and the ongoing management plan for this material (McKemmish, 2001). From an archive perspective, the selection of records that are to be accessioned replaces the first two of these elements (Booms, 1987). Typically, such analysis is performed from a single organisational perspective, for example, through the use of a functional analysis methodology such as *Designing and Implementing Recordkeeping Systems*[49] (DIRKS) (State Records New South Wales, 2007) or that specified in ISO 15489 (International Organization for Standardization, 2001a, 2001b), which identifies organisational records together with transactional actors and contexts.

However, even within a single organisation, such functional analysis may encounter issues that require a participatory approach. For example, as I reported in Chapter 7, some evaluation participants identified that organisational recordkeeping often must deal with disparate perspectives that result from heterogeneous internal cultures or objectives. Regardless of the scope of analysis, participatory recordkeeping reaches beyond a single 'functional' view to encompass all actors, activities, and perspectives that impact or are impacted by actions. While it is impractical for a local sociomaterial recordkeeping system to be hospitable to an entire universe of discourse, recordkeeping professionals should strive for interoperability that is able to accommodate perspectives beyond the immediate system boundaries.

The performative nature of records and recordkeeping means that they can and will change over time. For example, the documentation of records and hence their 'record-ness' is malleable, and such change is a natural part of recordkeeping. Consequently, this one-time functional analysis needs to become an ongoing review of records and the agency required of participants in relation to them across space and through time. In the same way that a record is not an 'end product' (Acland, 1992; Upward, 2004) neither are record (disposition) schedules or access control regimes. A recordkeeping approach implies that a new analysis and management methodology is needed; one that actively identifies, seeks out, and engages all participants in records; and addresses their changing needs over time.

The Records Continuum Model continues to be a useful tool with which to perform functional

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[49] Also known as *Design and Implementation of Records Systems* (DIRS) in the British version of ISO15489 2001 — arguably a backwards shift from a discourse around recordkeeping (a process), to one concerning records (afterfacts).

analysis (McKemmish, 2001; Reed, 2005b). For analyses in participatory contexts, it should be used in conjunction with the Participatory Recordkeeping Continuum Model in order to identify recordkeeping elements not only through dimensions of recordkeeping activity, but through the dimensions of participant agency as well. Together, these may be used as reference models in the two ways suggested by Hofman (2017): as a guide for analysis and development of new sociomaterial participatory recordkeeping systems; and as post-hoc or forensic tools to investigate issues or gaps in existing systems. Note that such activities are not limited to the recordkeeping paradigm, although that is where they will have the greatest applicability. In the same way that the Records Continuum Model "can also be used to analyse thinking and practice that are not themselves consciously cast within a records continuum frame of reference" (McKemmish, 2001), so too could the Participatory Recordkeeping Continuum Model be used to augment archive practice — for example, to extend Caswell's (2016) ethics-of-care paradigm to identify participants, roles, and responsibilities beyond the four already determined.

My design is not a methodology, but it does underpin the directions in which recordkeeping analysis should take. Perhaps existing recordkeeping analysis methodologies such as those described above could be augmented with ideas from other, related disciplines to round out its participatory aspects. For example: aspects of the Soft Systems Methodology (Checkland, 2000), protocols from inclusive research design (McKemmish, Burstein, Manaszewicz, Fisher, & Evans, 2012), examples of engagement from community informatics (Gurstein, 2003), or practices of co-design (Lee, 2008) to name a few. An example of the sort of analysis I envisage is given in Figure 8.1.

This diagram illustrates how the Records Continuum and Participatory Recordkeeping Continuum Models could be used together to examine a given domain of activity in order to identify activities (A^1, A^2), participants (P^1, P^2), and candidate traces (T^1, T^2) that may become records (R^1, R^2). I imagine that such an analysis (as with all approaches needed to understand complex phenomena) will be iterative. Each model is used to interpret the problem domain according to its constructs, however the emergent understandings from each can be used to inform the work in another quadrant. For example: consideration of evidentiary requirements could inform the inscriptions needed to be created by particular participants; alternatively, identified inscriptions could be analysed for their evidentiary qualities.

The output from such analysis will include definitions of the records that are of continuing use; the contextual metadata elements (defined in terms of elements of the Meta-model for Participatory Recordkeeping) that are needed to adequately document the contexts of the ac-
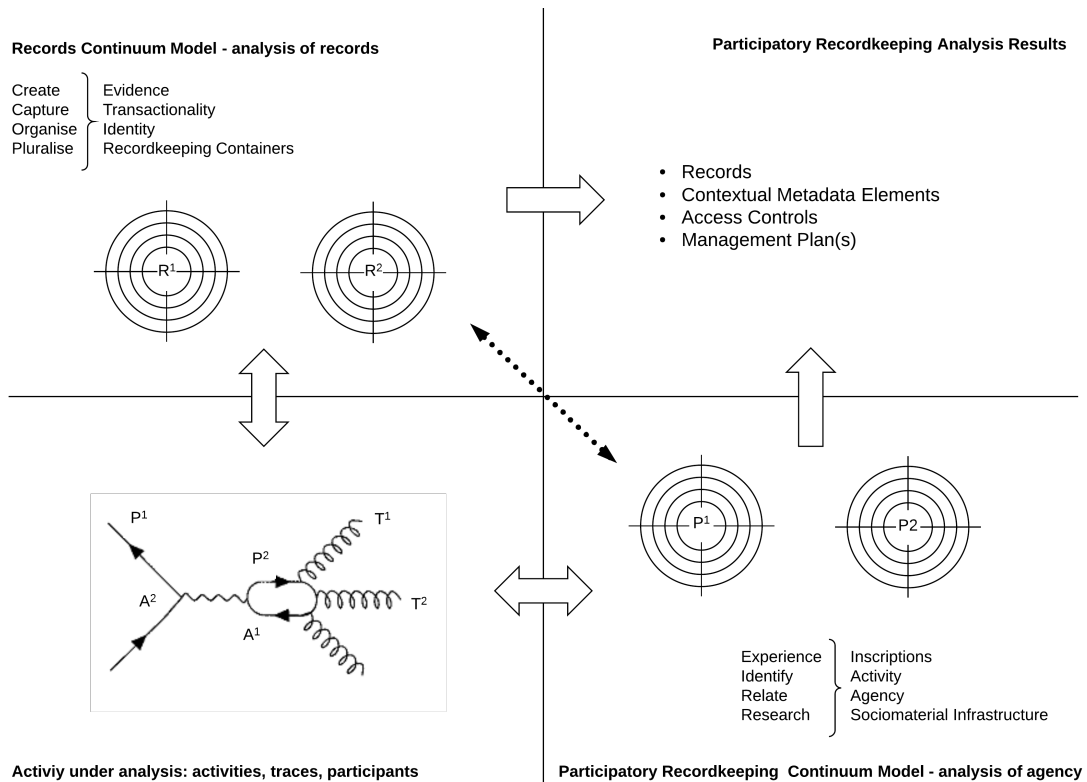
Figure 8.1: Example participatory framework for recordkeeping analysis

tivity and recordkeeping; suitable recordkeeping roles; authentication and authorisation rules that support the participants' rights in recordkeeping activities; reproduction rights; and ongoing management plans for the records and metadata. Of course these will change over time as perspectives shift, so all of these — from the evidential nature of records, to documentation elements, access controls, and ongoing management plans — may also need to change as well.

A more detailed description of such analysis is beyond the scope of this discussion, but I do address it in my concluding Chapter 9 as an area of further research.

8.2.2 Negotiation of rights in records

Even if such analysis is hospitable to a plurality of perspectives, a question remains — perhaps the largest 'elephant in the room' for participatory recordkeeping. On the one hand, my functional model assists in identifying various participants, their perspectives, and agential needs, while, on the other, my conceptual model provides the ability to express distinct perspectives and enact such agency. But it is the middle part that is missing: how to reconcile the competing rights and requirements for recordkeeping to be exercised by all participants. This situation reminds me of the seminal Sidney Harris "Then a miracle occurs" cartoon[50]. After all, such hospitality requires that disparate interpretations of roles, authority, and evidence be accommo-

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[50]See http://www.sciencecartoonsplus.com/pages/gallery.php

dated even though interpretations of rights may only be partially congruent or even mutually exclusive. Moreover, this navigation of rights may need to be played out against a backdrop of hostility between parties. In terms of recordkeeping systems, "how are conflict and consensus negotiated within multiple, disparate, and overlapping groups" (MacNeil, 2012)?

This issue goes beyond the documentation of records to affect their very existence and ongoing management. After all, multiple incommensurate perspectives can be articulated with my meta-model and, even if not all parties support or even acknowledge the various perspectives, at least everybody's voice can be heard. The problem is that records patently can serve a number of purposes beyond their immediate transactional use in addition to historical research (Caswell, 2010; Harris, 2001; Ketelaar, 2012). For example records that could confirm genealogy may have medical import; records of organisational or institutional activity may have a role as evidence of accountability when justice is prosecuted — even quite some time after a given event. Obviously perpetrators would prefer for such records to have been destroyed[51]; seekers of justice not so.

But this is the trivial case, and the complexity of the Archival Multiverse is far more nuanced. To give another example: in the case of Care-leavers, case files and other records have proved to be invaluable in identifying and/or incriminating perpetrators of institutional abuse (Eberhard, 2015). However, some Care-leavers justifiably see such records of their time in Care as weapons of affect (Wilson & Golding, 2015) that serve to perpetuate their trauma. They would prefer their 'file' destroyed rather than be retained by the state (O'Neill et al., 2012). Others recognise a right of the state to hold such records but demand agency over their management on ongoing use (J. Evans et al., 2015). Similar competing rights in records can be found in many jurisdictions and contexts (Caswell, 2016; Iacovino, 2015; Ketelaar, 2005b).

How then to resolve competing rights in records? I have no answer to this issue at this time; predominantly because contemporary recordkeeping and archival approaches have not provided a context for such issues to be satisfactorily addressed. Gilliland and McKemmish (2014) argue that existing rights frameworks are a good starting point for the establishment of participatory principles. Similarly Iacovino (2015) points to the *maximising principle* by which "each right should be maximised in individual cases in which they apply rather than seen as competing rights" and that "takes account of the need for accountability for past actions as a collective right". Caswell (2016), too, acknowledges the usefulness of existing rights frameworks, but recognises limitations in their effectiveness if administered in institutional contexts (as the insti-

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[51]If they were created in the first place. For example, the Australian Royal Commission into Institutional Responses to Child Sexual Abuse (2016, p. 10) has determined that an absence of recordkeeping constitutes institutional complicity in abuse .

tutional structures themselves may be a potential source of contention).

Perhaps the issue of competing rights lies at the core of the wickedness of the participatory recordkeeping problem. If so, I feel that we are far from a theoretical position — let alone practical protocols — in respect to this issue, and need to explore it further from empirical perspectives. To this end, I flag this as an additional area for future research in my concluding Chapter 9.

Having said that, I feel that I need to make one other point about interpreting the plurality of participant needs. Since the advent of the World Wide Web and it's ability to capture usage analytics, it is tempting to measure patronage of archive portals and other Archive 2.0 services in terms of on-line behaviour. However, it is inappropriate to take a 'market forces' approach in the interpretation of participant needs based on the measured level of demand from such patrons (M. Evans, 2007). This is particularly so in relation to the accelerating 'commercialisation of culture' (Blais & Enns, 1990) and the recent entrance of purely commercial players such as Ancestry.com (2015) in the "conflation of commons with commerce" (Brabham, 2012, p. 406). Such delivery may sit well with providers of traditional archival services but there is danger that a market-driven approach may distract from the broader social missions of archives (Lehane, 2006).

8.2.3 Transition

If mechanisms of analysis and negotiation described above begin to emerge into recordkeeping practice, what are the implications for practitioners wishing to embrace a Stage-3 conceptualisation and orient themselves for a more participatory engagement? Perhaps, what this comes down to, is the preparation of records and metadata, taking account of the patterns and anti-patterns identified in Chapter 4.

As my interview participant Geoffrey Yeo suggested, advances in technology will be necessary to cope with the volume and complexity of recordkeeping going forward, while others such as Dianiel Pitti also warned of the diminishing returns of overly complex and demanding documentation — particularly given the resource constraints many recordkeepers and archivists are facing. However, research projects such mine are tackling both issues: working toward technologies that will aid the recordkeeping mission at the same time as tackling the bottlenecks that lie at the root of the More Product Less Process (MPLP) problem (Greene & Meissner, 2005) without sacrificing depth of documentation.

For example, I have shown how existing Stage-2 documentation — whether Series System, or

well-formed and comprehensive ISAD-G/ISAAR-CPF — can be re-presented in a meta-model-compliant schema in an automated manner. In Chapter 7 I discussed how legacy schemas can be implemented in PaRIty, and it is not difficult to see how an automated approach could be used to re-present existing recordkeeping documentation in this way. Current documentation of organisations, organisational units, families, and individuals can be mapped to Discorporate and Corporeal Agent sub-types as required; records and their aggregations to Substantial sub-types; and functions to Performance sub-types. Similarly, Association relationships based on existing links could be automatically established to connect these together. While all this should be able to be accomplished with minimal human intervention, more work would be required to progressively transition the resultant schema to an activity-based orientation. I am not claiming that this would be a trivial exercise, but I am sure that such a bulk transition path is viable.

To digress slightly, it is exactly this sort of automated transition that could be used to quickly mock-up institutional holdings in a Stage-3 interoperable framework as described in Chapter 4 and foreshadowed by my earlier work in Series System interoperability (Rolan, 2015). In this way my design, and possibly it's instantiation, could be used as a pedagogical tool for practitioners (or 'marketing' tool for management) that addresses some of the conceptual barriers to adoption identified in Chapter 4. More generally, it could also be used as an aid in the promulgation of the concept of the fourth Records Continuum dimension that has proved to be troublesome in the past (See T. Cook (2000), Reed (2005a), O'Neill et al. (2012), and, as an example, Flynn (2001)).

As is the case with Series System implementations (and described by my interview participant Jaana Kilkki), once the main contextual entities have been documented, the subsequent documentation effort largely involves creating entries for new elements and linking up relationships with existing ones. In other words, the ongoing impost of a more complex schema is not as great as one might imagine, while it does lay the foundation for interoperability. Of course this assumes that there is Stage-2 documentation in the first place — which may not necessarily be the case, as reported by some of my interview participants. Obviously the transition path to interoperability will be more difficult for collections that are solely documented by finding aids or other inventory-management catalogues.

Creating linked contextual metadata elements within a local system is, perhaps, the first step in recognising the pluralities and interconnectedness of records and recordkeeping. However, in order to fully embrace participatory recordkeeping, practitioners will have to commit to a paradigm of stewardship of material that is connected with the wider Archival Multiverse.

In an interconnected network, unique identification of elements, together with persistence of such identifiers is crucial. The allocation of internally unique identifiers to records and/or their aggregations has long been a established practice in recordkeeping or archival contexts (Reed, 2005c, pp. 114-121). However, what may not be so entrenched, or even recognised, is the need to be able to uniquely identify all contextual entity and relationship metadata elements in order for them to be referenced from external systems as first-class internet resources (Kunze, 1995). Even before an interoperable information system can be deployed, work must be performed to ensure that the data can interoperate within the Archival Multiverse.

I use the word 'commit' above because of the conscious effort needed to ensure that record-keeping practice eschews the impermanence of internet resources and strives for persistence on recordkeeping time-scales (Laurent, 2016). Some thought must be therefore be given to the scheme of Uniform Resource Identifiers (URIs) that will be used to identify material (Berners-Lee, Fielding, & Masinter, 2005). Candidate identifier schemes abound, including the Handle framework (Corporation for National Research Initiatives, 1995), the Digital Object Identifier scheme (International DOI Foundation, 2017), the Archival Resource Key (ARK) scheme (California Digital Library, 2017), and various schemes for identifying persons and organisations (National Library of Australia, 2016; ORCID Inc, 2017). Brickley, Hunter, and Lagoze (1999) also identify a number of potential identifiers that may be incorporated into URI schemes including "ISBNs, ISSNs, URNs, URLs, DOIs, Handles, phone numbers, UUIDs and PURLs". For example, as described in Chapter 7, the PaRITY system employs a scheme of Universal Unique IDs (UUIDs) to uniquely identify all of the elements exposed by its API.

As some of the interview participants indicated, it may take some effort to assign such identifiers, however it is not inconceivable that such assignment could also be automated in the mapping from legacy systems to an interoperable schema as described above.

8.3 Contributions to systems design and development

All of the foregoing depends on the ability of suitably interoperable[52] recordkeeping systems to support the participatory practices described above. Unfortunately, this is a somewhat catch-22 situation whereby systems need to be created in order for practice to change to take advantage of the new functionality; however the development of recordkeeping systems generally takes place in line with prevailing standards and practices. Nonetheless, the findings from my design science research make a contribution that can serve to short-circuit this situation.

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[52]Or, at least, potentially interoperable by virtue of suitably modelled documentation, even if appropriate APIs etc. are not available.

Most of the design considerations for participatory recordkeeping systems have been discussed in Chapter 7, either in the context of the PaRIty proof-of-concept instantiation, or considered out of scope for the design exercise and listed in Appendix D. These include support for the Meta-model for Participatory Recordkeeping; interoperability support — preferably through a suitable RESTful API, semantic-web-compatible response documents, and LOD ontology as described in Chapter 7; granular access controls, functional recordkeeping roles, and reproduction rights; import/and export facilities for transition from legacy systems; and possibly multi-schema support for the hosting of multiple perspectives on records. However, several others are worth mentioning in more detail here:

- The design as a framework for the semantic interoperability of recordkeeping systems;
- This model of interoperability as a basis for Interface standards setting; and
- The affordances of the design for documenting 'recordkeeping-business' in an interoperable manner.

Even so, there are a number of technical aspects of recordkeeping systems that need to be resolved in order to claim a complete and detailed design. These include:

- Affordances for trust, authority, and rights in recordkeeping;
- Visualisation of the Archival Multiverse as a single, interconnected graph;
- Addressing performance implications of flexible and distributed schemas; and
- Marrying this design with existing semantic web approaches.

I will discuss each of these in turn:

8.3.1 Semantic Interoperability of recordkeeping systems

As should be clear, the primary benefit of my design is the affordance of semantic (Ouksel & Sheth, 1999) interoperability for recordkeeping systems. This interoperability enables the interconnection of ostensibly incommensurate recordkeeping documentation in order to support the multiple perspectives of participatory recordkeeping. Previous research has demonstrated how differences in the semantics of metadata models manifest as a barrier to interoperability in general (J. Evans, McKemmish, & Reed, 2009) and in Chapter 4, I explain this in terms of the three-stage conceptualisation model. Not only is interoperability problematic between systems created with different conceptualisations of recordkeeping, but the earlier stages lack sufficient semantic power to interoperate successfully amongst themselves — i.e. within a single stage of conceptualisation. For example, the Archives Portal Europe aggregation process that I describe in Chapter 4 illustrates that systems based on a Stage-1 conceptualisation (i.e. finding aids en-

coded with EAD) have difficulty in achieving even rudimentary interoperability. Similarly, my previous research demonstrated interoperability issues between (Stage-2 conceptualisation) Australian Series System schemas (Rolan, 2015).

In the case of aggregation services, in the absence of a meta-model approach, aggregators cannot address the participatory recordkeeping problem, because of the 'lowest common denominator' effect described in Chapter 4. Even if there are Stage-3 providers of recordkeeping metadata, their contributions will be 'collapsed' down to a Stage-2 or even Stage 1 conceptualisation. For example, the Australian Trove service (National Library of Australia, 2015) renders all aggregated material as bibliographic entries. And, while the SNAC project of EAC-encoded metadata aggregation is undoubtedly a ground-breaking initiative in archival co-operation for the establishment of archival authority files (Pitti, 2012), it remains a Stage-2 effort and one which operates from a strict archive perspective. SNAC takes an almost bibliographic approach that strives for sameness rather than diversity of perspectives. For example in explaining the SNAC process of name matching (Larson & Janakiraman, 2011) with authority files such as VIAF (OCLC, 2017), conflicting documentation is interpreted as a manifestation of "errors" due to "carelessness or lack of standards application" (Wisser, 2014, p. 93). Similarly, the UK Archives Hub has experienced similar problems with its attempts in name matching (J. Stevenson, 2013). This is not to say that resolving duplicates within an interconnected infrastructure is not worthwhile, however it is not an end-point for recordkeeping systems interoperability.

Similarly, metadata registries and cross-walks while useful for more unitary contexts such as bibliographic environments (Godby, Young, & Childress, 2004), are of limited value to participatory initiatives. Merely mapping the documentary capabilities of metadata schemas to existing standards, necessarily places them within a Stage-2 conceptualisation, and often within an archive perspective. In fact Gilliland et al. (2006, pp. 65-67), in exploring the potential for a registry for the registration and evaluation of recordkeeping and archival metadata schemas, found that differences in "underlying perspectives and practices" arose and the divergence between recordkeeping and archive perspectives "led to moments of confusion and even contention".

How much more powerful could such approaches be if they were based on a Stage-3 conceptualisation that enabled expression of the Archival Multiverse graph without needing to resort to such normalisation? To repeat a point made repeatedly in previous chapters, interoperability must be built-in to the conceptualisation or recordkeeping paradigm — it cannot be added-on to systems at a later time. A Stage-3 conceptualisation such as my design is necessary for the development of participatory recordkeeping infrastructure.

8.3.2 Standards setting

Recordkeeping standards lie at the intersection of theory, practice, and systems design and I would hope that my design can inform recordkeeping standard-setting at some point in time. After all, as I reported in Chapter 7, recognition of a conceptual model in some form of standardisation effort is the 'acid test' of such a design. Notably, though, one major difference of my design is that, while my conceptual model could contribute to a *Reference* standard (David, 1987) along with existing recordkeeping standards, the design as a whole could also (uniquely) inform an *Interface* standard that supports an interoperable infrastructure. However, before such an Interface standard could be developed, the theoretical and practical issues described above will need to be addressed so that interoperability can be achieved in all aspects of the recordkeeping mission.

In terms of contemporary standard-setting in recordkeeping and archival space, an interesting comparison can be made with the ICA RIC model that has been in development over a similar time period as my research project. While there isn't the space here for an in-depth analysis of RIC and it's development, I will make a few observations in relation to my research.

A consultation draft of the RIC was released in August 2016 (International Council on Archives Experts Group on Archival Description, 2016). The draft feedback comprised comments from more than sixty individual and institutional respondents worldwide (Pitti, 2017), and which contained both positive support for it efforts as well as elements of criticism (both constructive as well as some comments from detractors). In some ways, this feedback reflected the range of perspectives held by commenters as much as it did the content of the RIC model itself. For example, one source of this criticism was the conceptual barriers identified in Chapter 4, and which was identified by one of the evaluation participants when this topic came up in conversation.

> "EGAD is actually very nervous about how is the international archival professional community going to react to EGAD because it's absolute orders of magnitude beyond ISAD-G. And I think there's a distinct possibility that there'll be a mixture of horror, incomprehension, and rejection. [There is an] issue of bridging the gap between the conceptual work and the practitioner — which is a real challenge." (QSA)

Ironically, some of the criticism argued that the model did not go far enough in addressing particular recordkeeping concerns. The conceptual barriers are very real, and even though the RIC model is based upon an archive, Stage-2 conceptualisation (essentially Artefact-Actor documen-

tation, but with some activity entities as well), the conceptual gulf appears to be wide indeed. As discussed in Chapter 4, EGAD also suffered from members being at different conceptual stages from one another with the result that this version of the RIC model ended up being a compromise between conceptual positions. My ontological approach, admittedly developed by one person without formal consultation, arguably arrived at a more consistent Stage-3 model — but then again, my objectives were different from the ICA. Even so, the differences in the models, developed contemporaneously and informed by the same recordkeeping and archival issues, are clear.

Some criticism was also directed at the EGAD in terms of a lack of inclusion and/or consultation, however this reaction should not be totally unexpected (Timmermans & Epstein, 2010). This was a real problem for the hybrid standard-setting-by-committee approach that the (resource and funds-limited) ICA took with EGAD. It operated with neither an open call paradigm for working professionals, nor with a small, full-time design team such as I described in Chapter 4. It seems that, while the profession is hungrily waiting for standards that lead to better recordkeeping (and archive) outcomes, we appear to be stuck with an increasingly inefficient model of standards development. Rather than standardisation by fiat, perhaps we should be looking at incremental and iterative implementation that can, simultaneously, exercise concepts, generate feedback, and play a pedagogical role in order to overcome barriers. In other words, a process more closely aligned with the interventionist methodologies of design.

8.3.3 Documenting recordkeeping-business

Another significant aspect of the meta-model is it's ability to model the recordkeeping activities themselves. In Chapter 6 I made some general statements about how the meta-model could recursively document its use, while in Chapter 7 I described the PaRIty audit function that records the history of changes to schemas and domain data. This recursive nature of the meta-model is an important point and so I will provide some more detail about this aspect here.

One of walkthrough participants, whom I quoted in Chapter 7, put this succinctly, arguing that being able "to document the activity of archives [...] should be the goal of our description; the products of our description as a result of our business processes". Such "metadata about metadata" may be considered in terms of the identity and description, use, history, and planning of records and recordkeeping (International Organization for Standardization, 2006b, pp. 16-23). Not only is this documentation important for the systematic management of recordkeeping — the 'recordkeeping-business' (McKemmish et al., 1999) — but it is crucial for facilitating interoperable participatory recordkeeping systems.

To date, recordkeeping metadata models have largely been concerned with identity and description whether as a finding aids (Stage-1) or Artefact-Actor metadata schemas (Stage-2). The other aspects of management metadata (i.e. metadata for managing use, history, and planning), where they have been implemented, have had to have been kept 'out-of-band' to the main metadata data store using a separate and custom database schema. This is primarily because prevailing metadata conceptualisations do not incorporate an activity element. Thus constructs relating to use (for example, granular access control, reproduction rights etc.), history, and planning cannot be modelled within the recordkeeping metadata schema, even if this were desired. Within these legacy systems, even if identity and description metadata were made to be interoperable, the other recordkeeping metadata cannot be used in an interoperable way.

The ability of the meta model to support the documentation all of the contexts of a record — from the activities that it may represent, through the circumstances of its creation and capture, to the ongoing recordkeeping activities in which it may be involved — using the same schema elements is an important step in being able to satisfy the management requirements of ISO 23081 (International Organization for Standardization, 2006b, pp. 16-23) in an interoperable way. This is significant because it enables the full context of a record to be exposed in an interoperable manner, providing its provenance. Knowledge of 'who did what and when' in relation to a record and its documentation is crucial for assessing the evidential quality of the material and therefore its claims (Cumming, 2007). As described above, the provision of all of this documentation, then, is core to the moral defence of the record in a pluralist paradigm.

Moreover it provides for efficiency. Participants in records should be identifiable and expressed in terms of the metadata schema. Having recorded this information for identity and description, it makes no sense to enter and maintain it in a separate registers for the support of other management activities, For example, consider the case of granular information systems access controls or reproduction rights. If the context of a given record is documented well (for example by using the Participatory Recordkeeping Continuum Model to identify participants and their agential needs) then the graph of activities, agents, and other contextual elements, can be used directly to establish the relevant access or reproduction controls.

This is particularly important when designing for the granular and flexible access control required for participatory recordkeeping in which access to records that are representations of some activity needs to be granted to agents that enacted, or were involved in that activity. For example, access controls of records of time in Care, or complex role-based access rules in relation to Indigenous records — all of which may be documented as part of the record context. If

the documentation does change over time — for example, changes to identified agents or their proxies associated with records — then the access or reproduction controls can automatically change in line with the documentation. In this way, the agency of participants, based on the documentation itself, is 'baked in' to the recordkeeping system and processes.

This approach also improves accuracy. Because of the ephemeral nature of 'record-ness' described above, the relationships of agents with respect to material and documentation may very well change over time. Documenting each of these contexts within a single schema means that it is less likely for gaps and contradictions to emerge as they may if these functions were split between different management registers. This is an example of 'clever' use of recordkeeping metadata, envisioned as necessary for recordkeeping systems of the future that not only "represent multidimensional contexts" of records and recordkeeping but "keep records relating to all recordkeeping and archiving processes persistently linked to the records they form and transform" (J. Evans et al., 2006).

8.3.4 Affordances for trust, authority, and rights in records

In the theory section above, I discussed how recordkeeping provenance is a function of the trust in (and/or the reputation of) the various participants in records. A variety of generic trust and reputation mechanisms have been proposed for distributed networks such as that of the semantic web (Artz & Gil, 2007). It is conceivable that such mechanisms could be developed into frameworks mirroring the network-oriented authentication and authorisation protocols that have become internet standards (Hardt, 2012). While this needs further research within a recordkeeping context, such frameworks could likewise be standardised and built into recordkeeping infrastructure. Perhaps reputation management could be achieved through the implementation of some sort of enhanced ISDIAH profile (similar to the Index API response document developed for the PaRIty system) that becomes a reference point for network-contributed trust heuristics. Of course, this trust metadata will cascade like any other — how trustworthy is this source of trust metadata? A mechanism for such aggregated reputation will need to be established. Nonetheless, such trust metadata should be able to be modelled using the meta-model constructs and therefore could be made available in an interoperable manner as well.

A second aspect of authority is the use of authority files which, even from a recordkeeping perspective, form an important aspect of the Archival Multiverse. As I indicated above, various archival projects involve the batch-oriented exchange of authority records with bibliographic networks or the broader semantic web that, perhaps, lie outside of the traditional recordkeeping domain (Burrows, 2008; Larson & Janakiraman, 2011; Sibille, 2012; J. Stevenson, 2013). In

the case of integration with a participatory recordkeeping network, how such interoperability could actually be implemented in a generic way is not known at this time. While schemas for person or organisation authority are relatively straightforward (Pitti, 2004), it is unlikely that providers of bibliographic metadata will be motivated to deploy a Stage-3 interoperable interface. As Jaana Kilkki explained in her interview, institutions do not necessarily see the value in embracing interoperability with other disciplines unless there is some jurisdictional mandate for them to do so. On the other hand, Bill Stockting pointed out that, within the British Library at least, the bibliographic collections team saw some value in the rich archival data and were prepared to work with the archival staff in achieving internal interoperability for authority records. Most probably, interoperability with global authority services could, perhaps, be achieved through some sort of proxy mechanism.

Similarly the issue of the negotiation of competing rights in order for their expression in terms of access and utility needs to be considered as part of systems design — even if only in a research context at this time. Perhaps some form of Negotiation Support System (NSS) could be explored for this purpose. NSSs fulfil a similar function to Decision Support Systems; mainly as management information systems in organisational contexts. NSSs support parties in arriving at optimal negotiation outcomes, and this support ranges from facilitating the negotiation to proactively "coordinating the negotiators' activities, critiquing their actions, and making suggestions" (Kersten & Lai, 2007). Obviously such technology would need to be optimised for use in recordkeeping systems, and the output would need to be documented in a meta-model compliant way. Nonetheless, such technology could be a useful addition to the participatory recordkeeping tool-kit.

8.3.5 Visualising the Archival Multiverse

The models that I have created and the potential affordances they imply are one thing, but the actual working user interface of participatory recordkeeping systems is a key determinant of their ability to support agency in records. As Hedstrom (2002), put succinctly, "The interface is a site where power is negotiated and exercised. For archivists, that power is exercised, consciously and unconsciously, over documents and their representations". As I mentioned in Chapter 7, I did not put a lot of effort to designing and validating the user interface of the PaRIty system. As an exploratory tool, its user interface is highly complex, (for example, as shown in Chapter 7, Figure 7.11). It exposes the various layers of the underlying meta-, logical, and, domain data-models and is primary useful to me as a researcher and as a pedagogical tool for use in the evaluations. Within the PaRIty discovery interface, I did need to design some affordances

that could express the pluralities of participatory recordkeeping, though, again, as explained in Chapter 7, they were pretty rudimentary. As such, the PaRIty interface would not be suitable for a general-purpose recordkeeping system. Future system designers will need to spend much more effort in the user interface design of participatory recordkeeping systems.

In particular the display of material originating from multiple sources raises significant challenges. Such an interface needs to mesh documentation from multiple, possibly vastly disparate, sources, while indicating the provenance of individual elements including any trust or reputation heuristics and provenance history — all without cluttering the display. If there are multiple elements, or multiple labels for an element, how should they be prioritised? How can trust be visually conveyed? As detailed in the Chapter 4 requirements, participants at all times, need to be able to understand what is (and is not) being displayed, where it came from, and who has had a hand in its creation and maintenance.

The need to visualise relationships also introduces complexity. The temporal nature of Performances means that the currency of relationships need to be inferred. For example (and given an open world assumption) if 'A purchases B' then, in the absence of any other evidence, the ownership is current. However Performance entities that are represented in records allow for changing and overlapping complexities; for example, 'C sells B' or 'A is discontinued' at a later date. Displaying such elements will have its challenges. Nonetheless, the benefit of semantically interoperable relationships is that it opens up possibilities for interesting and useful interface elements. For example, PaRIty uses a basic mechanism of indicating records (i.e. elements in a Representation relationship) of an entity of interest. Temporal relationships mean that entities can easily be placed on a time-line. Similarly Structural, Genidentity, and Manifestation relationships could be visualised using stacked, expanding, or hyper-linked elements. To give another example, the recent release of the HuNI project has implemented a graphical and relationship-oriented user interface for exploration of the graph of its aggregated corpus of material (Verhoeven & Burrows, 2017).

Additionally, in the same way that access control and reproduction rights need to be granular, so must utility be expressed in the user interface. The agency to manage, to view, to reproduce, to edit, and to delete must be supported down to the element level. It should be clear what agency a given user does have, as well as what others are able to do. This is a far cry from the binary private 'archivist' and public 'user' views of records and documentation. Moreover, there may be no one 'correct' way to visualise this material. Participatory recordkeeping requires "interactive visual interfaces" providing "rich contextual information" of a domain space in order

for "the user to view that domain space from a traditional hierarchical perspective, a networked perspective, or possibly to reconfigure the records into a multiverse of representational forms or visual metaphors in order to support visual exploration" (Lemieux, 2014, p. 89).

8.3.6 Performance considerations

In the same way that networked recordkeeping systems requires re-thinking about trust, reputation and rights, such an approach also introduces new challenges for systems design and performance. In Chapter 7 I discussed some of the database performance issues arising from the late-binding of data in the EAV/CR design. While this allows flexible definition of entities and relationships at run-time, it slows down data entry[53] and increases the complexity of queries. Of course, a bespoke system designed for a particular domain schema would have no need for the EAV/CR architecture in order to comply with the meta model, and would not have these issues. However, the industry needs standard software packages such as the Online Heritage Resource Manager (OHRM) and Heritage Documentation Management System (HDMS) projects (A. Smith, 2017), AtoM (Artefactual Systems Inc, 2015), Archives-Space (ArchivesSpace, 2017), and Mukurtu (The Mukurtu team, 2017) to name a few. The challenge, therefore, is to find some middle ground between the absolute flexibility of PaRIty and the rigidity of a single-domain-schema bespoke design.

Remembering that schema design only happens once, early on in the deployment of a system (and perhaps with minor adjustments over time), conceivably it will be possible to create some sort of 'schema-generator' such as that employed by the 'Active Record' application frameworks described in Chapter 7. Such a tool could use input like the PaRIty schema import syntax to create the necessary database tables that support such a schema. This schema would be meta-model compliant, but not require the EAV/CR overhead of arbitrary entities, attributes, and relationships. Obviously more research is needed here to establish how this would work in practice.

In Chapter 7 I also noted that the performance implications of the network topography itself becomes a factor in systems design. The arbitrary interconnectedness between nodes in a graph means that search paths may not be deterministic and loops are possible. With PaRIty, I implemented a crude form of query limiting that constrained the number of 'hops' taken around the network in search of query results. However, this area is far more complicated, and the application of graph theory to systems design is a fertile area for improvement of network-based search and processing (Shirinivas, Vetrivel, & Elango, 2010). This is similar to the problem

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[53]In machine time, not human time — i.e. the bulk load of data is considerably slower than one would expect from a conventional database design. There was no noticeable difference when manually entering data.

of federated search in the bibliographic space, but complicated due to the arbitrariness of domain schemas, and the granularity of access needed as described above. Consequently, further research is needed to understand how to introduce parallelism into such processing in order to improve the performance of networked-based discovery and access in the recordkeeping context.

8.3.7 The semantic web

Finally, I would like to make mention of some implications for the expression of recordkeeping documentation using the semantic web. Thus far, in terms of requirements, systems design, and evaluation, an assumption has been made by my interview participants as well as myself that participation in the semantic web is a worthy goal. For example the LODLAM (2017) (Linked Open Data in Libraries, Archives, and Museums) movement as well as projects such as Europeana (2017) support the use of the semantic web for various forms of digital scholarship. However, there are a couple of issues with popular conceptions of the semantic web in relation to records and recordkeeping. While the interlinking of material can aid discovery within one jurisdictional domain or the simple harvesting by search engines, the requirements for true semantic interoperability are far more complex. Thus far, semantic web initiatives cater for public accessibility of institutional material without the nuances of differential access and reproduction rights.

A related issue is the primacy of relationships in recordkeeping modelling. Semantic web implementations use a 'triples' architecture, for example modelled in using the Resource Description Framework (RDF) (Berners-Lee et al., 2001). As a simple example, the Friend Of A Friend (FOAF) ontology may be used to model people and interpersonal relationships:

```
<foaf:Person>
    <foaf:name>Peter Parker</foaf:name>
    <foaf:knows rdf:nodeID="BruceBanner"/>
</foaf:Person>
```

While suitable for simple schemas such as FOAF, bibliographic metadata (i.e. title, creator, publisher etc. that are expressible in Dublin Core), and unitary archive metadata simple triples are not rich enough for a recordkeeping approach. In particular relationships must be modelled as first-class entities in their own right as they need to bear properties — most importantly dates of existence. Although the RDF architecture allows for the creation of relationships as a cluster of primitive triples (also known as reification) (W3C Working Group, 2006), such an approach causes issues with ontology definition and may not be amenable to the simple

harvesting described above. The PROV-O Provenance Ontology (W3C, 2013) goes some way to accommodate such bundles of triples necessary for documenting provenance, but does not directly address the issue of relationship reification.

There is also the problem of the proliferation of LOD ontologies or vocabularies (Vandenbussche et al., 2015), which is exactly the same problem as the issue with standards. Modelling within Stage-2 conceptualisations renders domain elements as first-class schema entities, with the result that local variation leads to a branching of the standard or ontology in question. In other words, once again, local requirements trump interoperability. A meta-model approach can address this issue, but in it's absence, semantic interoperability is not achievable. Perhaps PROV-O could be expanded in order to support the meta-model approach.

All of which is to say that participation in the semantic web is achievable and desirable, but it is far more complex than creating RDF triples in existing web pages for harvesting and discovery. As with the other aspects of design, more research is needed to understand the ontological impact of meta-modelling and reification within the semantic web.

8.4 Reflections on the design science methodology

Finally, I would like to comment on my experience in using design science in the investigation of a wicked problem. As I discussed in Chapter 7, I faced a number of issues in applying the methodology to my process of transformative design. I will discuses these in more detail in terms of:

- Limitations of reductionist approaches for IS research;
- Invention VS incremental improvement in design science;
- The evaluation of transformative artefacts; and
- Adaptation of design science for addressing wicked problems.

8.4.1 Epistemology in IS research

As I explained in the Chapter 2 discussion on modes of reasoning, the reductionist paradigm cannot be an end-goal for sociomaterial research, but simply an approach that applies to a limited range of problems. This is similar to the case of classical physics that once held sway but is now recognised as being only applicable to a bounded problem domain. When investigating the very small (i.e. at the quantum level) or the very big (cosmological scale), then classical physics breaks down. Classical approaches still apply at a mid-level scale but, globally, it is an approximation.

Similarly, I think that reductionist methodologies work when studying middle level (Gregor, 2006), inanimate IS artefacts. However, outside of this scale, the effect of *agency* becomes important. In the case of (unrelated to IS) quantum level investigation, the agency of the observer is significant (Barad, 1996). At the other end of the sociomateriality scale — arguably, the core focus of IS research — theories need to consider the effect of agency of individuals, groups, and societies on IS. Hence, despite attempts to reduce IS phenomena to be amenable to positivist measurement (Wand & Weber, 1995), interpretive, critical, and interventionist methodologies continue to grow in importance in IS research (Goldkuhl, 2012; Klein & Myers, 1999; M. D. Myers & Klein, 2011; Walsham, 1995).

Of course, an opposing positivist argument would be that interpretive or critical explanations are fine, and necessary, but they are steps along the way to a more complete reductionist theory about agency. But what if agency is not reducible? If not, then proponents of the reductionist approaches will never be able to arrive at grand theories of IS (Gregor, 2006).

And that is how it currently looks to me. For example, consider the IS theories wiki at http://istheory.byu.edu/wiki/Main_Page that, at last count, has over 100 distinct theoretical propositions. There is no dearth of IS theory, but none of it is grand. Perhaps these theories are merely explicating surface affects (B. Evans, 2009) that have been probed by reductionist research: the blind-men-and-an-elephant syndrome. My feeling is that critical interventionist approaches are needed to crack the surface, and see what lies beneath.

8.4.2 Invention VS incremental improvement in design science

Thus interventionist methodologies such as action research and design science are the best tools we have to effect change to IS within a research context. Such interventionist methodologies stem from a critical stance that seeks to understand and address the power, subjugation, and inequality imbued in social structures. Importantly these approaches look beyond the here-and-now to glimpse what 'might be' or the nature of 'possible worlds' and they employ an abductive logic of 'what if' that can create significant theoretical and practical contributions in terms of new constructs, new conceptualisations, and new paradigms. This is a process of design; indeed "everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (Simon, 1988). The design science methodology is a formalisation of this approach and is often used within an IS research context. Design science is concerned with the creation of design artefacts such as methods, models, or instantiated components that may be employed in sociomaterial IS.

In an attempt to characterise the nature of design artefacts, Gregor and Hevner (2013) propose

a design science knowledge contribution framework with four quadrants:

- **Routine design**: mature application domain / mature solution domain

- **Improvement**: mature application domain / immature solution domain

- **Exaptation**[54]: immature application domain / mature solution domain

- **Invention**: immature application domain / immature solution domain

Gregor and Hevner argue that *invention* is rare in design science, citing the first data mining, decision support, executive decision support, and group decision support systems as exemplars of inventive design in IS. They also concede that such invention "does not fit neatly" with models of design science that require up-front definitions of both the problem and any benefit that may accrue from its solution. They also point out that much of contemporary design science research falls within the *improvement* quadrant.

This perspective is at odds with the position of Purao (2002) that invention is "a key element of design science" — and which is supported by my observations in previous chapters. Perhaps the perceived rarity of invention in the field is because much of design science, dominated by the early literature (Venable, 2010), is situated within organisational IS, and conducted with an uncritical perspective on organisational informatics. Even the critical perspectives of Carlsson (2010) and Heusinger (2013) assume an organisational focus. Again, perhaps this 'useful tools for business' paradigm is the reason that Gregor and Hevner (2013) "cannot find a single example where an invention has been advanced as design theory before it was demonstrated in a physical artifact" — i.e. there is ostensibly no history of inventive methods or models from this uncritical perspective. Thus there is a tension here between, on the one hand, the potential for design science to bring about structural change or paradigm shifts in the sociomateriality of IS, and, on the other, an uncritical, almost straitjacketed view of design science for incremental improvement to organisational IS. Or, to put it another way, a tension between a hypothetic-deductive logic of incremental change and the abductive logic of transformation.

8.4.3 Evaluation of transformative artefacts

Even so, my difficulty with design science was not one of epistemological logic, but one of scale and evaluation. Again, as discussed in Chapter 2, the rigour of design science is conferred by the successful evaluation of design artefacts. How then to evaluate artefacts that represent a new or transcendent (if not entirely unknown or unexpected) paradigm? Of course, the

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[54]*Exaptation* is the application of an existing solution (or class of solutions) to a new problem domain (compared with *improvement* which is the application of new techniques to a well established problem).

problem of evaluation is closely tied to what it is that has been designed (Carlsson et al., 2011). If, indeed, the design is an improvement upon, or exaptation of, an existing mechanism, a number of assumptions may be made. There is (a) a baseline user experience or level of system performance against which the new design can be directly compared; (b) a technical context in which the new design can be evaluated — for example an existing socio-technical system or framework into which the new design (algorithm, visual display, process etc.) could be incorporated; and (c) a sociomaterial context, perhaps in terms of workflow and identifiable end-users, in which the new design can be compared to the old. This means that end-user — if not in-situ — evaluation can conceivably (even easily) be conducted within the constraints of a single research project.

On the other hand, if a designerly way of thinking (Cross, 2001) actually leads to an inventive paradigm shift, then (d) there may be no baseline user experience or system performance for comparison; (e) an entire technical framework (e.g. infrastructure) may need to be created to perform any sort of end-to-end evaluation; and (f) there may be a pedagogical issue of bringing the sociomaterial context (i.e. people, their understanding, skills, expectations etc.) up to a point whereby the new paradigm may be effectively exercised for evaluation. Gleasure (2014) argues that this is an effect of particularly novel design artefacts "when the scale and scope of design theorizing makes the initial stages of design theorizing unusually complex [and] when the resources required to build and evaluate an instantiated artifact are not yet available".

As I described in Chapter 7, this was the situation in which I found myself, unable to perform traditional, in-situ evaluation of my design. This preoccupation with evaluation placed me in a kind of research paralysis early on in my project. I recall from my research journal that I experienced a kind of thrashing[55], alternating between deciding upon what to design and build, and working out how it should be evaluated — moving back and forth between the two tasks and not advancing the research. In the end I decided to put aside my concerns about evaluation for the time being and to design what I thought was 'right'. As it happened, this turned out to be a reasonable way of breaking the logjam, and I learnt to not let concerns about evaluation dampen the 'creative spark' of design.

However, when it did come to evaluation, the breadth of the requirements for participatory recordkeeping, as well as the implications for IS expressed in my functional and conceptual models meant that I ended up evaluating a core slice of a much larger, wicked problem. True,

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[55]*Thrashing* is a computer science term use to describe a processor that is constantly switching between two or more context states (usually due to severe memory resource constraints) to the exclusion of doing any useful work. See Denning (1968).

I was able to find a path from my conceptualisation to evaluation, essentially drawing a justificatory thread through the research outputs as described in Chapter 7: instantiation as support for my conceptual model that was, in turn, support for the functional model and requirements. Nonetheless, it must be said that the broad support that I received from the domain expert evaluations of this slice, that recognised the design as being both novel (or at least fresh), is at odds with canonical design science that would require some sort of broader evaluation based on (a-c) above in terms of Sun and Kantor's (2006) "real users, real problems, and real systems".

As others have argued, this is an issue that impacts the use of design science to transform organisational IS (Carlsson et al., 2011; Gleasure, 2014; Heusinger, 2013; Sonnenberg & vom Brocke, 2012). I would claim that the problem of evaluation has even greater impact on social informatics in general, and recordkeeping research in particular. As my research demonstrates, individual studies of transformation sociomaterial IS cannot hope to create end-to-end replacement infrastructure for evaluation — incremental infrastructural improvement is only possible once transition has been effected. Yet, as I stated above, there is much research to be performed in order to confirm various implications of my research outputs. And even if alternative approaches are explored, such research will necessarily involve dealing with one part of the wicked participatory recordkeeping problem at a time for the foreseeable future. How then should the design science methodology be used for investigating such slices of a larger, wicked problem?

8.4.4 Design science for wicked problems

To start with, we need to go further than the critical realist approach of Carlsson (2010) and embrace a broader critical epistemology applicable to sociomaterial IS, such as through the critical principles of (M. D. Myers & Klein, 2011). Such an approach also needs to be freed from the strictures and assumptions of organisational IS, perhaps by considering experiences in community informatics (Gurstein, 2003).

Secondly, we need to be ever mindful of building up a to an infrastructural capability (d-f above) in a piecemeal manner. The advice of Heusinger (2013) is important here: for individual studies to "carve out" a unit of analysis, posit "possible worlds" of improvement grounded in theory, and design artefacts that could effect such improvement — mindful that the understanding of the wickedness of the problem (and indeed the slice) maybe imperfect. Remember, too, that the selection of a unit of analysis depends on an ability to understand the problem domain. In my case, it is necessary to continually review and refine the requirements for participatory recordkeeping as they emerge, clarify, and consolidate in parallel with the development of potential solutions (Conklin et al., 2007).

There is also a subtle implication for the role of instantiations here. While not built to be production-ready (Boehm, 1984), instantiations may need to be created with an eye to their incorporation in future design science evaluations — a notion that is at odds with the idea of instantiations as 'throw-away' prototypes as described in Chapter 7. Similarly, while the ability to move nearer to evaluation with the Sun and Kantor (2006) 'reals' is attractive, the constraint of working within a pre-existing framework of previously created instantiations may impact inventiveness and creativity. Nevertheless, even findings of a mismatch of fit to previously created artefacts is learning that will contribute to understanding of the problem domain.

Thirdly — and here is the rub — an evaluation strategy is still necessary. Artefacts that correspond to problem 'slices' may be almost meaningless to end-users, however to the community of experts, they should make sense (Pfadenhauer & Menz, 2009, p. 82). Hence, I doubt that, in terms of these intermediate design slices, any sort of in-situ evaluation is possible. Even if some sort of usability study were theoretically possible to conduct, I feel that the narrowness of the slice and the lack of sociomaterial contextualisation of the functionality under study will usually prevent these. What remains are the proxies for real use that I employed, such as theoretical justification, laboratory testing, and evaluation by domain experts. These methods need to be placed in the critical epistemological context described in the first point above, and their results accepted as provisional, yet sufficient, evidence that the approach has merit. There is also an associated academic problem that paradigmatic resistance to such acceptance may, of course, present barriers to publication.

This design cycle then needs to be repeated, with the learning from earlier cycles, other studies, and different slices forming part of the justificatory knowledge that informs later efforts. This is simply the design science methodology executed on a larger scale — micro-iterations, for example, using a systems development method, macro iterations concerning a particular artefact, and 'super' iterations building up artefacts into transformational infrastructure.

In the end, though, design science that tackles wicked sociomaterial problems needs to take a transdisciplinary approach. This is because questions regarding transition between sociomaterial paradigms cannot be addressed from solely an IS perspective; IS researchers don't have all of the tools, let alone answers here. For example, in recordkeeping, such transformation involves other questions of pedagogy, professionalism, and purpose — not to mention the impacts on human rights, societal power, and politics (J. Evans et al., 2017).

Transformational design is a long game. To address wicked sociomaterial problems, design science needs to move from a transactional or component view of IS to an infrastructural one.

Conclusion

In this chapter I have identified some of the contributions and other implications of my research for recordkeeping and archival theory, practice, and standards and systems design. In doing so I have attempted to find a balance between highlighting the contributions of this project, and overstating their import, but it is clear that the design contributes to the recordkeeping discourses — even if it appears to raise more questions than it answers. Perhaps this is the hallmark of research, that (to, perhaps, mix metaphors) in boldly going where no one has gone before[56], finds itself in uncharted waters.

One outcome of my design is that it clarifies the distinctions between the archival and recordkeeping paradigms as introduced in Chapter 3. While some aspects of these paradigms "are not that far apart conceptually if not terminologically" (Gilliland et al., 2006), the differences do cut across all aspects of the discipline. I have catalogued these differences in Table 8.1.

Table 8.1: Differences between archive and recordkeeping paradigms.

Aspect	Archive paradigm	Recordkeeping paradigm
Evidence	Unitary	Pluralistic
Logic	Closed world assumption	Open world assumption
Use-Model	Life-cycle	Continuum
Provenance	Custodial	Postcustodial
Roles	Creator, Owner, Subject, User	Participatory Agency Continuum
Intellectual Control	Owner (or delegate)	Participants
Granularity of access	Collections	Items (however they are defined)
Standards and Systems	Jurisdictional / institutional	Interoperable

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[56]While this declaration is popularly attributed to the captain of that intrepid band of interplanetary explorers, such phrasing had previously been used by NASA (President's Science Advisory Committe, 1958), H. P. Lovecraft (Lovecraft, 2014, p. 1), and explorer James Cook well before that (J. Cook, Beaglehole, Edwards, Cook, & Hakluyt Society., 2003, entry for December 30, 1733)!

Although these are extreme positions — the situation, naturally, is far more nuanced with variations and combinations of all aspects found throughout the Archival Multiverse — such a taxonomy helps to identify the discourses that situate each position in relation to one other.

The archive paradigm, therefore, is traditionally founded on a custodial perspective that employs the life-cycle method to establish provenance. Access to collections of records is determined by the owner(s) (or their delegate(s)) of records in terms of other stakeholders — the creator(s), subject(s), and user(s) of records — as is the documentation of material. A closed world assumption leads to a unitary perspective on the evidential nature of records; that is implemented via jurisdictional or institutional standards and monolithic systems.

Alternatively, the recordkeeping paradigm is postcustodial in nature and one that engages with a continuum understanding of records. Provenance is defined in terms of the plurality of participant perspectives. Granular access[57] is controlled by the participants themselves in line with their needs for agency (perhaps, as identified through the Participatory Recordkeeping Continuum Model), as is the pluralistic documentation of records. An open world assumption mandates a pluralistic perspective of evidence, and one that is achieved through interactions through interoperable infrastructure.

While some of the differences may not be so great, the two paradigms, together with the differences in conceptualisation identified in Chapter 4, mean that there is still much work to be done in order to arrive at a unified approach for participatory recordkeeping that can be put into practice.

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[57] As with other constructs within a plurality of perspectives, levels of granularity are arbitrary. For example, from one perspective, a ledger may be a record; from another a particular post-hoc inscription on a given page may be a record.

Chapter 9: Conclusion

*We do not know the true value of our moments until they have
undergone the test of memory.*

Georges Duhamel

So. I return to my original question: how can we design such systems so that they better serve
all of the stakeholders in records?

What of Vlad; of Frank; of the hundreds of thousands with disrupted childhoods and discon-
nected memories? What of the colonised; the conquered; the diaspora who peer into the record
seeking confirmation and identity, only to find a distorted caricature or worse still, nothing at
all? What of those unable to trust the custodians of their records but have nowhere else to turn?
Does my design hold an answer for these and others disenfranchised from their records? Can
my research impact the sorts of cases with which I introduced this thesis in Chapter 1?

If only it were that simple. Problems on the scale of the Archival Multiverse are wicked indeed,
and defy straightforward yes/no answers.

My research was successful — I achieved what I set out to do — but such success must be tem-
pered in the context of the complexity of the recordkeeping problem. The outcomes from
this research are, at once, both broad and narrow. Broad, in the sense that I posed open ques-
tions about the nature of recordkeeping and developed a similarly comprehensive design. The
requirements I determined for participatory recordkeeping encompass the wide-ranging experi-
ence of recordkeeping; my design blueprints — the functional and conceptual models — were
similarly inclusive; and my proof-of-concept instantiation demonstrated interoperability be-
tween disparate perspectives. However, any claim I may make for 'shovel-ready' solutions is
necessarily more constrained. I demonstrated that the design facilitates interoperability be-

tween disparate recordkeeping systems and supports the pluralistic agency of participants in recordkeeping. Similarly I have made contributions to theory and practice, refining our understanding of the records continuum in general and participatory recordkeeping in particular. Even so, these findings also raise a number of theoretical and practical questions; my findings are more foundations than edifices.

In this final chapter I will summarise the answers to my research questions, my contributions to recordkeeping theory, practice, and systems design, as well as my reflections of research and the design science methodology. Additionally, I will also describe the work that is left to do, the questions that remain unanswered, and the direction that future research could take in this area.

9.1 Understanding participatory recordkeeping

To investigate recordkeeping design, I elected to employ the design science research methodology as a critical interventionist approach to not only facilitate the development of such a design, but to also understand the nature an impact of such a design. Within this design science framework, I used the systems development method to develop a transformative design for participatory recordkeeping systems. I supported the systems development method with a variety of research techniques for requirements elicitation, analysis, design, development, and evaluation — including semi-structured interviews, literary warrant analysis, ontological analysis, peer review, agile software development, focus groups, personal reflection, and reflexive practice within the design process. These are all introduced and discussed in Chapter 2.

The first stage of my design involved developing an understanding of the problem domain as well as identifying the theoretical basis for likely design solutions. To this end I performed an analysis of recordkeeping literature, standards, and systems in order to both frame the research and clarify my understanding of the problem and solution domains. In doing so, I addressed the first of the research questions that I pose in Chapter 1.

1) *What emergent and theoretical approaches to recordkeeping address issues of disenfranchisement and participation?*

    i. *Can a comprehensive and consistent understanding of participatory recordkeeping be articulated?*

    ii. *What forms of interoperability are necessary to support participatory recordkeeping?*

    iii. *How can an interoperable and participatory recordkeeping infrastructure address issues of disenfranchisement and participation?*

I discuss these sub questions in the Chapter 3 literary analysis in which I identify the conceptual basis for structural problems in recordkeeping. I define and make a distinction between the archive and recordkeeping perspective, drawing on emerging ideas of the Archival Multiverse that embraces postmodern, postcustodial, and continuum theories of recordkeeping. I show how tensions between the assumptions and affordances of the archive perspective and custodial practice on the one hand, and the needs of a plurality of stakeholders on the other, give rise to the need for new participatory approaches to recordkeeping. I then show how semantic interoperability and an infrastructural approach to recordkeeping is necessary for hospitality to the pluralities inherent within Archival Multiverse; such hospitality forming the basis of participatory recordkeeping.

Limitations and Future work

As I declared in Chapter 1, I have not considered the juridical structures within which recordkeeping takes place. Such structures are deeply embedded and are difficult to change due to their entanglement with structures of societal power. Even the best recordkeeping system design can be thwarted by those with the law at their disposal. Understanding the foundations, reach, and limitation of (domestic and international) law of mandates for recordkeeping, the role of recordkeeping provenance in evidence, and the embodiment of rights in records are necessary for a full critical and sociomaterial treatment of recordkeeping systems. This is an important aspect of recordkeeping and one which bears further research.

9.2 Transformative design for participatory recordkeeping

Given this understanding of the problem domain and the structural issues to be addressed by participatory recordkeeping, my second research question concerns the capability of transformational design to address these issues.

2) *Can infrastructural and participatory approaches to recordkeeping be addressed through transformative design?*

Remember from Chapter 1, that the thrust of this second question concerns the possibility of transformative design to address the wicked problem of participatory recordkeeping. It also seeks to determine whether such a design is effective in addressing participants' needs in recordkeeping in terms of its breadth and flexibility in catering for different recordkeeping perspectives.

I will summarise my contributions from the design in terms of the elicited requirements, my models, and the proof of concept instantiation.

9.2.1 Requirements

In Chapter 4 I introduced and discussed the set of meta-requirements for participatory record-keeping; answering my fourth research sub-question introduced in Chapter 1.

> iv. *To what extent can the detailed requirements and goals for such a system design be articulated?*

These requirements comprised both the general patterns and anti-patterns of interoperable recordkeeping systems design, as well as the more detailed descriptions of the specific affordances needed to support participation in recordkeeping and participant-oriented interoperability of recordkeeping systems. These first, general, requirements were elicited through interviews with domain experts, a cohort comprising some European members of the ICA Expert Group in Archival Description along with some other academics and practitioners. I derived the more specific requirements through a warrant analysis of recordkeeping and other literature, recordkeeping standards, and existing recordkeeping systems. An account of all of these requirements is given in Chapter 4 and the detail of the specific requirements for participatory recordkeeping is given in Appendix C.

Findings and Contribution

While, perhaps, not of the stature of the *Functional Requirements for Evidence in Recordkeeping* outcome of the Pittsburgh Project (Cox, 1994), these requirements extend the recordkeeping mission to embrace the pluralistic agency of participants. In particular they demonstrate that such exercising of agency is a requirement across all aspects of recordkeeping.

In terms of the conceptualisation of recordkeeping (particularly as expressed through the development and/or adoption of recordkeeping metadata), I showed how these requirements could be expressed in terms of three-stages of developmental maturity and how the approaches taken in various jurisdictions can be considered to lie somewhere along this spectrum.

These stages are:

1. Artefact description
2. Artefact-Actor modelling
3. Activity Modelling

The first stage is concerned with the description of records-as-artefacts and is the realm of a finding aids.

The second is also artefact-oriented, but by introducing a formal treatment of actors and the 'business' functions they perform, provides a basis for metadata schemas such as found in the Australian Series System and recordkeeping standards such as ISO23081 (International Organization for Standardization, 2006b). However, it is the third stage that explicitly recognises records as being representations of human activity, with the implication that a record may represent many activities and any activity may be represented by many records. Significantly, activity modelling embraces a plurality of recordkeeping perspectives, and recognises that all participants in records need to be represented and potentially participate in recordkeeping activity. This has profound theoretical practical implications described below.

A Stage-3 conceptualisation therefore facilitates interoperability at all levels from the technical to the semantic (Ouksel & Sheth, 1999), and is the context in which I was able to develop my other design artefacts. Importantly, however, the reverse is also true: recordkeeping systems at Stage-1 or 2 levels of conceptualisation are unable to achieve participant-oriented interoperability.

Another important finding from these requirements is the nature of barriers to change in record-keeping systems as anticipated by my tenth research sub-question introduced in Chapter 1.

  x. *(In what ways does my design impact:) transitioning to a participatory paradigm?*

In particular, cross-jurisdictional and professional differences in the maturity of conceptualisation are an impediment to the diffusion of designs, the development of standards, and, ultimately, the acceptance of change in recordkeeping systems. Furthermore there are additional economic and organisational barriers to the transition from legacy systems including the quality and format of data, as well as a lack of understanding of the need for change. Surmounting these barriers may require the instantiation of participatory recordkeeping in the form of concrete systems that use existing data in order to both explicate new conceptualisations and demonstrate their practicality. Different instantiations may be needed for practitioner and management audiences.

Moreover, recordkeeping standards lie at the intersection of theory, practice and systems design. However differences in conceptualisation described above are a barrier to standard-setting for interoperable recordkeeping infrastructure. As discussed above, standards that are not based on a Stage-3 conceptualisation will be unable to support participant-oriented interoperability. This is the difference between Reference standards oriented toward compliance (as with existing recordkeeping standards) and Interface standards that facilitate interoperability (David, 1987).

Limitations and Future work

The specific requirements for participatory recordkeeping were obtained trough the literature which acted as a proxy for direct requirements elicitation. It is possible that requirements (and any associated issues) may have been missed or misinterpreted by the academics or practitioners conducting their research or projects depending on their stage of conceptual maturity. At some point, these requirements may need to be verified by dealing directly with participants in various contexts — if for no other reason than to gauge their relative importance or priority.

9.2.2 The models

The rest of the design emerged organically from the design science research activities, and comprised two models that were informed by the reflexive nature of the systems development method. The *Participatory Recordkeeping Continuum Model* began as an attempt to consolidate the requirements and emerged as a comprehensive functional model for participatory record-keeping as described in Chapter 5. It was published as 'Agency in the Archive: a model for participatory recordkeeping' in *Archival Science* in July 2016. The *Meta-model for Recordkeeping Metadata* was the result of a Stage-3 ontological analysis, and became the conceptual model of the design as described in Chapter 6. This model was published as 'Towards interoperable recordkeeping systems: A meta-model for recordkeeping metadata' in the *Records Management Journal* in June 2017.

Findings and Contribution

These design artefacts — the functional and conceptual models — provide evidence for an affirmative answer to my fifth research sub-question introduced in Chapter 1.

    v. *Can conceptual and other models be developed that express the characteristics and affordances of a meta-solution?*

These models do comprise a meta-solution that may be applied across the Archival Multiverse in a variety of contexts. As an expression of Stage-3 activity modelling, the models directly necessitate, justify, and support the need for differential and granular access and utility for participants in records and recordkeeping.

While the Participatory Recordkeeping Continuum Model addresses Huvila's (2011) call for "a model of different degrees of participation in archival contexts", it transcends the archive paradigm, embracing the full pluralism of the recordkeeping perspective. Furthermore by identifying the nature of agency in the records continuum, the Participatory Recordkeeping

Continuum Model leads to a refinement in records continuum theory; distinguishing between identifying the creators of records and the attribution of agency. In particular, the Participatory Recordkeeping Continuum Model complements the Records Continuum Model in order to address agency in the records continuum. These can be used as complimentary reference models to identify recordkeeping elements not only through dimensions of recordkeeping activity, but through the dimensions of participant agency as well. They can be used together as a guide for analysis and development of new sociomaterial participatory recordkeeping systems, or as post-hoc or forensic tools to investigate issues or gaps in existing systems.

Similarly, the Meta-model for Recordkeeping Metadata is, in effect, an ontology for pluralistic recordkeeping in the continuum; and one that supports the semantic interoperability of the model elements. As such, my conceptual model enables the interoperable documentation of traces as they manifest through the dimensions of the records continuum. One major feature of this model is the means by which it expresses recordkeeping pluralities in terms of representations of activity; effecting the shift from a Stage-2 to a Stage-3 recordkeeping conceptualisation. This is a shift from understanding a record as a distinct type of thing — as a first-class entity-type in a conceptual model — to the idea that the 'record-ness' of an entity exists by virtue of its relationships with other entities. This dynamic and contingent understanding of 'record-ness' enables a plurality of perspectives to be represented using the meta-model constructs. It also has interesting ontological implications that are discussed below.

Limitations and Future work

As I argued in Chapters 5 and 6, modelling is not a once-off exercise, but one that needs to constantly revised in light of a continually changing understanding of the problem domain. Similarly, beyond the evaluations that I performed in this study, both models need to be exercised in a wide variety of contexts in order to provide further validation and, perhaps, refinement of their constructs. In the case of the Participatory Recordkeeping Continuum Model, this would involve checking the applicability of the four dimensions and axes to a variety of participant scenarios as described in Chapter 5. Likewise, while the schema-mapping evaluations provide a high confidence in the Meta-model for Recordkeeping Metadata constructs, these too need to be tested within other modelling scenarios.

One other area that could be of further interest to understanding the conceptualisation of recordkeeping would be the development of metrics regarding the level of divergence between existing recordkeeping metadata schemas and standards, and my meta-model. Such a study could be a means of refining the three-stage taxonomy of conceptualisation and placing existing

systems within that framework. Using such metrics, it may be also possible to actually measure the 'power' or 'expressibility' of a given recordkeeping metadata schema as a quality indicator of such design efforts.

9.2.3 The proof-of-concept instantiation

Finally, the development and subsequent evaluation of the PaRIty proof-of-concept instantiation, discussed in Chapter 7, provided evidence of the implementability of the design and, in doing so, addresses the sixth and seventh research sub-questions introduced in Chapter 1.

  vi. *Can such a design be implemented?*

  vii. *How well can such an implementation fit the requirements for participatory recordkeeping design?*

Findings and Contribution

The PaRIty instantiation demonstrated the core aspects of the design: the creation of arbitrary activity-modelled and interoperable metadata schemas (including the schemas of legacy systems and standards) that enable the pluralistic expression of recordkeeping perspectives. The instantiation also demonstrated the (again, interoperable) documentation of 'recordkeeping-business' metadata that not only informs the provenance of recordkeeping material, but indicates how pluralistic agency and utility may be 'built-in' to such a system. The PaRIty system demonstrated that my design is a framework for the semantic interoperability of recordkeeping systems and a basis for Interface standards setting.

Limitations and Future work

As described in Chapter 7, my original intention was to implement an end-to-end (albeit constrained) recordkeeping system that exercised the models. However, the limitations of a single study meant that I focussed on instantiating the conceptual model as a means for demonstrating their documentation and interoperability aspects. Additional work is necessary to comprehensively demonstrate the full breadth of pluralistic agency and utility in a networked context. There are many avenues for further research in recordkeeping systems design and development, ranging from the investigation of standard schemes, to the exploration of implementation issues.

These include:

- While the meta-model supports the definition of granular access, utility, and reproduction rights, mechanisms for its support via network-oriented authentication and authorisation need to be investigated. Protocols such as oAuth (Hardt, 2012) are likely candidates for this functionality which must be able to protect resources at arbitrary levels of granularity across heterogeneous systems. Such protocols need to be tested using meta-model definitions of authentication and authorisation principals.

- Additionally, the PaRIty API only implemented read-only functionality. The API needs to be exercised in terms of create/update/delete functions in order to determine whether the ontology needs any additional constructs. Such a read/write API also needs to work in concert with the authentication/authorisation mechanisms described above.

- There is a need to standardise on the expression of various types that form the *Inscriptions* axis of the Participatory Recordkeeping Continuum Model. Perhaps ideas from theoretical work such as Agosti and Ferro's (2007) annotations model, contributions from the Text Encoding Initiative (TEI Consortium, 2016), or the Open Annotation Community (MIT, European Research Consortium for Informatics and Mathematics, Keio University, & Beihang University, 2017) may be of use here.

- A standardised scheme for interoperability of 'fuzzy' dates, periods, and date-ranges needs to be established. Perhaps an extension to the latest version of ISO8601 (still in draft) (Lewis, 2017) could be informed by existing standards or projects such as the Period-O gazetteer of period definitions for linking and visualizing data (Institute of Museum and Library Services, 2016).

- Similarly, the standardisation of schema versioning or the historical views of data — for example using technologies such as the Memento protocol (Van de Sompel, Nelson, & Sanderson, 2013).

- The degree to which the cardinality of relationships needs to be expressed within an interoperable implementation is also an open question. For example, at any given time, there can only be a maximum of eight members on a board with one chair. Should we constrain those cardinalities in an interoperable way and, if so, how could that be expressed?

- Similarly, while the models and the instantiation demonstrated the interoperability of recordkeeping perspectives, further work needs to be performed in user interface design for the meshed display of material originating from multiple sources. Beyond the innovative visualisation of cultural artefacts — such as the examples by Tim Sheratt (Sherratt,

2017) or Mitchel Whitlaw (Whitlaw, 2009) — such interfaces need to give full access to the pluralistic provenance of records, including documentation about what is and is not being displayed, from where it originated, and who has had a hand in its creation and maintenance. The visualisation of various (meta-model) types of relationship is also a fertile area of future investigation.

- The performance of graph-oriented processing needs to be investigated — perhaps via the exploration of parallelism, and white/black listing of nodes — in the recordkeeping context, in order to optimise loop-free discovery and access within a networked Archival Multiverse. This is similar to the problem of federated search in the bibliographic space, but complicated due the arbitrariness of domain schemas, and the granularity of access needed for agency in recordkeeping. Questions remain, too, about mechanisms for the display of amalgamated search results; including cross-site relevance rankings, the sequencing of such results, and their pagination (for example, how to calculate 'M of N filtered results from a total of P' in a parallel process). Possibly the application of graph-oriented databases for recordkeeping could also be investigated to see whether they shed any light on graph-oriented search and analysis in this context.

- To avoid the EAV/CR overhead, an 'Active Record'-like schema generation mechanism should be investigated to explore how input like the PaRIty schema import syntax could be used to create the necessary database tables that support such a schema.

9.3 Other ramifications for recordkeeping

Beyond the immediate context of a design that addresses participatory recordkeeping, there are ramifications of my findings that have broader applicability to recordkeeping and archive theory and, in doing so, potentially impact practice as well. This is the focus of the third research question posed in Chapter 1.

3) *In what ways does my design impact (mainstream theories of records, archives, and recordkeeping, professional practice, and transitioning to a participatory paradigm)?*

These consequences are largely due to a shift in logic that one must make when moving from a unitary to a pluralistic conceptualisation of records, and from a closed world assumption to the open world one.

9.3.1 Theory

In Chapter 8 I discussed the ways in which my findings inform recordkeeping theory, addressing the eighth research sub-question posed in Chapter 1.

viii. *(In what ways does my design impact:) mainstream theories of records, archives, and record-keeping?*

Importantly, my design demonstrates that not only can the constructs of postmodern, post-custodial, and continuum perspectives be implemented in a tangible recordkeeping system, but they serve to address issues of disenfranchisement through the application of participatory recordkeeping. But, beyond that, there are a number of contributions to this body of knowledge that this research has generated.

Findings and Contribution

As described above, the main contribution of the Participatory Recordkeeping Continuum Model to these discourses is that it is model of agency. In dealing specifically with the dimensions of agency in recordkeeping, it complements the Records Continuum Model dimensions of recordkeeping activity. Together, they serve to provide a more complete account of the records continuum.

Similarly, as an ontology for the records continuum, the Meta-model for Recordkeeping Metadata deals with this agency explicitly, differentiating between purposeful *Enactment* of activities and the more passive *Involvement*. This has implications for various recordkeeping and archive perspectives that conflate the act of creation of a record (or its 'ownership') with the attribution of rights in that record and its use within the Archival Multiverse.

The meta-model works equally as well for performative records as it does for inscriptions of all types. It introduces the idea that 'record-ness' is not an inherent property of an object (or a performance) but exists by virtue of that entity's relationships with other entities. The meta-model, therefore does away with the 'Record' as a primary entity type as well as various constructs and aggregations such as *fonds*, *record group*, *series*, *item*, and so on. The meta-model does this via a *Representation* relationship that allows a given record (as defined as a Substantial or Performance entity within a domain schema) to represent a number of activities and an activity to be represented by a number of records — as it must, in order to support a plurality of recordkeeping perspectives.

It is this Representation relationship — the nature of which (or even it's existence) can change over time — that leads to a performative epistemology of recordkeeping; which, in turn, explains previous continuum-thinking findings such as McKemmish's (1994) "records are always in a process of becoming" and Upward's (2011) "flicker". Importantly, that this performativity underscores the temporal nature of the Archival Multiverse and repudiates the prevail-

ing paradigm of a one-time intellectual treatment of records. Such treatment is usually found within the archive perspective; involving 'set-and-forget' mechanisms such as record (disposition) schedules and accession-time description. Instead, a major ramification of this design is that such 'recordkeeping-business' is actually required to be perpetually, and iteratively performed over time[58].

The open world assumption means that there is no single arbiter of truth in the universe of discourse. If "anyone can say anything about anything" (Berners-Lee, 1997) — and such utterances may change across space and through time — then provenance within the Archival Multiverse cannot be absolute. The moral defence of the record, then, is couched not in terms of a single unbroken chain of custody and interpretation (though that may well be a significant strand in the fabric of evidence), but in terms of the recognition of the multiple participants in records and their ongoing recordkeeping needs.

In other words, my design implies a re-definition of the moral defence of records in terms of ensuring sufficiently interoperable sociomaterial systems that facilitate participatory engagement with stewarded material. It is for this reason that the documentation of the 'recordkeeping-business' described above needs to be exposed in an interoperable manner. The availability of the full context of a record provides for its provenance within the pluralistic recordkeeping paradigm. Knowledge of 'who did what and when' in relation to a record and its documentation is crucial for assessing the evidential quality of the material and therefore its claims. The provision of all of this documentation, then, is core to the moral defence of the record in a pluralist paradigm.

Similarly, in a pluralist paradigm the archival threshold becomes the point at which the record is introduced into a participatory recordkeeping framework; thus ensuring its pluralistic moral defence.

Implications and Future work

If moral defence is defined in terms of a plurality of perspectives, how will the veracity of evidence be defined in the face of multiple, and perhaps competing, interpretations of events and their representation in records? How does one determine which account to accept? A key area of future recordkeeping research will need to be the investigation of mechanisms for inferring trust amongst networked actors in a recordkeeping context. This could involve the development

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[58]Even if recordkeeping-business activities, such as appraisal in an archive context, are performed more than once (with a view to check, review, or refine disposal schedules) this is still a manifestation of isolated and discrete instances of intellectual control and not the perpetual, granular, dynamic, and iterative process that is required for participatory recordkeeping.

of trust or reputation metrics (i.e. perhaps a Bayesian approach rather than authority by fiat) and may touch upon cryptography, graph processing techniques, and social network analysis. This may end up being a practice concern, rather than a theoretical one, but it should be considered from a theoretical basis in the first instance.

9.3.2 Practice

This pluralistic and contingent paradigm also introduces new challenges for recordkeeping practice. I described these in Chapter 8, addressing the ninth research sub-question that I posed in Chapter 1.

> ix. *(In what ways does my design impact:) professional practice?*

Findings and Contribution

The ability of the meta model to support the documentation all of the contexts of a record — from the activities that it may represent, through the circumstances of its creation and capture, to the ongoing recordkeeping activities in which it may be involved — is an important step in being able to satisfy the management requirements of recordkeeping standards such as ISO 23081 (International Organization for Standardization, 2006, pp. 16–23) in an interoperable way.

This documentation is expressed through systems design that result from analyses of record-keeping situations. In pluralistic recordkeeping contexts, these are not one-time analyses, but the perpetual and iterative intellectual treatment of records described above. Moreover this treatment needs to employ both the Records Continuum Model and the Participatory Record-keeping Continuum Model in order to identify recordkeeping elements not only through dimensions of recordkeeping activity, but through the dimensions of participant agency as well.

Implications and Future work

Before an Interface standard for participatory recordkeeping can be established, there are several additional theoretical and practical issues that need to be resolved to ensure interoperability in a networked Archival Multiverse. These include a framework for the negotiation of rights in records; and the further development of recordkeeping analysis for a plurality of contexts.

The first major issue is how competing rights in records may be resolved. Despite discussion in the literature on the origin, nature, and import of rights in recordkeeping, this issue has not been satisfactorily addressed as a practical problem because contemporary recordkeeping

and archive approaches have not provided a suitable systemic context for such ethical issues to be explored. Perhaps some form of Negotiation Support System (NSS) could be investigated for their ability to enable participants to arrive at an optimal outcome that maximises their respective rights in records — while understanding that some sets of rights may, in fact, be incommensurate. Obviously the output from such negotiations needs to be documented in a meta-model compliant way. Nonetheless, such technology could be a useful addition to the participatory recordkeeping tool-kit.

Secondly, as described above, the one-time functional analysis for recordkeeping systems needs to become an ongoing review of records and recordkeeping across space and through time. Such a review would use the Records Continuum and Participatory Recordkeeping Continuum Models together to examine a given domain of activity in order to identify activities, participants, candidate records, access roles and future management plans. This analysis could potentially be augmented with ideas from other, related disciplines to round out its participatory aspects. For example: aspects of the Soft Systems Methodology (Checkland, 2000), protocols from inclusive research design (McKemmish, Burstein, Manaszewicz, Fisher, & Evans, 2012), examples of engagement from community informatics (Gurstein, 2003), or practices of co-design (Lee, 2008) to name a few.

9.3.3 Transition

Finally, as foreshadowed in the requirements for participatory recordkeeping described in Chapter 4, the transition between conceptual stages and, in particular, the transition to a participatory recordkeeping paradigm, poses some specific challenges. This issue is the basis for the tenth research sub-question that I posed in Chapter 1 and addressed in Chapters 4 and 8.

> x. *(In what ways does my design impact:) transitioning to a participatory paradigm?*

The barriers to transition relate to the readiness of individual professionals and organisations for structural change, together with several technological prerequisites for migration between systems.

Findings and Contribution

Some of the professional barriers to transition stem from the generational attitudes and practices of recordkeeping professionals and a resistance to fundamental shifts that may appear at odds with the conceptualisations upon which they have built their career. As I found in Chapter 4, perhaps this is due to unfamiliarity with the abstract nature of conceptual models, or even a lack of education in the sector on how to 'read' a model (Hofman, 2017, p. 648). However, it

is not the change per se, but the leap from conceptualisation to practical implementation that is the stumbling block. Either way, my findings indicate that the single most effective way of addressing such resistance is through the use of model instantiations or even comprehensive tools that explicate new approaches for recordkeeping systems and standards design. It is therefore important to develop a proof-of-concept as early as possible in order to engage the community and short-circuit debates around paper models.

A similar argument holds for organisational reticence for change. Normally, justification needs to be made in terms of a business case for financial or compliance reasons and not simply an improvement in recordkeeping service provision. Unfortunately, 'business' benefits may not necessarily be quantified a-priori as, in an interconnected world, network effects result in emergent opportunities and successes. Perhaps, again, one way of approaching this is through the instantiation of models as a path to their acceptance in the management context — practical demonstration, perhaps with familiar data, rather than dwelling on theory. One opportunity for such communication is through addressing the fear by management (and indeed members of the recordkeeping profession) of increased complexity — through demonstration of the power of interoperable, schema-based documentation.

Note that a complete re-analysis is not necessary for the inclusion of legacy systems in an interoperable infrastructure. For example, the PaRITY proof-of-concept system demonstrated that legacy Stage-2 documentation — such as that from the Australian Series System or well-formed and comprehensive ISAD-G/ISAAR-CPF metadata — can be mapped to the meta-model in a straightforward manner. It is also not difficult to see how an automated approach could be developed to present existing recordkeeping documentation in this way. Not only does this provide a transition from legacy to participatory recordkeeping, but it suggests that this sort of demonstration or pedagogical re-presentation of jurisdictional metadata is feasible.

Nonetheless, I Identified three technical prerequisites for transition to a participatory recordkeeping infrastructure, to ensure that the data can interoperate within the Archival Multiverse. The first is that there is Stage-2 documentation of material in the first place. Obviously the transition path to interoperability will be more difficult for collections that are solely documented by finding aids or other inventory-management catalogues. The second technical prerequisite is the assignment of unique identifiers to records and/or their aggregations as well as to all contextual entity and relationship metadata elements in order for them to be referenced from external systems as first-class internet resources. As described in Chapter 8, there are a number of schemes which may be employed for such identifiers. Finally, linked contextual metadata

elements are fundamental for recognising the pluralities and interconnectedness of records and recordkeeping. The third technical prerequisite is the establishment of these links using the unique identifiers established above. Note that this identifying and linking requires conscious effort to ensure that they persist on recordkeeping time-scales.

In Chapter 8 I showed how such linked records and metadata could be automatically transitioned into an interoperable infrastructure using a similar mechanism to the schema-mapping evaluations described in Chapter 7. It is exactly this sort of transition that could be used to quickly mock-up existing holdings for use used as a pedagogical tool for practitioners (or 'marketing' tool for management) that addresses some of the conceptual barriers to adoption identified in Chapter 4.

Limitations and Future work

In Chapter 8 I discussed how legacy schemas can be implemented in PaRIty, and that such an approach could be used to transition existing recordkeeping documentation into interoperable infrastructure. Further research is needed to comprehensively validate this assertion and, in particular, understand the limitations and trade-offs in automating transition an activity-based orientation.

9.4 Design science for wicked problems

Finally, I would like to discuss the implications for using the design science methodology in the investigation of recordkeeping problems. Design science is an interventionist methodology concerned with the generation of insight through the creation of design artefacts that address sociomaterial Information Systems. There are issues, however, in the way that the formalisation of design science impacts studies that attempt to explore transformative design, such as was the case of my research.

Findings and Contribution

As an interventionist approach, design science can employ a critical stance that seeks to understand and address the power, subjugation, and inequality imbued in the sociomaterial nature of Information Systems. Importantly, a critical interventionist perspective employs an abductive logic of 'what if' that can create new constructs, new conceptualisations, and new paradigms in order to understand what 'might be' or the nature of alternative 'possible worlds' in such contexts. Despite this, design science has historically been conducted within an organisational context and with an uncritical perspective on organisational informatics. Thus the norms for de-

sign science research revolve around incremental change in a 'useful tools for business' paradigm — and not one that addresses broader sociomaterial issues or offers up inventive, new solutions that address issues surfaced by critical analysis.

The main outcome of this tension is that the guidelines for rigour in the evaluation of design science artefacts do not accord with the realities of transformational research. Formal design science aspires to naturalistic, in-situ evaluation of artefacts with Sun and Kantor's (2006) "real users, real problems, and real systems". However, such evaluation requires an existing baseline user experience, technical framework, and sociomaterial context against which such artefacts may be evaluated. Again, such an assumption lends itself to incremental improvement of new designs (for example, an algorithm, visual display, process etc.) rather than inventive paradigm shifts.

On the other hand, a transformative design may not any have baseline user experience, technical framework, or sociomaterial context against which to evaluate. Thus, within conventional design science guidelines, the evaluation of such inventive or transformational design artefacts is nigh impossible — or, a least, not recognised as possessing appropriate rigour. There is also the academic problem that such a perceived lack of rigour may be a barrier to publication. Nonetheless, it makes no sense to suggest that inventive design science cannot be performed rigorously. Therefore the design science guidelines for artefact evaluation need to be interpreted differently when investigating a transformative design. In my case, I demonstrated that evaluation by proxy — i.e. the focus group walkthroughs conducted with domain experts — triangulated with laboratory evaluations and agreement with theory, indicated provisional, yet sufficient, evidence of my design as a promising solution for participatory recordkeeping.

Even so, the aspiration for evaluation with Sun and Kantor's 'reals' remains. The investigation of transformative design needs to proceed with successive 'slices' of a complex problem investigated, perhaps, sequentially. Design artefacts corresponding to problem 'slices' may be almost meaningless to end-users, however they should be understandable to the community of experts. Design cycles would then be repeated, with the learning from earlier cycles, other studies, and different slices forming part of the justificatory knowledge that informs later efforts.

Furthermore, design science instantiations may need to be created with an eye to their incorporation within a broader technical framework. While not sufficiently robust for production use, such an infrastructural capability could support future design science evaluations that are closer to the aspirational 'reals'. Such a testable infrastructure would, however, be a double-edged sword. The ability to move nearer to realistic evaluation is attractive, however the constraint

of working within a pre-existing framework of previously created instantiations may impact inventiveness and creativity. Nevertheless, even findings of a mismatch of fit to previously created artefacts can contribute to an understanding of the problem domain. This is simply the design science methodology executed on a larger scale — micro-iterations, for example, using a systems development method, macro iterations concerning a particular artefact, and 'super' iterations building up artefacts into transformational infrastructure against which more conventional evaluations may be conducted.

Limitations and Future work

The way forward for research such as mine is through the formalisation and acceptance of these mechanisms in the use of design science in tackling wicked problems[59]. In addition to the idea of super' iterations that aggregate the findings from multiple investigations of aspects of wicked problems, such an approach also needs to embrace a broader critical epistemology applicable to sociomaterial IS. Additionally, it needs to take a transdisciplinary perspective — including, not only, viewpoints from other IS disciplines, but from 'foreign' disciplines as well, depending on the domain of research.

Conclusion

So, is there hope for the disenfranchised in records? As is the case with all wicked problems, there is no simple answer to such questions. True, I have demonstrated that we can design such systems so that they better serve all of the stakeholders in records. Moreover, the findings from this project do lay the foundations for an approach to participatory recordkeeping. My design addresses the structural flaws in current recordkeeping structures and systems and, by introducing a new conceptual basis for recordkeeping systems, it provides mechanisms by which many of these issues can be mitigated if not eliminated.

However, whether or not this research will have broader impact is an open question. An understanding of participatory recordkeeping provides a path towards more equitable recordkeeping. However, as I have discussed, professional, societal, and economic challenges still remain. There is also much more that needs to be investigated before we can claim a successful transformation of recordkeeping. This research provides a way forward; what is needed now, is the will to take it.

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[59] And those performing design science research in the recordkeeping space would be aptly placed for this, given the scope and sociomaterial import of such work.

Afterword

So, there you have it. This project has indeed been quite the journey — I am wiser for it, and I hope that my contribution will make some small dent in the world of recordkeeping.

As I suggested in the preface, the development of a thesis is a drawn out process of discovery in its own right, and I am sure that some shifts in my perspectives and understanding, and even language, are perceptible as I progressed through the writing. Interestingly, as a record of my research project, the thesis changed internally even as it was being written.

To get even more meta, this thesis is but one *representation* of the cluster of *performances* that made up my doctoral project. But there are other representations such as publications and presentations, and I trust that there will be more in the future. The temptation while writing has been to go back and tweak passages in this thesis to update it with my thoughts du jour. I am sure that, even after it is submitted for examination, I will have further ideas or interpretations that I would have liked to include.

In so many ways, the journey is never over. The discovery is ongoing. The record, indeed, is always in a process of becoming.

Part IV

References, Glossary, and Appendices

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Glossary

<div align="center">Table G: Glossary.</div>

Term	Definition
Active Record	An implementation of an object-relational mapping pattern that connects application classes to relational database tables with (almost) zero configuration.
APEx	Original project acronym for the Archives Portal Europe aggregation initiative.
API	Application Programming Interface.
ARK	Archival Resource Key — persistent identifier for internet objects.
CIDOC-CRM	International Council of Museums, International Committee for Documentation, Conceptual Reference Model — a museum conceptual model.
CSV	Comma Separated Value — a text-based file format.
EAC	Extended Archival Context — an encoding standard for ISAAR-CPF metadata.
EAD	Extended Archival Description — an encoding standard for ISAD-G metadata.
EAV; EAV/CR	Entity Attribute Value — a data modelling pattern that stores individual entities and attributes as entries in Entity, Attribute, and Attribute Value tables. The extension of EAV databases into object-oriented modelling is termed EAV Classes and Relationships or EAV/CR.
Edge	In a graph or network, an edge is a line or link joining two nodes.
EGAD	Expert Group on Archival Description — ICA team constituted to develop the next generation of ICA archival standards.
FOAF	Friend Of A Friend — a machine-readable ontology describing persons, their activities, and their relations to other people and objects.
FRBR;FRBR-oo	Functional Requirements for Bibliographic Records — a bibliographic conceptual model. FRBR-oo is the object-oriented version of this model (harmonised with CIDOC-CRM).
Graph	A network comprising two or more nodes and the edges which connect them.

Term	Definition
HATEOAS	Hypertext As The Engine Of Application State — a constraint of the ReST application architecture that holds that application state can only be expressed in terms of HTTP requests and responses.
HCI	Human Computer Interaction.
HTTP	Hypertext Transfer Protocol — an application protocol for distributed and collaborative hypermedia.
ICA	International Council on Archives — the peak international body representing archival institutions and practitioners.
InterPARES	International Research on Permanent Authentic Records in Electronic Systems — a recordkeeping research programme, now in its fourth phase.
IS	Information Systems.
ISAAR-CPF	International Standard for Archival Authority Records — an ICA standard.
ISAD-G	General International Standard Archival Description — an ICA standard.
ISDF	International Standard For Activities/Functions — an ICA standard.
ISDIAH	International Standard for Describing Institutions with Archival Holdings — an ICA standard.
JSON	JavaScript Object Notation — a lightweight data-interchange format commonly associated with web-based APIs.
JSON-LD	JavaScript Object Notation for Linked Data — a representation of LOD documents in JSON.
LOD	Linked Open Data — the practice of sharing information on the Semantic Web using URIs and RDF.
LODLAM	Linked Open Data in Libraries, Archives, and Museums — an informal network of individuals interested in LOD for galleries, libraries, archives, and museums.
MADS	Metadata Authority Description Schema — U.S. metadata schema for authority records.
MARC	Machine Readable Cataloging — a biblographic metadata standard for cataloguing
MVC	Model View controller — an application development pattern focussed on separation of data, logic, and interface concerns.

Term	Definition
Node	A point in a graph or network that is connected to other nodes via edges.
NSS	Negotiation Support System.
OAI	Open Archives Initiative — organisation that develops and promotes interoperability standards for archives.
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting — OAI protocol for the exchange of metadata between archival systems.
OCLC	A global library cooperative that provides shared bibliographic technology services.
OOHC	Out Of Home Care.
OWL	Web Ontology Language — a semantic Web language designed to represent rich and complex knowledge about things, groups of things, and relations between things.
PROV-O	Provenance Ontology — OWL vocabulary used to represent and interchange provenance information (information about entities, activities, and people involved in producing a piece of data or thing).
RAD	Rules for Archival Description — Canadian archives metadata standard.
RDA	Resource Description and Access — a bibliographic cataloguing metadata standard.
RDBMS	Relational Data Base Management System.
RDF	Resource Description Framework — a standard model for data interchange on the Semantic Web.
ReST	Representative State Transfer a stateless, client-server API pattern based on HTTP.
RIC	Records In Contexts — a conceptual model proposed by the ICA EGAD.
Semantic Web	A development of the World Wide Web in which data in web pages is structured and tagged in such a way that it can be read directly by computers.
SIAF	Service interministériel des Archives de France — a heritage service of the French Ministry of Culture that deals with managing archives.
SNAC	Social Networks and Archival Context project — a recordkeeping metadata exchange consortium that maintains a graph of EAC encoded records .

Term	Definition
TEI	Text Encoding Initiative — a consortium which collectively develops and maintains a standard for the representation of texts in digital form.
URI	Uniform Resource Identifier.
VIAF	Virtual International Authority File — OCLC-hosted name authority service.
WAR	Web Archive — file format for packaging web applications.

Appendix A: Instruments

A.1 Requirements Interview Guide

The following is the interview guide that formed the basis for the semi-structured interviews conducted for requirements elicitation, described in Chapter 4.

Project: Transforming archival systems design for interoperability

Interview Group 1: List of questions to form basis of the semi-structured interviews

Background

- What is your background/interest in archival systems interoperability?

- What do you think the challenges are in community access to archives, particularly with respect to networked archival systems?

- Describe the background of your archival systems project. How did it come about?

- What was the scope of the project? What were its aims or goals; it's critical success factors?

- What was your role? How many people were directly involved in the project? What were their roles?

- For how long did the project run or if it is still running, describe the phases or iterations of the project.

- Describe the target stakeholders of the project. What were their needs?

Development

- What development approach do you take for designing interoperable archival systems?

- What technologies do you consider key for interoperable archival systems?

- What standards or protocols do you consider key for interoperable archival systems?

- What other projects or initiatives were major influences in your work?

- Which aspects of interoperable systems design are the most challenging?

Reflection

- How do you view the success or otherwise of your systems? Are they meeting its goals; its critical success factors?

- Is there anything in your design you didn't expect (or want) to do that you had to?

- Is there anything in your design you expected (or wanted) to do that you couldn't?

- If you had to (or are) doing it again, would you do (are you doing) anything differently?

- What did you learn about archival systems development? What recommendations would you make to other individuals or organisations attempting similar projects?

A.2 Evaluation Focus Group Guide

The following is the guide for the focus group evaluations, described in Chapter 7.

Project: Transforming archival systems design for interoperability

Group 1:   List of questions to form basis of the semi-structured focus group

Statement of Requirements

- What do you think the challenges are in designing for participatory access to archives, particularly with respect to web-based systems?

- Is the statement of requirements clear; comprehensive; of sufficient detail?

- Do you think the statement of requirements adequately captures the significant issues with respect to participatory archiving?

- What would you like to see added or removed from the statement of requirements?

The reference model

- Is the reference model clear; comprehensive; of sufficient detail?

- Does the reference model accurately represent current aspirational requirements for archival systems informatics? If not, what's missing, wrong, and/or extraneous?

- Does the reference model address issues of participatory access in a web-based systems context?

- Do you think the reference model has practical value in informing archival systems development?

- What would you like to see added or removed from the reference model?

The prototype implementation

- Is the prototype implementation an accurate implementation of the reference model?

- Do you think the prototype implementation has practical value in informing archival systems development? Do you think the approach resulted in a usable API; a usable tool?

- Is there anything that you would like to see added to, removed from, or changed in the prototype implementation?

Reflection

- Based on the statement of requirements, the reference model, and the prototype implementation, would you like to see more research in this direction? If so, what form should this research take? What are the key questions this work has raised for you?

Appendix B: Literary Warrant Sources

As described in Chapter 4, number of sources were selected using a snowball approach for use in the literary warrant analysis for requirements elicitation. The final list of sources is as follows:

B.1 Reports and research literature

Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN). (2012). *Aboriginal and Torres Strait Islander protocols for libraries, archives and information services.* Australian Library and Information Association. Retrieved 2017-08-11 from `http://aiatsis.gov.au/sites/default/files/docs/collections/atsilirn-protocol.`

Bingo, S. (2011). Of Provenance and Privacy: Using Contextual Integrity to Define Third-Party Privacy. *The American Archivist*, 74(2), 506–521.

Caswell, M. (2013). Rethinking inalienability: trusting nongovernmental archives in transitional societies. *The American Archivist*, 76(1), 113–134.

Caswell, M. (2014). Toward a survivor-centered approach to records documenting human rights abuse: lessons from community archives. *Archival Science*, 14(3–4), 307–322. doi: 10.1007/s10502-014-9220-6

Committee on best practices and standards - working group on access. (2014). *Principles of Access to Archives.* International Council on Archives. Retrieved 2017-08-11 from `http://www.ica.org/13619/toolkits-guides-manuals-and-guidelines/principles-of-access-to-archives.html`

Department of Social Services, Commonwealth of Australia. (2015). *Access to Records by Forgotten Australians and Former Child Migrants: Access Principles for Records Holders, Best Practice Guidelines in providing access to records.* Commonwealth Government. Retrieved 2017-08-11 from `https://www.childabuseroyalcommission.gov.au/downloadfile.ashx?guid=5177243f-0484-48ab-9984-46a07e3e1f04&type=exhibit&filename=DHS.3148.001.0079&fileextension=pdf`

Duff, W. M., & Harris, V. (2002). Stories and names: archival description as narrating records and constructing meanings. *Archival Science*, 2(3–4), 263–285.

Farley, L. (2014). The participatory finding aid and the archivist: how user annotations are changing everyone's role. *Archival Issues*, 35(2), 79–98.

Gilliland, A. (2013). *Conceptualizing Twenty-first Century Archives.* Chicago, IL: Society of American Archivists.

Gilliland, A. (2014). Reconceptualizing records, the archive and archival roles and requirements in a networked society. *Knygotyra: Book Science*, 63, 17–34.

Gilliland, A., & McKemmish, S. (2014). The Role of Participatory Archives in Furthering Human Rights, Reconciliation and Recovery. In Archivio di Stato (Trieste), Mednarodni Institut Arhivskih Znanosti (Maribor), *Atlanti : review for modern archival theory and practice*. Trieste: Archivio di Stato.

Huvila, I. (2008). Participatory archive: Towards decentralised curation, radical user orientation, and broader contextualisation of records management. *Archival Science*, 8(1), 15–36. doi: 10.1007/s10502-008-9071-0

Iacovino, L. (2011). Beyond distributed networks: Participatory governance of digital memory [Ma! is ala de redes distribuidas: Gobernanza participativa da memoria dixital]. In *The Future of Memory: The Digital Archival Heritage [Futuro da Memoria: O Patrimonio Arquivistico Dixital]* (pp. 41–72). Arquivo de Galicia.

Iacovino, L. (2015). Shaping and reshaping cultural identity and memory: maximising human rights through a participatory archive. *Archives and Manuscripts*, 43(1), 29–41. doi: 10.1080/01576895.2014.961491

McCarthy, G., & Evans, J. (2012). Principles for archival information services in the public domain. *Archives and Manuscripts*, 40(1), 54–67. doi: 10.1080/01576895.2012.670872

Office of the Australian Information Commissioner. (2014, January). Privacy fact sheet 17: Australian Privacy Principles. Retrieved 2017-08-11 from `http://www.oaic.gov.au/images/documents/privacy/privacy-resources/privacy-fact-sheets/privacy-fact-sheet-17-australian-privacy-principles_2.pdf`

Orentlicher, D., & United Nations. (2005). *Impunity : report of the Independent Expert to Update the Set of Principles to Combat Impunity*. Geneva: United Nations.

Paterson, L. (2007). Protocols for Native American Archival Materials. In *Proceedings of the 5th International Indigenous Librarians Forum* (pp. 70–94). Brisbane, Australia: Aboriginal and Torres Strait Islander Library Information and Resource Network Inc. (ATSILIRN).

Ross, F., McKemmish, S., & Faulkhead, S. (2006). Indigenous knowledge and the archives: designing trusted archival systems for Koorie communities. *Archives and Manuscripts*, 34(2),

112–151.

Sellie, A., Goldstein, J., Fair, M., & Hoyer, J. (2015). Interference Archive: a free space for social movement culture. *Archival Science*, 15(4), 453–472. doi: 10.1007/s10502-015-9245-5

Shilton, K., & Srinivasan, R. (2007). Participatory appraisal and arrangement for multicultural archival collections. Archivaria, 63, 87–101.

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Wood, S., Carbone, K., Cifor, M., Gilliland, A., & Punzalan, R. (2014). Mobilizing records: reframing archival description to support human rights. *Archival Science*, 14(3–4), 397–419. doi: 10.1007/s10502-014-9233-1

Wurl, J. (2005). Ethnicity as provenance: in search of values and principles for documenting the immigrant experience. *Archival Issues*, 29(1), 65–76.

Yaco, S., Jimerson, A., Anderson, L. C., & Temple, C. (2015). A web-based community-building archives project: a case study of Kids in Birmingham 1963. *Archival Science*, 15(4), 399–427. doi: 10.1007/s10502-015-9246-4

B.2 Systems

Ara Irititja project. See `http://www.irititja.com/index.html`. Also `http://wiki.ara-irititja.com/index.php/Main_Page`

Mukurtu CMS. See `http://www.mukurtu.org/`

Plateau Peoples' Web Portal. See `http://plateauportal.wsulibs.wsu.edu/html/ppp/index.php`

Recollect by NZ Micrographic Services Ltd. See `http://recollect.co.nz/`

Topothek project. See `http://www.topotheque.eu/`

Appendix C: Detailed Requirements

This appendix provides a detailed explanation of the elicited requirements summarised in Chapter 4 that act together to support participatory recordkeeping. In the following, the term "the system" is used to denote this larger network of individual socio-technical systems. Note that, as these requirements are aspirational, normative terms such as "shall" and "must" have been eschewed in favour of terms such as "needs to" and "should". The requirements are described in terms of their origin from the literary warrant sources and organised by category.

C.1 Overall architecture and design approach

In addition to the general notions of interoperability as described in Chapter 3, the following architectural and design requirements have been identified:

Distribution, interoperability and standardisation

(a) Effective participatory recordkeeping is concerned with pluralities of records, of systems, and of communities (Gilliland, 2013; Huvila, 2008; McCarthy & Evans, 2012). While not all functionality will be supported by every system in the network, collectively, the distributed systems should interoperate to facilitate all functions. McCarthy and Evans (2012) emphasise the need for standardisation and interoperability; similarly I have previously argued that jurisdiction-oriented customisation is a deterrent to access and utility (Rolan, 2015). This standardisation and interoperability should be 'designed-in' from the start and cannot be 'bolted-on' as an additional layer or afterthought (J. Evans, 2007; Rolan, 2015).

(b) Records and documentation need to be exposed in such a way as to allow interlinking between distributed systems (Gilliland, 2013).

(c) Note that the distributed nature of systems places an onus on system designers and operators to be especially vigilant in order to "respond to and protect against potential vulnerabilities, particularly those relating to privacy and security, that might be exposed" (Gilliland, 2014c).

Hospitality to participants

Most sources describe the system as a safe space for a 'conversation' around records rather than the presentation of "given" material (Washington State University's Libraries, Manuscripts, Archives and Special Collections (MASC), Museum of Anthropology, & National Donors, 2009).

(a) The system needs to provide 'virtual spaces' that can be configured to support differentiated rights in records (Gilliland & McKemmish, 2014). Hospitality may be expressed in terms of upholding rights of all participants (Department of Social Services, Commonwealth of Australia, 2015; Duff & Harris, 2002; Iacovino, 2011); the ability to hold alternative viewpoints, sub-narratives and counter-narratives simultaneously; striving to not 'shoe-horn' material, viewpoints, or participants into pre-conceived categories; pursuing the de-marginalisation of groups and avoidance of "speaking-for" them (Duff & Harris, 2002); and transparent operation for all participants (Committee on best practices and standards - working group on access, 2014).

(b) In particular, access should be granted for all parties engaged in accountability determination including victims and any accused. Access controls may not be used as a form of censorship (Orentlicher & United Nations, 2005).

(c) McCarthy and Evans (2012) also note the need for the system to communicate with end users and encourage engagement.

(d) The system needs to provide a mechanism for identifying and/or accepting nominations for participants (Department of Social Services, Commonwealth of Australia, 2015) and a workflow system for determination of their status.

Simplicity of administration and use — without being simplistic.

(a) One of the keys to hospitality is to design interfaces to be as simple as possible, while facilitating distributed and pluralistic documentation and access to material (Department of Social Services, Commonwealth of Australia, 2015). This is not to say that the system should be simplistic, just that open systems need to pursue clarity (rather than jurisdiction-oriented complexity — see interoperability above). Some extant systems are built upon this principle (ICARUS, 2015). Others have explored hybrid approaches employing the sorts of social networking technology with which participants may already be familiar (Farley, 2014).

(b) Resources should be allocated a persistent identifier, and global standards for represen-

tation and information interchange (McCarthy & Evans, 2012) should be developed in order to support this notion of simplicity along the lines of emergent Web 2.0 technologies (O'Reilly, 2005).

Flexibility in operation

Hospitality is also achieved through the flexibility of system design.

(a) The system should embrace material in a variety of formats and languages (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012).

(b) It should also provide a platform for the flexible definition of community protocols (for example for access and utility) acknowledging that these will evolve and promulgate over time (Gilliland, 2013).

Notions of stewardship and the archivist role of facilitator rather than a custody/gatekeeper paradigm

Central to the concept of participatory recordkeeping is the idea of stewardship in favour of custody. Stewardship has, as its goals, preservation and access that facilitate memory (Wurl, 2005). Stewardship treats archival material less as property and more as a jointly held cultural asset (Wurl, 2005). Iacovino (2011) notes that changed attitudes towards property rights are needed to fully embrace this idea[60].

(a) The system needs to separate ownership and control of records from their stewardship. It should support archivists to relinquish control in a structured manner in order to build value through collaboration (Duff & Harris, 2002; Iacovino, 2015).

(b) The system should support community groups as specialists and integration points for records held elsewhere (Huvila, 2008; Trust and Technology Project, 2008).

C.2 Access control

One of the major differences between traditional archive portals and participatory systems is that while the former generally has two levels of access and utility (full access to all material by archivists; and public, read-only access to a sub-set of materials by everyone else[61] — see Reed (2014), J. Evans et al. (2015), and, as an example of the affect of such regimes, Wilson and Golding (2015)), participatory achieving calls for a granular and flexible authorisation regime. The

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[60]Whether or not the current intellectual property paradigms (principally copyright law) are appropriate for archival material is a whole other matter and beyond the scope of this argument.

[61]Of course this generalisation does not take into account other mechanisms such as the shallow participatory affordances described in Chapter 3 or other paths to access such as requests under Freedom of Information or similar legislation. The point is that the primary portal-based access mechanism for archival material is generally two-tiered.

requirements for access control may be considered according to three interdependent aspects: Authentication, Authorisation, and Reproduction Rights Management. Additionally, from an integrity and provenance perspective, records of changes to material and metadata need to be kept and made available (International Organization for Standardization, 2006a).

C.2.1 Authentication

Authentication is concerned with identifying users of the system so that appropriate access to system functions may be authorised.

Granular and flexible authentication

(a) In the case of participatory recordkeeping, once the need for granular access control is acknowledged, it is necessary to be able to verify the identity of participants that require access at arbitrary level of granularity. Several sources note that participants may be individuals, families, communities, organisations or other groupings of actors (for example, Huvila (2008); Department of Social Services, Commonwealth of Australia (2015); NZ Micrographic Services Ltd (2014), The Mukurtu team (2017)).

(b) The architectural principle of flexibility is key here, and no pre-formed hierarchy or categorisation of users should be assumed.

Use of pseudonyms for identification; no identification needed for public access

(a) Australian privacy law mandates that, where possible, users may identify themselves via a pseudonym (Office of the Australian Information Commissioner, 2014). This requirement may be at odds with the tracing and audit requirements described below.

(b) There should also be a level of public access that does not require authentication (Sellie et al., 2015).

Networked, trusted authenticators

Authentication brings particular problems when dealing with distributed systems.

(a) Some sources explicitly note the need for interoperable access controls across disparate systems (Paterson, 2007).

(b) Others discuss the need to reduce onerous re-authentication whenever a different repository is accessed (Department of Social Services, Commonwealth of Australia, 2015).

(c) Thus, the networked environment requires a framework for trusted authenticators that can vouch for end users to others in the network; for example, a single-sign-on framework

such as OpenId (The OpenID Foundation, 2015).

C.2.2 Authorisation

Authorisation concerns the restriction of functionality and access to records and documentation based on the identity of end-users.

Access controls determined by participants; negotiation of access rights between multiple participants

(a) A core aspect of participatory recordkeeping is that all participants, not just the record stewards, determine the access controls to be applied to their material both through the system and in respect to any represented physical material. (Department of Social Services, Commonwealth of Australia, 2015; Gilliland, 2013; ICARUS, 2015; Ross et al., 2006; Trust and Technology Project, 2008; Washington State University's Libraries, Manuscripts, Archives and Special Collections (MASC) et al., 2009).

(b) It should not be assumed that communities, families, or other participant groups are homogeneous (Huvila, 2008). The hospitality principle and the existence of contested material means that seemingly competing access rights may need to be negotiated between multiple participants (Department of Social Services, Commonwealth of Australia, 2015; Gilliland, 2013; Iacovino, 2015; Ross et al., 2006).

(c) The system needs to support the negotiated setting of access controls in this manner.

Flexible and granular authorisation

(a) Flexible authorisation controls need to be provided at arbitrary levels of granularity — both in terms of the resources accessed and the actors who are authorised for access (ICARUS, 2015; NZ Micrographic Services Ltd, 2014; The Mukurtu team, 2017).

(b) Access includes not only discovery and retrieval, but the annotation, creation or removal of material, and the setting of the access controls themselves as discussed below (Winiata, 2002).

(c) At the most basic level, authorised individuals or representatives of groupings negotiate access controls (Department of Social Services, Commonwealth of Australia, 2015; Gilliland, 2013). However individuals within groups may have different perspectives on access (Gilliland, 2014c) and access may be delegated to others. (Department of Social Services, Commonwealth of Australia, 2015).

(d) Note that the conditions of such delegation may change over time or according to the

status of the delegator or delegates.

(e) Where no explicit authorisation definitions have been nominated by participants, the
default public access mandated under recordkeeping legislation should be provided (Department of Social Services, Commonwealth of Australia, 2015).

Access rights maximised according to cultural and privacy contexts

(a) Access to material is dependent on the contexts of creation and exposure (Bingo, 2011).
It should be noted that cultural and privacy rights are not absolute and access control is
tempered by the need for accountability for past actions (Iacovino, 2015).

(b) Additionally, the system should ensure that material that could compromise privacy, national or corporate security is not inadvertently exposed (Gilliland, 2014c).

(c) If required, material may be encrypted to ensure access only by authorised participants
(Gilliland, 2013).

Access controls applied consistently in a networked context

(a) Participatory access may take place within a networked context and so the access control
regime should span distributed systems (Department of Social Services, Commonwealth
of Australia, 2015; Paterson, 2007).

(b) It should be noted that issues of privacy and cultural sensitivity scale differently when
material is aggregated from multiple, networked systems (Department of Social Services,
Commonwealth of Australia, 2015; Gilliland, 2014c; Paterson, 2007). The system should
ensure that the original intent of access controls within the local context be preserved
(Bingo, 2011).

Access conditions clearly documented clearly;explanation of any restrictions

(a) The access control regime should be implemented in a transparent manner.

(b) Participants and, where appropriate, other end-users should be presented with documentation explaining the reason(s) for prevailing access control with respect to a given record
(Committee on best practices and standards - working group on access, 2014).

C.2.3 Reproduction Rights Management

Reproduction rights management is concerned with what authorised system users can do with
material — usually in publication contexts external to the system from which the material
was obtained. These rights normally manifest as reproduction permissions and attribution

requirements in relation to the re-use of material.

Negotiation of reproduction rights

(a) Many sources stipulate that all participants should determine the reproduction rights delegated to participants and end-users (Department of Social Services, Commonwealth of Australia, 2015; Gilliland, 2013), however there may be competing notions of ownership and granting of rights.

(b) Reproduction rights management is relevant to all content including annotations and crowd-sourced material. A rights policy should be displayed by the system at any point where information may be entered into the system (Farley, 2014).

Granular reproduction rights

Reproduction rights may also depend on the nature or format of material (NZ Micrographic Services Ltd, 2014). In particular, rights change depending on context and through time and space (Iacovino, 2015). Participants may acquiesce for material to be made available in one context, but may not wish the same rights to be granted in other contexts. This due to records lying outside of the 'publication' paradigm.

Restriction of access to records or documentation to the local context

While participants may allow material and documentation to be accessible within the context of the system, they may wish to prevent it from being disseminated beyond that scope (Gilliland & McKemmish, 2014).

(a) This means that documentation of the existence of material may be, perhaps, provided in a networked context but end-users may need to navigate (and authenticate) to local systems in order to access the detailed documentation and/or material.

(b) There may also be additional protocols for the transmission of knowledge across contextual boundaries (Gilliland, 2013).

C.2.4 Tracing and audit

Activity by participants needs to be recorded for a number of operational and evidentiary reasons.

Record of activity

The complete provenance of a record includes documentation of the recordkeeping-business related to the record (Huvila, 2008; Standards Association of Australia, 2006). Hospitality

requires the exposure of such metadata for complete documentation of the record.

Roll-back of changes

Most sources addressing this requirement stipulated the need to roll-back changes if necessary (Huvila, 2008; NZ Micrographic Services Ltd, 2014). This is because of the possible need to mediate between contested perspectives of records as well as the possibility of changed contextual circumstances or participant perspectives. Additionally, the potential inexperience of participants may lead to inadvertent changes.

Untraced public access

Where material has been made public, end users should have free and untraced access to such materials (Committee on best practices and standards - working group on access, 2014). However, this is a matter of trust and communities that, in the past, have had their records abused may wish to track who has accessed records. In the end, "The public and open nature of the space should be balanced with a sense of security" (Sellie et al., 2015).

C.3 Appraisal

Many sources determined that participants should have input into appraisal decision-making (Caswell, 2014b; Gilliland & McKemmish, 2014; Shilton & Srinivasan, 2007).

Involvement of participants in appraisal decisions

The system needs to support participant involvement in appraisal activities such as determining which records should be created, preserved for their enduring value and, possibly destroyed when they no longer have value (Caswell, 2014b).

(a) The system needs to support the pluralistic documentation of records and recordkeeping processes as described below that facilitates appraisal decision-making. This decision-making is highly dependent on the level of trust that exists between record-creating/holding organisations and other participants (Caswell, 2013) and so the system needs to be able to support distributed and negotiated decision-making relating to preservation and documentation (Trust and Technology Project, 2008).

(b) The system needs to support archivists to proactively engage with communities to seek out appraisal participants (Iacovino, 2015).

Removal of records or documentation

In the disposal of material, the support of individuals' rights to self-determination should be bal-

anced against the need to provide accountability through time (Gilliland & McKemmish, 2014) — even the removal of inaccurate information can have unforeseen consequences (Iacovino, 2011).

C.4 Creation

A participatory archive needs to accommodate the addition of a plurality of material — whether primary traces, documentation of, and annotations to, existing traces by record participants, or other contributions form the broader community..

Creation of records by participants

(a) All participants should be able to create and maintain their own material within the system — subject to the rights described previously (Caswell, 2014b; Department of Social Services, Commonwealth of Australia, 2015; Gilliland & McKemmish, 2014; Trust and Technology Project, 2008).

(b) When linked to records, this material then should be made available and be searchable along with the records themselves (Department of Social Services, Commonwealth of Australia, 2015).

(c) The system needs to flexibly support created material in a wide variety of formats (Ara Irititja Project, 2011; Trust and Technology Project, 2008) and enable its direct upload (Caswell, 2014b; ICARUS, 2015; NZ Micrographic Services Ltd, 2014; The Mukurtu team, 2017).

Challenging records

(a) Participants have a fundamental right to challenge records and exercise a right of reply — particularly in the case where they are the subject of records made by others (Gilliland & McKemmish, 2014; Iacovino, 2015; Orentlicher & United Nations, 2005).

(b) As with other linked content, this material should be made available and be searchable along with the original records (Department of Social Services, Commonwealth of Australia, 2015)

Annotations to records or documentation

(a) The system needs to support participants' right to annotate any archival content or documentation (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012; Department of Social Services, Commonwealth of Australia,

2015; Farley, 2014; Gilliland & McKemmish, 2014).

(b) Furthermore, in the interests of contextual accuracy, participants should be encouraged to annotate records providing interpretation, correction or additional context (Ara Irititja Project, 2011; Gilliland & McKemmish, 2014; Trust and Technology Project, 2008; Washington State University's Libraries, Manuscripts, Archives and Special Collections (MASC) et al., 2009). Annotation functionality should be tailored to the format of the material being annotated (Ara Irititja Project, 2011) and the annotations themselves should be able to be made in any format (Ara Irititja Project, 2011; Iacovino, 2015).

(c) As with other content, documentation contributions by participants needs to be managed as other documentation and should be made available and be searchable along with the original records (Department of Social Services, Commonwealth of Australia, 2015).

(d) Annotations should not be edited or subjected to any other changes (Department of Social Services, Commonwealth of Australia, 2015; Farley, 2014) unless it is felt to contravene cultural protocols, privacy rights, or copyright, defamatory or other legislation (Iacovino, 2011) in which case changes will be negotiated with the contributing participant(s).

Crowd-sourcing of comments tags and questions

Beyond immediate participants, the broader community needs to be able to contribute to the participatory archive.

(a) The system needs to provide mechanisms for visitors to the site to submit documentation such as comments, questions, descriptive- and geo- tags etc. (ICARUS, 2015; Washington State University's Libraries, Manuscripts, Archives and Special Collections (MASC) et al., 2009). Similar to participant annotations, crowd-sourced material improves the accuracy and engages the broader community (Farley, 2014; NZ Micrographic Services Ltd, 2014).

(b) This content shall be subject to the same management processes, default public access policy and reproduction rights as other material (Farley, 2014; Iacovino, 2011; ICARUS, 2015).

(c) This functionality should include the facility to provide feedback about specific material to its participants (Ara Irititja Project, 2011) — particularly if the material is felt to contravene cultural protocols, privacy rights, or copyright, defamatory or other legislation (Iacovino, 2011).

C.5 Documentation

Records in the system should be documented in such a way as to support the world views of the plurality of participants. This is a departure from traditional archival description that takes a single (record-holding organisation) or bifurcated (distinct organisational and community) approach.

Pluralistic documentation

(a) The system's facilities for documentation needs to operate in an inclusive manner that respects the rights of all voices (Duff & Harris, 2002) and in recognition that no single participant can provide a complete account of a record (Duff & Harris, 2002; Gilliland, 2014c; Huvila, 2008).

(b) While necessarily comprehensive, the overhead of documentation management should not be an impediment to casual or inexperienced participants (Huvila, 2008).

(c) Contributors to documentation should be acknowledged if required (Gilliland, 2013; Gilliland & McKemmish, 2014) in terms of their choosing.

Documentation of the contextual perspectives of all participants

Different participants may view records from vastly different perspectives.

(a) The system should enable a plurality of documentation of records (Hurley, 2005b) that accommodates the perspectives of multiple participants (Caswell, 2014b; Gilliland, 2013; Gilliland & McKemmish, 2014). These perspectives may change over time and interact in unexpected ways (Wood, Carbone, Cifor, Gilliland, & Punzalan, 2014).

(b) This documentation needs to include the defining of contextual entities and their relationships with each other and records (Gilliland & McKemmish, 2014; Huvila, 2008; Iacovino, 2015), and links to other material available on the web (NZ Micrographic Services Ltd, 2014).

(c) The documentation needs to persist and retain meaning through time (McCarthy & Evans, 2012), and should provide cultural explanation of the relevance of material (ICARUS, 2015) and/or warnings about cultural sensitivity (Ara Irititja Project, 2011; Paterson, 2007). Rich context is also necessary to preserve meaning when material is aggregated in a networked environment (Paterson, 2007)

(d) The context should also include details of documentation authors (Duff & Harris, 2002; Wood et al., 2014) and description of relevant institutions and holdings (Committee on best practices and standards - working group on access, 2014).

Use of terminology and ontologies of all participants

Part of the task of supporting parallel provenance is enabling participants to document records using their terminology and cultural ontologies (Gilliland, 2013).

(a) Instead of the imposition of 'universal' classification schemes, participants will employ their own ontologies, perhaps that develop over time (Huvila, 2008; Washington State University's Libraries, Manuscripts, Archives and Special Collections (MASC) et al., 2009). The ontologies can include knowledge architectures, classification systems, thesauri, tag sets, and specific languages, words, and cultural identifiers (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012; Caswell, 2014b; Gilliland, 2013; Shilton & Srinivasan, 2007).

Evidenced-based Documentation

Where possible, the system should ensure that documentation claims are backed with evidence by providing facilities for the citation of appropriate sources. Ambiguous prose should be avoided and doubtful assertions need to be identified as such (McCarthy & Evans, 2012). However, standards and types of evidence vary between participant groups and so evidence-support needs to be treated in a culturally sensitive way by the system (Wurl, 2005).

C.6 Discovery

The discovery of resources in a distributed, participatory system is different from conventional collection-oriented portals. Instead of static, finding-aid approaches, discovery should be via dynamic browse and search facilities that support the plurality of end-user modalities.

Flexible and contextual browsing and navigation of material

(a) The browsing and navigation interface needs to bring together records and documentation from disparate sources (Trust and Technology Project, 2008) and display it in culturally sensitive and flexible ways — for example using time-lines, multi-dimensional image carousels, tag clouds, and facet lists. (Ara Irititja Project, 2011; ICARUS, 2015; NZ Micrographic Services Ltd, 2014; Yaco, Jimerson, Anderson, & Temple, 2015).

(b) Where possible, material should be geo-located through the use of maps which can then be used for browsing (ICARUS, 2015; Washington State University's Libraries, Manuscripts, Archives and Special Collections (MASC) et al., 2009).

(c) Similarly, indexes of people and objects can be constructed using marked-up images (ICARUS, 2015). The discovery interface should indicate related material and contextual elements, or additional material that could be of interest (Duff & Harris, 2002; Farley, 2014; NZ Micrographic Services Ltd, 2014).

Searching from participant perspectives

All of the material — records, documentation, annotations etc. — shall be searchable using terms and content as described by all participants (Farley, 2014; Gilliland, 2013).

(a) The system should provide a variety of search facilities including-
    i. faceted and
    ii. advanced options (Ara Irititja Project, 2011; NZ Micrographic Services Ltd, 2014),
    iii. date-range, and
    iv. location-based searching (Ara Irititja Project, 2011; ICARUS, 2015).

Flagging of content

(a) It is important that all participant perspectives are taken into account when displaying material and that appropriate language and terms are used (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012; Gilliland, 2013; Paterson, 2007).

(b) Navigation to material that could be distressing should be flagged with warnings and/or confirmations (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012; Ara Irititja Project, 2011; Department of Social Services, Commonwealth of Australia, 2015).

(c) Material that has been digitised should be highlighted to set record-seekers' expectations regarding retrieval (NZ Micrographic Services Ltd, 2014). Records, documentation, comments and materials should be clearly displayed in a connected way (Duff & Harris, 2002; Farley, 2014).

(d) Where access to material is restricted or is not longer available, the discovery facility should display reasons for the restriction and the circumstances under which the restriction may be lifted (Committee on best practices and standards - working group on access,

2014).

(e) Similarly if undocumented material is known to exist, discovery services should indicate it's existence along with plans for its inclusion in the system (Department of Social Services, Commonwealth of Australia, 2015).

Privacy and access controls enforced during resource discovery

(a) The discovery functionality should not leak sensitive or restricted material (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012).

(b) The system should also guard against the possibly of 'dossier' creation or the 'outing' of individuals (Gilliland, 2013).

C.7 Retrieval

Retrieval concerns the access of material from the discovery interface. it involves the display of records and documentation along with other content that informs the context of the material being retrieved.

Display of records and documentation in context and in a culturally sensitive manner

(a) As with navigation and search facilities, material itself should be displayed using appropriate language and terms (Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN), 2012; Gilliland, 2013; Paterson, 2007).

(b) Jargon, acronyms, or terms and language that may be considered derogatory should be accompanied with explanations for their use (Department of Social Services, Commonwealth of Australia, 2015; Paterson, 2007).

(c) Views of records and documentation should show links to related material and contextual elements, or additional material that could be of interest (Duff & Harris, 2002; Farley, 2014; NZ Micrographic Services Ltd, 2014).

(d) Depending on access rights, material may be made available in different formats, for example, images at different levels of resolution (ICARUS, 2015; NZ Micrographic Services Ltd, 2014).

(e) Material and documentation need to be displayed along with licensing or rights information, specific to the context of the record seeker and the material itself (Iacovino, 2011).

Virtual collections

(a) Record seekers should be able to maintain 'virtual collections', for example as the result of searches or as an aggregated list of items of interest (Ara Irititja Project, 2011; ICARUS, 2015). Virtual collections should be able to be compared side-by-side (ICARUS, 2015).

(b) Similarly, seekers should be able to manipulate results into these collections, for example degrading, resizing, rotating or cropping images (NZ Micrographic Services Ltd, 2014).

Appendix D: Out-of-Scope Activities

As I foreshadowed in Chapter 4 and expanded upon in Chapter 7, there were a number of features indicated by the requirements and the functional model that were not instantiated in the PaRIty proof of concept system. A full explanation of this is given in Chapter 7 but, in summary, the constrains of a single research project meant that I focussed mainly on the ability of the system to articulate, and provide interoperability between, arbitrary and disparate recordkeeping metadata schemas. While I provide details of the more significant of these out-of-scope features in the Chapter 9 future work section, the following list is taken from my research journal notes.

D.1 Access Control

Although I did show how access controls could be modelled using the meta-model, I did not instantiate any such features within PaRIty.

Such features include:

- Local authorisation control based on schema contents;
- Distributed authentication adn authorisation protocols such as OpenID and OAuth;
- Authorisation of activity within PaRIty including:
    - Create, Update, Delete, List, and View;
    - Entities, relationships, and inter-schema links;
    - Uploading and removing referenced material (e.g. documents, images, audio/visual resources etc.); and
    - Management of access controls themselves;
- Enforcement of licenses and reproduction rights; and
- Application of access controls to API access.

Similarly, while I demonstrated a rudimentary history feature, I did not instantiate the full documentation of recordkeeping provenance.

I also did not implement support for the negotiation of competing rights between participants, though this is probably a research area in its own right.

D.2 Graph-oriented issues

There were a number of issues in graph-oriented processing that I identified but did not pursue in the instantiation. These included:

- Distributed query optimisation;
- Loop detection;
- Black/white listing of network nodes;
- Distributed relevance ranking;
- Pagination of distributed result sets; and
- Trust and/or reputation metrics.

Similarly, I did not explore the use of Graph-oriented databases save for an initial analysis that I indicated in Chapter 7. However for some analytical uses, a graph-database approach may be of use — for example, see Verhoeven and Burrows (2017) in relation to the recent version of HuNI project.

D.3 Implementation, transition, and maintenance

The PaRIty API implementation was read-only. For full production implementation, a complete read/write API would need to be developed.

While the PaRIty system did have some import/export functionality that assisted in the mapping of legacy schemas to the meta-model, I did not explicitly create transition mechanisms, including:

- Schema versioning;
- Ingestion of legacy data using existing protocols such as OAI-PMH or encoding standards such as EAD or EAC-CPF; and
- Export of data using standard protocols or encoding mechanisms.

I did develop a schema generation facility for use in the schema-mapping evaluation, but it was a data-only solution — i.e. creating entries within an existing EAV/CR database. A higher-performance mechanism is needed for transition that, similar to the Active Record paradigm, creates native tables and constraints that can be used for optimised update and query operations.

D.4 User interface Considerations

As I explained in Chapter 7, the user interface design of the PaRIty system was not a high priority. Specific affordances that would need investigation for inclusion in a more generalised participatory recordkeeping system include:

- Non-intrusive mechanisms for the display of history and provenance information for material;

- Simpler definition of relationships (beyond the complex wizards of PaRIty) e.g. relationship first, entity first; drag'n'drop or graphic mode affordances;

- Visualisation of relationships from an entity perspective;

- Graph-oriented display of relationships;

- Display of material from multiple schemas in the discovery interface; indicating origin, trust, reputation etc. and with links to more detailed provenance information; and

- Addition of field groups to entity definition;

D.5 Modelling and ontology concerns

During the course of the design exercise, a number of scheme-related issues emerged. At the time, I dealt with them in a localised manner, but they need further investigation for an interoperable approach. These include:

- Investigation into whether relationship cardinalities need formal specification within the meta-model

- How history should be represented, e.g. as part of he Ontology, or as part of some external scheme;

- Standardisation of (fuzzy) date formats;

- Standardisation on the various forms of inscription defined in the Participatory Recordkeeping Continuum Model; and

- Formal development of a LOD name-space and schema corresponding to the meta-model;

Appendix E: PaRIty screen shots

The following are large-format versions of the PaRIty screen-shots from Chapter 7.

Figure E.1: PaRIty Instance Landing Page

System Schema: Simple Schema

(3292d109-c147-415e-810b-1428bfc0e514)

A simple schema to be used as an example

Change Details

Types | Attributes | Relationships | Relationship Roles

Show 25 ▼ entries

Filter:

☐ Show deleted types?

Name	Description	Actions
activity		
Function	A concrete administrative activity	⚙ ✖
discorporate_agent		
Agency	An administrative unit	⚙ ✖
substantial		
Series	A series of related records	⚙ ✖

Showing 1 to 3 of 3 entries

New Type

Previous 1 Next

Figure E.2: Simple partial schema entities in PaRIty

Type: Series

(d81fb0b6-1fda-493f-9fa3-e38a8fc94f58)

Change Details

(Sub-type of substantial in Schema: Simple Schema)
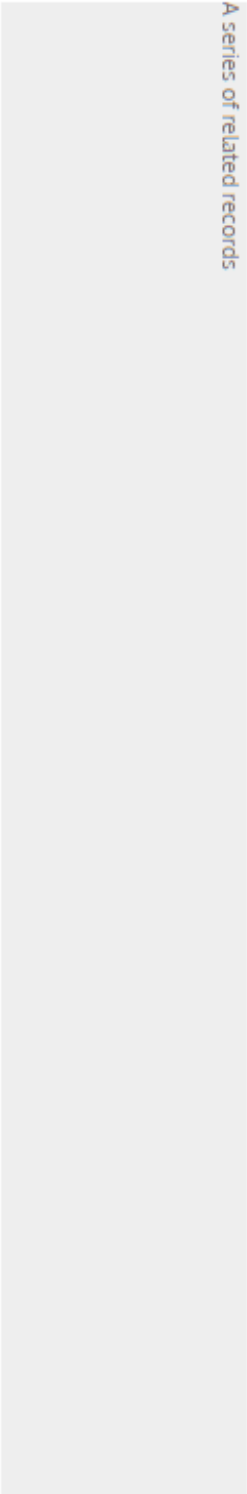
A series of related records

| Specified Attributes | Allowed Relationships |

Show 10 ▼ entries

Filter: ☐ Show deleted attributes?

Name	Alias	Description	Mandatory	Multiple	Order	Actions
Name		A short text identifier	Yes	No	0	(Default)
Description		A long text identifier	Yes	No	1	(Default)
Start Date	First Accumulation Date	A start date of a non-living thing or performance	No	No	1	✏ ✖
End Date	Last Accumulation Date	An end date of a non-living thing or performance	No	No	1	✏ ✖
ID		The series identifier	Yes	No	1	✏ ✖
Picture		A visual representation of the thing or performance	No	No	2	(Default)

Showing 1 to 6 of 6 entries

Specify Attribute

Previous 1 Next

Figure E.3: 'Series' entity attributes in PaRIty

Create Allowed Relationship in schema 'Simple Schema'

1. Relationship type

2. Related types

3. Relationship Roles

Select the type of this relationship:

Relationship Type

Representation (A record represents a performance) ▶

- Select a relationship type -
Structural (Structural relationships e.g. is part of)
Temporal (Time-based relationships e.g. follows)
Genidentity (Origin relationships e.g comes from)
Spatial (Space-based relationships e.g. is near)
Affiliation (Association-based relationships e.g. is member)
Enactment (Active relationship with a performance e.g. witness to)
Involvement (Passive relationship with a performance e.g. victim of)
Situation (Spacetime relationship with setting e.g. occurred during)
Manifestation (Denotes a transformation e.g. digitised copy of)
Authorisation (Sanctions a performance e.g. legalises)
Representation (A record represents a performance)
Reference (Referred to in a record)
Influence (Agent influences another entity e.g. owns, controls etc.)
Sanction (One entity mandates another entity e.g. allows)

Figure E.4: PaRIty Allowed relationship creation wizard (Step 1 of 3)

Create Allowed Relationship in schema 'Simple Schema'

1. Relationship type	2. Related types	3. Relationship Roles

Select the types to be related in a 'Representation' -> 'Function' (A record represents a performance)' relationship

Types Involved

```
'Series' -> 'Representation' -> 'Function'          ▼
-Choose a combination-
'Series' -> 'Representation' -> 'Function'
'Function' -> 'Representation' -> 'Function'
```
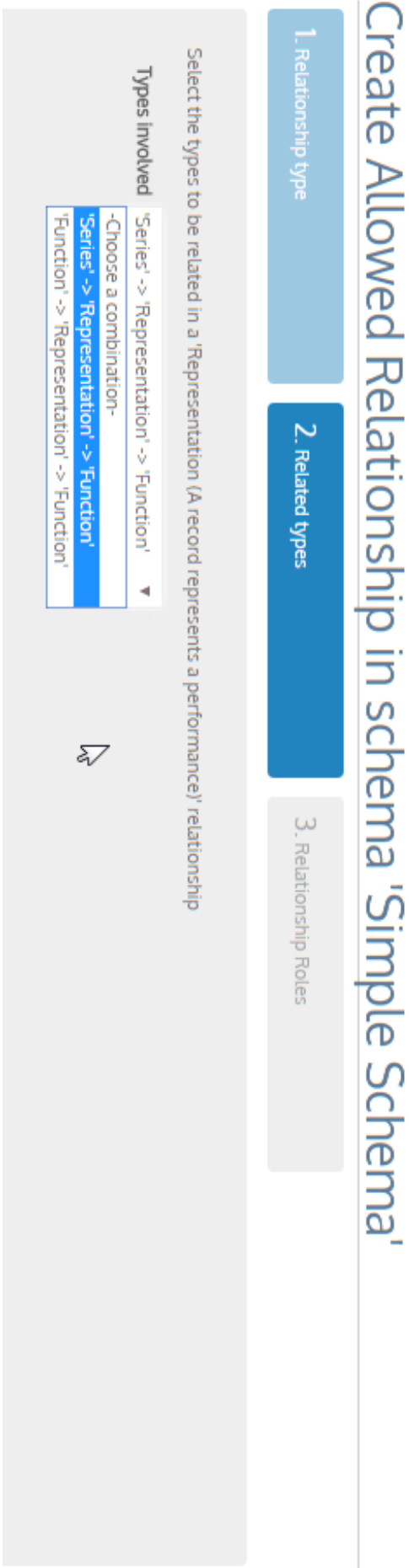
Figure E.5: PaRIty Allowed relationship creation wizard (Step 2 of 3)

Create Allowed Relationship in schema 'Simple Schema'

1. Relationship type

2.. Related types

3. Relationship Roles

Select the relationship between Series and Function

Series

Role   -Choose a role- ▸
              -Choose a role-
              Business Activity

Simple
Name

Function

Role   Business Activity ▸

Simple   is documented by
Name

Figure E.6: PaRIty Allowed relationship creation wizard (Step 3 of 3)

System Schema: Simple Schema

(3292d109-c147-415e-810b-1428bfc0e514) [↑] [▣] [Change Details]

A simple schema to be used as an example

| Types | Attributes | Relationships | Relationship Roles |

Show [10 ▼] entries

☐ Show deleted allowed relationships?

Filter:

From	Label	To	Usages	Actions
Series (Business Records)	documents	Function (Business Activity)	0	✎ ⊞ ✗
Agency (Executive unit)	performs	Function (Business Activity)	0	✎ ⊞ ✗

Showing 1 to 2 of 2 entries

Previous [1] Next

[Specify Allowed Relationship]

Figure E.7: Simple schema relationships in PaRIty

System Schema: Simple Schema

(3292d109-c147-415e-810b-1428bfc0e514)

Agency
[discorporate_agent]

(Executive unit) performs (Business Activity)
[Enactment]

Function
[activity]

(Business Records) documents (Business Activity)
[Representation]

Series
[substantial]

Figure E.8: PaRIty visualisation of the simple schema

401

Schema 'Simple Schema'

A simple schema to be used as an example

3292d109-c147-415e-810b-1428bfc0e514

Types in schema 'Simple Schema'

Search schema... Go

Agency
An administrative unit

Function
A concrete administrative activity

Series
A series of related records

Go Back.

Figure E.9: List entity types in simple example schema

Create new item of type 'Series'

Name * Case Files

Description *

Styles ▾	B	I	U	S	x₂	x²	Iₓ
Normal ▾						¶ ▾
Font ▾	Size ▾		A ▾	A ▾

The solcial worker files related to children managed by the agency

body p

First
Accumulation
Date   1 Apr 2017   Approximate Range   OFF

Last
Accumulation
Date   to   Approximate Range   ON

ID *   CFI234567

Picture   Choose Image....

Caption

Save   Cancel

Figure E.10: Create entity type in simple example schema

Items of type 'Series' in schema 'Simple Schema'

Create new item

Show 10 ▼ entries

Filter:

☐ Show deleted items?

Case Files (Series)

The social worker files related to children managed by the agency

Showing 1 to 1 of 1 entries

Previous | 1 | Next

Go Back

Figure E.11: Display entity type in simple example schema

Figure E.12: Creating a domain relationship (Step 1 of 3)

New Relationship from Child Welfare (Function)

1. Choose the related Item

2. Select relationship and Roles

3. Add details for this relationship

Select the relationship between 'Child Welfare' and 'Case Files '

Relationship

- Choose a relationship -
- Choose a relationship -
Child Welfare (Business Activity) is documented by Case Files (Business Records)

Figure E.13: Creating a domain relationship (Step 2 of 3)
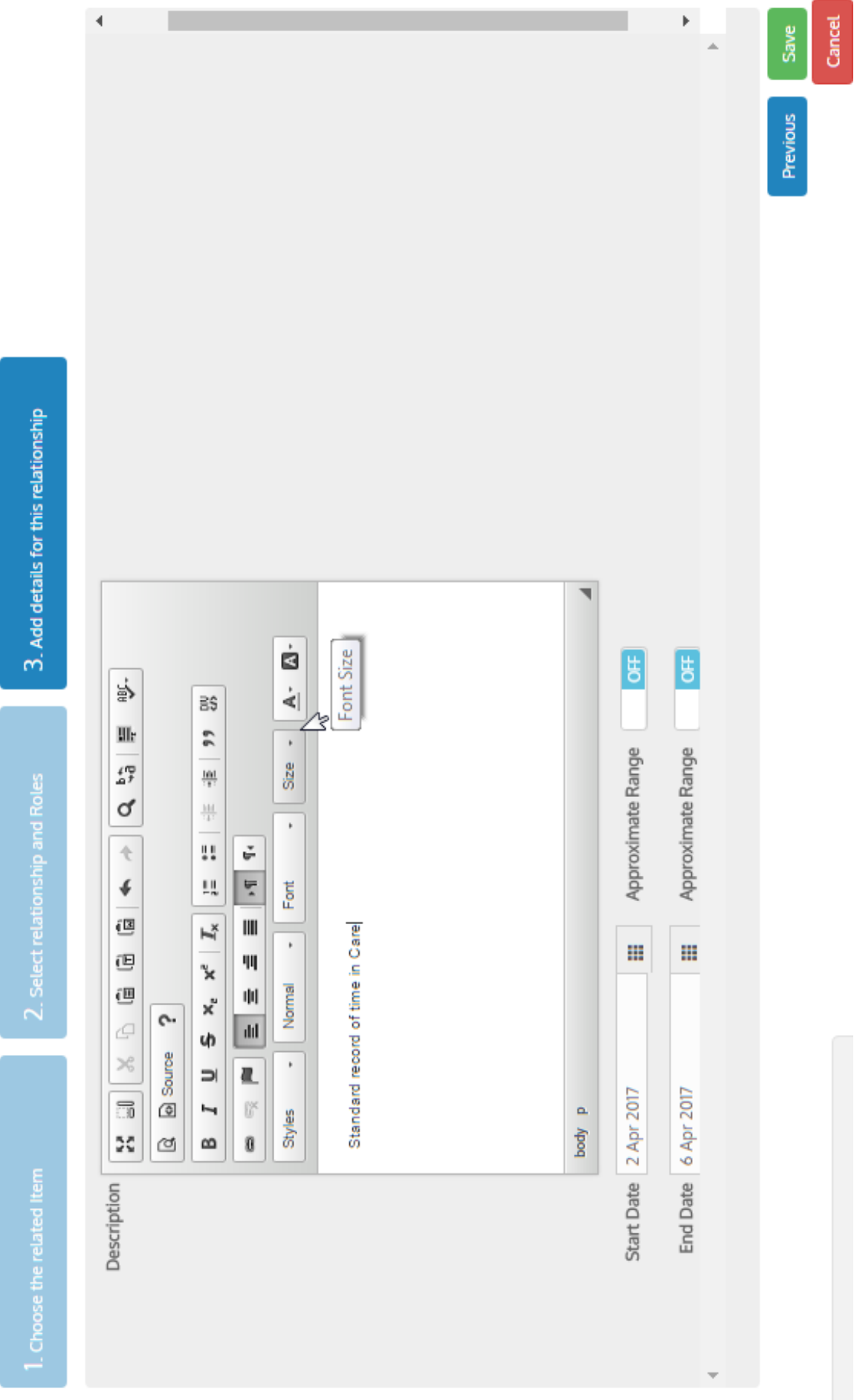
Figure E.14: Creating a domain relationship (Step 3 of 3)

Child Welfare

Item of type 'Function' in schema 'Simple Schema'

36569bf5-8d54-4ce2-8d8f-41239ldc5e13

Details   Relationships   Records   History

Name: Child Welfare

Description: State-run provision for children in need of care

Start Date: 27 Mar 2017

End Date:

Picture:

Go Back.

Figure E.15: Complete entity documentation in PaRIty — details

Child Welfare

Item of type 'Function' in schema 'Simple Schema'

36569bf5-8d54-4ce2-8d8f-41239ldc5e13

Details   Relationships   Records   History

☐ Show deleted relationships?
Show 10 ▾ entries

As 'Business Activity'

Representation
is documented by
02 Apr 2017 - 06 Apr 2017

Case Files (Series) as Business Records
740el8fa-f780-41ee-9bc9-eala638cab09

As 'Business Activity'

Enactment
is performed by
-

Department of Human Services (Agency) as Executive unit
9b174e3e-03a4-4ell-aa7a-975b3e4fb213

Showing 1 to 2 of 2 entries

Previous   1   Next

Go Back.

Figure E.16: Complete entity documentation in PaRIty — relationships

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Child Welfare

Item of type 'Function' in schema 'Simple Schema'

36569bf5-8d54-4ce2-8d8f-41239ldc5e13 &

Details   Relationships   Records   History

Search depth   1

Case Files (Series)

The social worker files related to children manag…

☐ Show deleted records?

Show 10 ▼ entries

Showing 1 to 1 of 1 entries

Previous   1   Next

Go Back

Figure E.17: Complete entity documentation in PaRIty — records

Child Welfare

Item of type 'Function' in schema 'Simple Schema'

Details Relationships Records History

36569bf5-8d54-4ce2-8d8f-41239ldc5e13

Timestamp	Action	Details
15 Apr 2017 09:01	Item created	"Function: Child Welfare ..."
15 Apr 2017 09:12	Item changed	"Function: Child Welfare ..."
15 Apr 2017 09:28	Item changed	"Function: Child Welfare ..."

Go Back.

Figure E.18: Complete entity documentation in PaRIty — history

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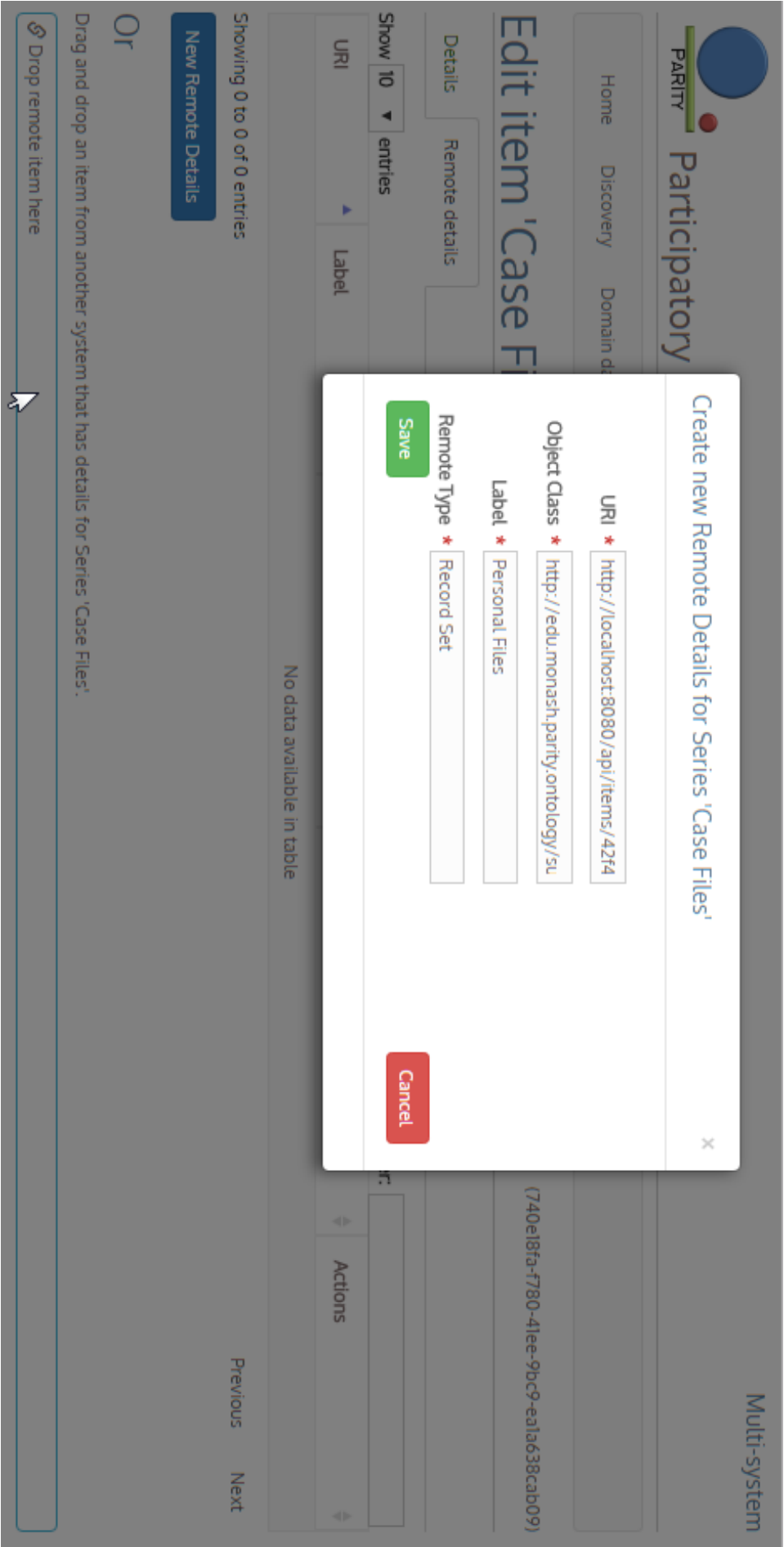
Figure E.19: Create remote PaRIty Manifestation Link

Edit item 'Case Files' of type 'Series'

(740e18fa-f780-41ee-9bc9-ea1a638cab09)

Details Remote details

Show 10 ▼ entries

Filter:

URI	Label	Local type	Remote type	Actions
http://localhost:8080/api/items/42f41c17-4eb2-40ab-bd6e-4324ca625694	Personal Files	Substantial	Record Set	

Showing 1 to 1 of 1 entries

New Remote Details

Previous 1 Next

Or

Drag and drop an item from another system that has details for Series 'Case Files'.

Drop remote item here

Figure E.20: List remote PaRIty Manifestation Links

Child Welfare

36569bf5-8d54-4ce2-8d8f-412391dc5e13 🔗

Item of type 'Function' in schema 'Simple Schema'

Details   Relationships   Records   History

Timestamp	Action	Details
15 Apr 2017 09:01	Item created	"Function: Child Welfare ...."
15 Apr 2017 09:12	Item changed	"Function: Child Welfare ...."
15 Apr 2017 09:28	Item changed	"Function: Child Welfare ...."

Go Back

Figure E.21: List PaRIty audit records

Item changed

Item of type 'admin_edit' in schema 'Audit'

Details   Relationships

Name: Item changed

Description: Function: Child Welfare

Before: {"http://edu.monash.parity.ontology/api/attributes":
[{"http://edu.monash.parity.ontology/api/type":"http://edu.monash.parity.ontology/Text", "http://edu.monash.parity.ontology/api/s
["Child Welfare"],"http://edu.monash.parity.ontology/api/label":"Name"},
{"http://edu.monash.parity.ontology/api/type":"http://edu.monash.parity.ontology/l.ongText","http://edu.monash.parity.ontology/i

ad69bf72-155b-4714-a487-a2fa5dfbb4fc 🔗

Go Back.

Picture:

Start Date: 15 Apr 2017

Start Time: 09:12

Figure E.22: Details of PaRIty audit records

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Item changed

Item of type 'admin_edit' in schema 'Audit'

ad69bf72-155b-4714-a487-a2fa5dfbb4fc

Details | Relationships

As 'Administrative function'

Showing 1 to 1 of 1 entries

☐ Show deleted relationships?

Show 10 ▼ **entries**

Involvement
Edited
15 Apr 2017 -

Child Welfare (Function) as Managed item
36569bf5-8d54-4ce2-8d8f-41239ldc5e13

Previous | 1 | Next

Go Back.

Figure E.23: PaRIty audit record relationships

Create Record Source

Label * | Multi-system - Remote Simple Schem

URI * | http://localhost:8080/api/schemas/b

Colour | # 57ff57

Or

Drag and drop a schema from another system.

Drop remote schema here

Save

Cancel

Basic Colors | Saved Colors | Advanced

white
red
orange
yellow
green
blue
purple
black

Figure E.24: CReate schema specification in PaRIty discovery

Record sources

Show 10 ▼ entries   Filter:

Name	▶	URL	colour	Actions
Multi-system - Remote Simple Schema		http://localhost:8080/api/schemas/b233c12d-b6d1-4433-b3f4-64bb8ec8b653	🟩	
Multi-system - Simple Schema		http://localhost:8080/api/schemas/3292d109-c147-415e-810b-1428bfc0e514	🟨	

Showing 1 to 2 of 2 entries   Previous 1 Next

New Record Source   Go Back

Figure E.25: Source definitions in PaRIty discovery

418

Record discovery

search...

Go

Types

Agency
An administrative unit

Function
A concrete administrative activity

Out of home Care
Types of DCare provided by government and non-government agencies

Record Set
Sets of documentaiton relating to the provision of out of home Care

Series
A series of related records

Record Sources

× Multi-system - Remote Simple Schema

× Multi-system - Simple Schema

Figure E.26: Schema specifications in PaRIty discovery

Search results.

rela   Go

Record Sources

× Multi-system - Remote Simple Schema

× Multi-system - Simple Schema

⚙

Retrieve up to [10 ▼] records at a time from each source.

Case Files (Series)

[1.23] The social worker files related to children managed by the agency

Personal Files (Record Set)

[1.23] Files relating to individuals

Showing page 1 of 1 (filtered from 4 total entries)   Previous   Next

Go Back.

Figure E.27: Search results in PaRIty discovery

Personal Files (Type: Record Set [Substantial]) from 'Multi-system: Remote Simple Schema'

Link depth 1

Details   Relationships   Records

Details from remote site 'Multi-system: Remote Simple Schema'   http://localhost:8080/api/items/42f41cl7-4eb2-40ab-bd6e-4324ca625694

Name: Personal Files

Description: Files relating to individuals

See in original context ↻   History ⊕

Figure E.28: Search result details in PaRIty discovery (1 of 2)

Details from remote site 'Multi-system: Simple Schema'

http://localhost:8080/api/items/740e18fa-f780-41ee-9bc9-ea1a638cab09

Name: Case Files

Description: The social worker files related to children managed by the agency

First Accumulation

Date: 01 Apr 2017

ID: CFI234567

This remote item has additional information from other linked remote sites. See in original context 🔗

History ⏱

Figure E.29: Search result details in PaRIty discovery (2 of 2)

Greg Rolan Foster (Type: Out of home Care [Activity]) from 'Multi-system: Remote Simple Schema'

Link depth 1

Details   Relationships   Records

Records depth 1

Personal Files (Record Set) - via 'Multi-system: Remote Simple Schema'
Files relating to individuals

Case Files (Series) - via 'Multi-system: Simple Schema'
The social worker files related to children managed by the agency

Showing 1 to 2 of 2 entries

Show 10 ▼ entries

Previous   Next
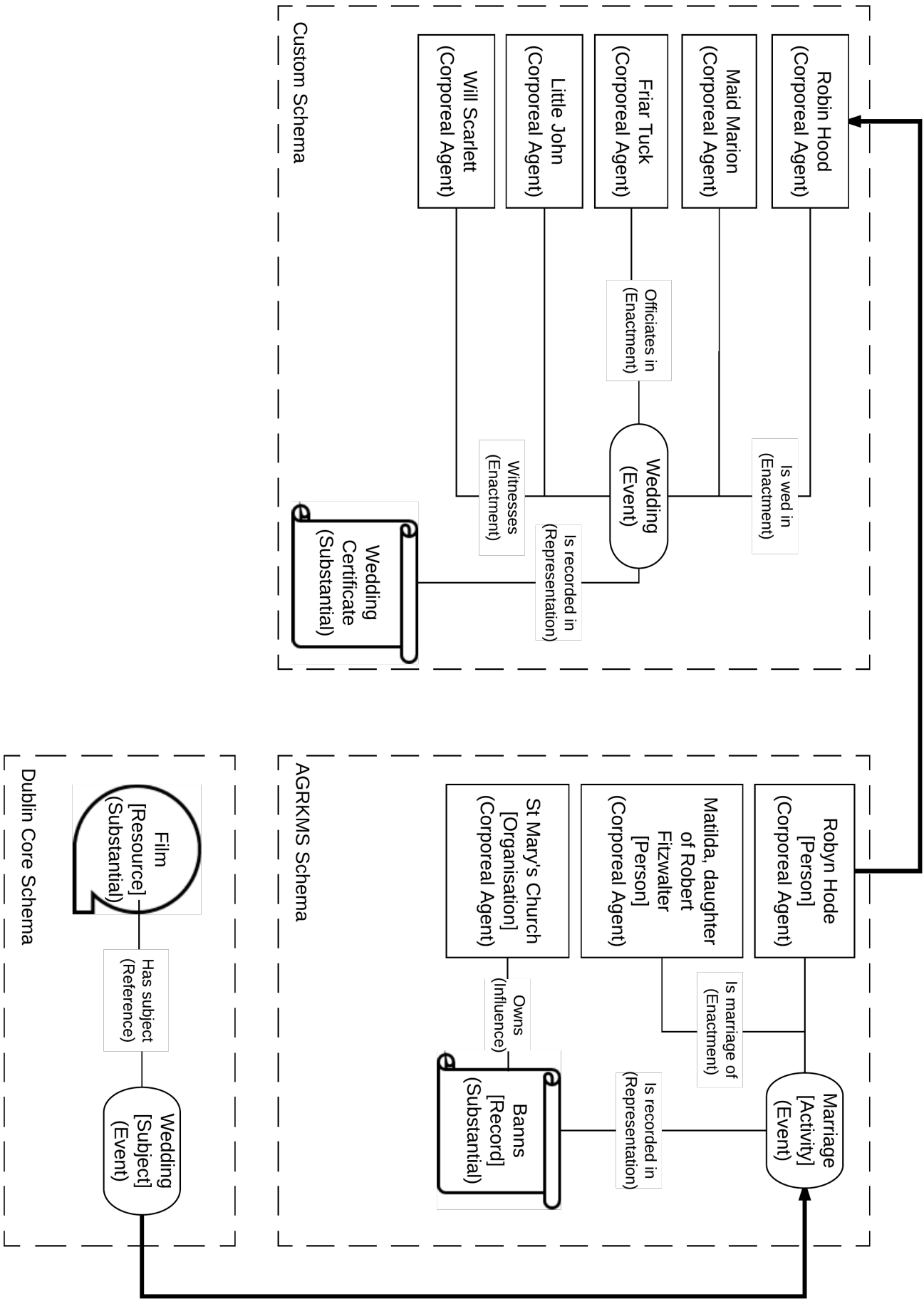
Go Back.

Figure E.30: Records in PaRIty discovery

Figure E.31: Scenario used for walkthrough evaluation

Appendix F: PaRIty Ontology

This is the ontology used for the PaRIty proof-of-concept system API response documents.

Namespace: http://edu.monash.parity.ontology/api/

Table F.1: PaRIty Ontology.

Term	Type	Meaning
attributes	Collection	Set of *attribute* elements corresponding to an entity.
auditevent	Entity	Item in *history* collection that describes a change in status of a given audited entity.
description	Property	Long text value — usually an extended description of an *item*.
end_date	Property	A date stamp corresponding to the final date of an entity e.g. date of death, abolition, dissolution etc. (Internal parity schema that allows fuzzy date ranges).
has_remotes	Property	Indicates whether the entity has associated Manifestation links to an entity in another schema.
history	Collection	Set of *auditevent* items corresponding to the change history of an audited entity.
index	URI	Reference to a document that contains the *isdiah* definitions.
isdiah	Entity	Basic recordkeeping system documentation corresponding to the ICA ISDIAH schema.
isdiah/name	Property	ISDIAH name of recordkeeping system.
isReversed	Property	Used when linking a *relationship item* to other entities; specifies the entity's 'side' of the relationship.
items	Collection	Set of *item* entities.
item	Entity	A schema entity; comprises *label decrption*, *type*, other properties of various types, and links to its *schema*, *presentation* page etc..
label	Property	Short text value — usually a short name of an *item*.
presentation	URI	Reference to a web page representation of an *item*.
records	Collection	A set of *items* that have a representation *relationship* with a performance.

Term	Type	Meaning
relationship	Entity	Item that defines a link between two other items. Has a forward and backward sense, depending on which item the relationship definition is considered.
relationships	Collection	A set of *relationship* entities.
relevance	Property	Indicates the weighting of an item that is returned as the result of search.
resolved_type	Property	The meta-model super-type of a given *schema type*.
role	Property	Short text description of the role that an *item* plays in a *relationship*.
schema	Entity	A set of recordkeeping documentation. comprises *items*, *types* and other properties such as *label* and *description*.
schemas	Collection	A set of URIs of schemas held on this recordkeeping system.
sequence	Property	An indicator or priority. Used when sequencing elements in a collection.
start_date	Property	A date stamp corresponding to the first date of an entity e.g. date of birth, creation, formation etc. (Internal parity schema that allows fuzzy date ranges).
timestamp	Property	Value of a given date and time (Internal parity schema that allows fuzzy date ranges).
type	URI	Local schema entity type that has a *resolved-type* of the Meta-model for Participatory Recordkeeping.
types	Collection	A set of URIs of each entity *type* defined within the local schema.
uuid	Property	Globally unique identifier of *item*.
values	Collection	Set of values for properties that allow multiple values.

Appendix G: PaRIty CSV Schema Example

The following is part of the Dublin Core Collection Schema expressed in the PaRIty CSV format:

id	type	label	description	attrtype	cansubclass	superclass	attribute	relationship	entity	ismultiple	ismandatory	sequence	entityfrom	rolefrom	simplelabelfrom	entityto	roleto	simplelabelto
1	schema	Dublin Core + Collection Profile	The Dublin Core Metadata Initiative (DCMI) supports shared innovation in metadata design and best practices across a broad range of purposes and business models.															
2	entity	Resource	Resource		1	http://edu.monash.parity.ontology/substantial												
3	entity	Licence	Licence		1	2												
4	entity	Policy	Policy		1	2												
5	entity	Standard	Standard		1	2												
6	entity	CorporealAgent	CorporealAgent		1	http://edu.monash.parity.ontology/corporeal_agent												
7	entity	Discorporate Agent	Discorporate Agent		1	http://edu.monash.parity.ontology/discorporate_agent												
8	entity	Activity	Activity		1	http://edu.monash.parity.ontology/activity												
9	entity	Setting	Setting		1	http://edu.monash.parity.ontology/setting												
9001	entity	Object	Object		1	http://edu.monash.parity.ontology/substantial												
9002	entity	Concept	Concept		1	http://edu.monash.parity.ontology/non_concrete												
9003	entity	Collection	Collection		1	http://edu.monash.parity.ontology/substantial												
9004	entity	Catalogue or Index	Catalogue or Index		1	2												
9005	entity	Service	Service		1	http://edu.monash.parity.ontology/substantial												
9006	entity	Location	Location		1	http://edu.monash.parity.ontology/substantial												
10																		
11	#-------																	
12	# Contains																	
13	#-------																	
14	role	Container	Container															
15	role	Contained	Contained															
16	relationship	Contains	Contains	x	1	http://edu.monash.parity.ontology/Structural												
17	allowedrelationship	Contains	Contains						16				2	14	has part	2	15	is part of
17001	allowedrelationship	Contains	Contains						16				6	14	has part	6	15	is part of
17002	allowedrelationship	Contains	Contains						16				7	14	has part	7	15	is part of
17003	allowedrelationship	Contains	Contains						16				9003	14	is gathering of	2	15	is gathered into
18																		
19	#-------																	
20	# Manifestation																	
21	#-------																	
22	role	Original	Original															
23	role	Manifestation	Manifestation															
24	relationship	Manifestation	Manifestation	x	1	http://edu.monash.parity.ontology/Manifestation												
25	allowedrelationship	Manifestation	Manifestation						24				2	22	is source of	2	23	has source
26	allowedrelationship	Manifestation	Manifestation						24				2	22	has version	2	23	is version of
27	allowedrelationship	Manifestation	Manifestation						24				2	22	has format	2	23	is format of
28	allowedrelationship	Manifestation	Manifestation						24				2	22	is replaces by	2	23	replaces
29																		
30	#-------																	

Figure G.1: Dublin Core Collection Schema