MONASH University

Everyday household practices: The flow of portable electronic devices

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Abstract

Using a social practice theoretical framework, informed by industrial ecology and circular economy principles and concepts this thesis explores the acquisition, use, retirement and divestment of portable electronic devices in Australian households. Qualitative research methods are used to gain in-depth understanding of household practices and device flows in 36 diverse Australian households.

Three key household domains are now entangled with the use of electronic devices: social and economic capital; leisure and entertainment; and cultural capital. Device use-practices within each of these domains encouraged the retirement of devices and drove electronic material flows into households. Once performed, they encouraged the domestication of electronic devices and the ratcheting-up of further practice performances. Device built-in obsolescence also drove electronic device acquisition and the ever-increasing stocks of retired electronic devices within households and led to an increasing loss of devices from the electronic materials cycle.

I argue that householders are primarily players in this process through their preparedness to act as carriers of social practices involving the use of electronic devices. It is everyday household practices that propel material flows. Material flows are, therefore, an outcome of a complex and interactive ongoing process. This process occurs between household domains, and their practices and how they are configured in the performance of everyday activities. Each individual practice performance reflects a unique configuration of a bundle of elements, in this case context, materials and infrastructure, knowledge, skills and competencies, and meanings and understandings. I demonstrate that practices and performances are dynamic over time and place and explain how this occurs.

It would be expected that households are also sites of device retirement, post-retirement handling and divestment practices — the later phases of the household electronic material flow cycle. However, I found that device accumulation was common across households, with divestment practices non-existent in most. I found the meanings that householders attach to devices, and the contexts of use, are key considerations for understanding the processes of accumulation rather than divestment of devices in households. The disjunct between electronic device inflows and outflows, resulting in low levels of devices being returned to the electronic materials cycle, is a key finding of this research.

Based on these findings, I argue achieving more sustainable electronic material flows within Australian households would require changes in the way household practices involving

electronic devices are configured. This would involve a shift away from a one-size fits all approach based on behavioural change principles, to one that acknowledges diversity and difference, ongoing contextual changes and the dynamics of practice configurations, whilst ensuring desired social equity outcomes. Given that electronic devices, especially mobile phones have existed within households for well over 20 years without any real progress being made towards their post-use management there is now a growing need for some form of definitive policy action to be implemented at the personal, household, community, national and global levels to effect the sustainable management of electronic material flows.

Declaration

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.

Kaye Follett

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Abbreviations

ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
ACMA	Australian Communications Media Authority
AIFS	Australian Institute of Family Studies
AMTA	Australian Mobile Telecommunications Association
ASIC	Australian Securities and Investment Commission
BBC	British Broadcasting Corporation
CBD	Central Business District
CSIRO	Commonwealth Scientific Industrial Research Organisation
DELWP	Department of Environment Land Water and Planning (Victoria)
DIY	Do-it-yourself
EU	European Union
GPS	Global Positioning Services
IC	Industry Commission
IC System	Information-Communication System
IT	Information technology
kg	Kilograms
MUHREC	Monash University Human Research Ethics Committee
NBN	National Broadband Network
NGO	Non-Government Organisation
OH and S	Occupational Health and Safety
PC	Productivity Commission
PC^2	Personal Computer
SA	South Australia
sms	Short Message Service - also known as text message
TV	Television
USB	Universal Serial Bus
24/7	Twenty-four hours a day – seven days a week
4G	Fourth generation mobile communication technology standards – see also glossary of terms

Glossary of terms

2G, 3G, 4G and 5G	2G—second-generation mobile telecommunications Mobile telecommunications services that use digital techniques, providing voice communications and a relatively low transmission rate for data. Denoted by the introduction of the digital encryption of telephone conversations and of mobile data services with SMS text messaging. 3G—third-generation mobile telecommunications Broadband mobile telecommunications services with improved data rates over their 2G predecessors providing for applications such as web-browsing, video-conferencing and location-based services. 4G—fourth-generation mobile telecommunications Enhanced broadband mobile telecommunications services that are expected to provide increased bandwidth to support voice, video, data and high-quality streaming multimedia content over an all-IP network. See also LTE. 5G—fifth-generation mobile telecommunications. The proposed next iteration of broadband mobile telecommunications services that is expected to provide increased data rates and reduced latency to support greater connectivity and enable machine-to-machine services and the Internet of Things. While trials of the technology are currently underway, it is not anticipated that 5G will be commercially available until approximately 2020.
3-D printer	Is a machine that creates a physical object from a three-dimensional computer digital model, typically by laying down many thin layers of a material in succession.
ADSL	Asymmetric digital subscriber line. A transmission technology that enables high-speed data services to be delivered over a twisted-pair copper line, typically with a download speed greater than a lower upload data speed. Availability restricted by distance from telephone exchange.
Capital	The use of the term capital in this thesis builds on Bourdieu (1986) notions of economic, social and cultural capital. *Economic capital* is that capital that is immediately and directly convertible into money and maybe institutionalised in the form of property rights. *Social capital* is interpreted as being made up of social obligations (connections) which is convertible, in certain conditions into economic capital and maybe institutionalised in the form of nobility title. On the other hand, *cultural capital* can be converted in certain conditions into economic capital and maybe institutionalised in the form of educational qualifications.
Centrelink	Centrelink is responsible for delivering the Australian Government's social security payments and services to Australians, subject to eligibility conditions. It is part of the Department of Human Services (Commonwealth).
Connectivity	Connectivity is the ability of a computer, program, device, or system to connect with one or more others. https://dictionary.cambridge.org/dictionary/english/connectivity.
Convergence	A converged environment is one in which users can access a wide range of multimedia services using any device and any type of network connection. Examples of converged services currently available in Australia include internet access using a mobile phone and accessing television broadcasts via the internet.

Deregulation	Refers to the removal of legislative and regulatory restrictions and barriers to competition and in some instances a reduction in government provision of goods and services as a monopoly supplier. It is frequently linked to the privatisation of government assets to the private sector, such as energy generation and distribution.
Discretionary income	This income is the amount which a person has available to spend after payment of income tax and expenditure on necessary living expenses, such as shelter, food, and clothing are subtracted. The term is often confused with disposable income which refers to the income a person has available after taxes are taken out.
Colonisation	A term used to denote the arrival of British forces and convict labour to Australia in 1788. It resulted in Australian Aboriginal land being taken by British colonists on the premise that the land belonged to no-one ('terra nullius') when in fact it is estimated that Aboriginal Australians had inhabited the continent for between 50,000 to 120,000 years. Originally, this process was referred to as European settlement.http://www.workingwithindigenousaustralians.info/content/History_3_Colonisation.html.
Extended family	This is a family (in the case of this research) living within the same dwelling. It includes relatives such as grandparents, parents, children, uncles and aunts and nieces and nephews.
e-waste	Electronic waste, or e-waste refers to items of electrical and electronic equipment (EEE) and its parts discarded by an owner as waste without the intention of re-use. It is also referred to as WEEE, Waste Electrical and Electronic Equipment.
FitBit	This is an electronic device that takes its name from the American company that produces it. It is a wireless-enabled, wearable device that measures personal health and fitness data such as the number of steps walked, heart rate and sleep patterns.
Hobby	An activity or interest pursued by householders for pleasure or relaxation. In most instances it is not the main occupation of a householder. https://www.business.gov.au/info/plan-and-start/a-business-or-a-hobby.
Home-schooling	Home-schooling refers to the provision of educational services in the "home" and provides students and parents/guardians with an alternate to the services that are provided institutionally such as through schools. Those providing the home-schooling service have legislative responsibilities and are required to comply with state and national curriculum standards and auditing requirements.
Integration	For this thesis integration relates to several aspects of information-communication technology. It includes the combining of various electronic information-communication functions into the one device e.g. the multiple functions incorporated into a smartphone. It also refers to the incorporation of different forms of information-communication technology to achieve a specific outcome e.g. the use of a laptop and television to live-stream movies in a house. Another aspect is the incorporation (embedding) of technology resources and technology-based practices into the daily routines of households.
Memory card	Also known as a flash-card. These are electronic data storage devices used for storing digital information. They are used in nearly all portable electronic devices such as laptop computers, tablets, mobile phones, media players, video game consoles and cameras. They are separate/different to SIM cards.
Men's Shed	The modern Men's Shed is an updated version of the shed in the backyard that has long been a part of Australian culture. Men's Sheds are found in many cities and towns around Australia and exist internationally. https://mensshed.org/what-is-a-mens-shed/.

Mobile apps	Mobile apps (short for applications) are software-based tools which can be downloaded and installed on a smartphone or tablet to enhance the device's functionality e.g. software that allows a consumer to view their banking information via a smartphone or tablet.
MobileMuster	It is an industry-based mobile phone recycling initiative. It takes all brands and types of mobile phones, plus their batteries, chargers and accessories. It is managed by the Australian Mobile Telecommunications Association.
MP3 player	This refers to Portable Media Player (MP3) and is also known as a digital audio player. It is an electronic device that is used to play digital audio files, e.g. music and interview recordings on the move. As a portable device it took hold in the late 1990s.
Officeworks	A stationary and office supplies retail business that operates in all states of Australia. Sells the full gamut of electronic devices and equipment for personal and business use such as computers, printers and smartphones. It provides bins for the return of retired electronic devices.
Operating system	The software that supports a computer's basic functions such as scheduling tasks, executing applications, receiving input from the user and controlling the display. In Australia, the two most common operating systems for smartphones and tablets are: • iOS: proprietary software used by Apple devices such as the iPhone and iPad. iOS content is limited to content directly supported by Apple. • Android: an open-source platform that is used by a variety of smartphone devices, including some of those manufactured by HTC, Motorola and Samsung.
Quality of life	This relates to the extent that a person's life is comfortable or satisfying, especially in terms of health and happiness rather than wealth and money. https://www.collinsdictionary.com/dictionary/english/quality-of-life.
Self-employed businesses	This relates to where a person regularly and repeatedly undertakes various activities on a commercial basis with the aim of making a profit. https://www.business.gov.au/info/plan-and-start/a-business-or-a-hobby.
SIM card	Refers to a card with a micro-chip, which is used in mobile radio technology to identify a mobile device and its unique mobile phone number within its network. The acronym SIM is short for the technical term 'Subscriber Identity Module'.
Smartphone	A smartphone is a mobile phone built on a mobile operating system, with more advanced computing capability and connectivity. They are characterised by the ease they can access information online and their ability to have their functionality expanded through custom-designed apps.
Social media	This refers to different electronic communication forms-mediums that enable users to create online communities to share information, ideas, personal messages, and other content such as photos. Various commercial platforms exist to support and provide specific sharing experiences such as Skype, Facebook, Snapchat, Instagram, Twitter and LinkedIn.
Stress	Stress is a human response to challenging or dangerous situations and is part of being a person. It can lead to increased alertness, energy and productivity but at the same time a complete lack of stress can lead to reduced motivation and performance. Where a stress response extends for too longer a period it can have damaging effects on a person's mind and body. https://www.healthdirect.gov.au/stress.
Tablet	A handheld, internet-enabled, wireless personal computer usually having a touchscreen or a digital pen-enabled interface and no hardware keyboard. Tablets may have Wi-Fi-only or Wi-Fi connection plus mobile internet connectivity. Most non-iOS tablets can also connect to the internet through a USB port.

Tariffs	Tariffs are like taxes. They are introduced by national governments on imported goods and services from other countries. The purpose of tariffs is to make the cost of the imported goods and services higher and hence less attractive to domestic consumers.
Telstra	Telstra is a leading telecommunications and technology publicly listed company on the stock exchange in Australia and offers a broad suite of connectivity, media and content to customers, as well as connectivity and enterprise services globally. The Australian Government created the corporation from a former government business enterprise, with Telstra still required by government to deliver on a suite of community service obligations.
the brick	Colloquial language for the first forms of mobile phones of the 1970s and 1980s. These were large and heavy devices (almost non-portable by today's standards). They weighed around 1.15 kilograms and 25 centimetres long with very short battery charge times – approx. 20 minutes.
Third-party provider	This is where a business or organisation wishes to and does deliver goods and services through a third-party (business), separate from the business or organisation e.g. rural postal services are delivered through contractors to Australia Post.
USB stick	USB sticks are electronic devices that store data in flash memory. They are designed to interface/connect with a USB portal such as those on a computer, printers, digital camera, external hard drives, mouse, keyboards, and scanners. Their data storage capacity has increased significantly in the last five years or so. Several householders used USB sticks to save movies onto from a computer, to view later through a television.
Walkman	This is a brand name (Sony Corporation, Japan) for a portable device used to play audio cassettes and dates back to the 1970s.
Well-being	This relates to a person's state of being comfortable, healthy, or happy. https://en.oxforddictionaries.com/definition/us/well-being.
Wi-Fi	Technically, a digital wireless network protocol with specific constraints and characteristics. It does not necessarily need to be used with the internet as it can be used locally within a network at home or a workplace. Comes from the words *wi(reless) fi(delity)*, viewed 12 March 2018, https://www.collinsdictionary.com/dictionary/english/wi-fi.

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1. Introduction

The mobile phone boom: an unprecedented success. If phones end up as waste, we risk irretrievable dissipation of scarce but essential metals into the biosphere. (Reller et al., 2009, in GAIA, vol. 18, no. 2, pp. 127 – 135)

1.1 Accumulation of electronics in households

1.1.1 Technology, change and everyday life

Everyday living involves individuals and households participating in various practices. Some of these are essential for survival, requiring regular performance such as cooking, eating and communication and information exchange, whilst others are more discretionary, less essential and require intermittent participation. Regardless of their significance all practices involve the consumption and use of technology and tools, whether that consumption is facilitated through monetary or some other value exchange form, such as bartering.

Throughout human history new technologies and tools have emerged, and or existing ones have constantly evolved. Such development and evolution maybe rapid, gradual, stop-start and or a mix of both rapid and gradual embedding processes (Jessop 2006; Rogers 2003; Ajzen 1991; Straub 2017). Either way the uptake and embedding of technologies and tools has shaped the configuration or form of specific practices at a household level (Shove et al. 2007).

With the emergence of newer or different forms of technology and tools, flow-on effects are triggered in households. This includes how people and households organise themselves in their day-to-day lives as the practices incorporating the technology and tools are performed (time specific) and post the performance of the practice (Fortunati 2002 and 2009). Technology and tools, along with household organisational arrangements, also influence what skills and knowledge are necessary to support the household practices and or people's ability to acquire the necessary skills and knowledge to perform the practices in the future. In most instances, technology and tools enable people and households to overcome time and geographical constraints that impact on their day-to-day living (Sheller and Urry 2000; Hjorthol 2008; Maher et al. 2008).

In the last 30 to 50 years, the adoption of electronic device technology by households and individuals has become commonplace. The technology has had profound impacts on how society operates and especially on how households and individuals undertake their everyday life. Like the introduction of networked electricity and the washing machine, the emergence of networked digital data, the internet and portable electronic devices have changed how people

and households go about their daily lives and organise their lives more broadly (Fortunati 2002 and 2006; Jessop 2006). Now electronic device technology permeates and shapes virtually all aspects of the everyday lives of people, ranging from how people go about communicating with one another, how they go about managing their finances, interacting with other household members and how they participate in entertainment and education services (Fortunati 2006; Ongondo and Williams 2011; and Tacchi et al. 2012).

Importantly electronic devices provide people with an even greater capacity to navigate and overcome time and geographical limitations, as well as the conflicting social pressures they face when living their daily lives (Castells et al. 2007; Couldry and Hepp 2016; Couldry 2012). In effect time and geographical limitations and potential interpersonal conflicts are neutralised by electronic and digital technologies, including using personal portable electronic devices and the internet (Hjorthol 2008; Hassan 2006). Consequently, with the assistance of electronic devices, people now participate in an instant and geographically and, potentially conflict neutral personal world — characterised by same time communication and information data exchange between devices and between devices and people — regardless of time and or place and household and personal outcomes desired (Fuchs 2013; Sutherland 2014; Green 2002).

But change is not solely the domain of technology and tools. Historically, change is evident and a constant in how the society in which people and households live their day-to-day lives is organised. For example, over the centuries there have been changes in society's philosophical position on the role of the state but also in relation to the role of the individual in society and the role of government. The philosophical positioning of what role the state and the individual plays in society shapes other societal institutions including the economic, political, legal and knowledge systems, as well as the meanings ascribed to everyday life practices, including the role of technology and tools, households and families, and the distribution of income and wealth.

Today, Australian households exist in a world dominated by a capitalist-profit making economic system, one in which the social systems of society centre on individuals and households taking greater responsibilities for meeting their day-to-day living needs. As Allon (2011) argues, there has been a marketisation of social relations (Carson and Kerr 2017; Allon 2011; Lindsay and Maher 2013; McEnhill and Taylor-Gooby 2018). This is a significant shift in social arrangements to emerge in the last 50 years or so. It has (and is having) important implications for how households operate and organise themselves day-to-day, and how and why they consume and use various forms of technology and tools such as portable electronic devices and information-

communication infrastructure and systems (Carson and Kerr 2017; Allon 2011; Lindsay and Maher 2013; McEnhill and Taylor-Gooby 2018).

1.1.2 Electronic device technology dispersal

The emergence of new electronic device technology practices has been underpinned by a paralleled and rapid increase in the dispersal of portable electronic devices across individuals and society. This rapid increase is reflected in device numbers, the number of individuals who possess devices, the number of different device types and the rapid and extensive connection to the internet within Australia and globally by individuals.[1] For example, as of 2014, it was estimated there had been 46 million mobile phone units sold in Australia, about two phones per capita or about 5.1 phone per household — all phones not just smartphones (Golev et al. 2016). By 2016 there were 13.75 million Australians who were smartphone users, along with 15.78 million people having an internet connection (Australian Communications Media Authority (ACMA) 2016)**.**[2]

Cumulatively the numbers of personal devices at the household, national and global levels is contributing to a mounting stockpile of electronic devices. This is both in terms of devices currently in use and those devices withdrawn from day-to-day use. Regardless, all electronic devices require waste management at some point in their material existence. Further, new, alternative and yet to be developed forms of electronic device technology are likely to emerge in the future, thereby contributing more to the existing and already growing stockpile of in-use and retired devices. Once again, the need for more effective waste management of these devices is increased. For example, at a global scale in 2010, 33.8 million tonnes of e-waste was generated or 5.0 kg per global inhabitant. By 2018 this was expected to be 49.8 million tonnes of e-waste generated or 6.7 kg per global inhabitant. Yet, according to 2014 estimates, only approximately 6.5 million tonnes of the e-waste is collected through official take-back systems, leaving massive volumes of electronic devices, hence e-waste unaccounted for (Baldé et al. 2015 and 2017).

The above suggests that people and households freely and consciously pursue the consumption of portable electronic devices out of self-interest and that this consumption is driving the

[1] This is one area where the uptake of electronic devices differs significantly compared with technology such as motor vehicles and televisions. For motor vehicles and televisions, when first adopted it was relatively rare for each household member to individually possess a vehicle or television, in many circumstances these were and still are shared amongst household members. The same is not the case for electronic devices, especially mobile and smartphones. With these devices all household members (subject to age) have their own device, which are not shared with members.

[2] In the 2016 Census conducted by the Australian Bureau of Statistics (ABS), Australia's population was 23,401,892 million (ABS 2017).

increasing stockpile of electronic devices within society. Yet from a producer, production-end perspective, a more nuanced picture emerges. According to Reller et al. (2009), Wieser (2016), Mayroft (2009) and Valant (2016) consumers are caught up in a process of object and service obsolescence — this process has become the *economic and cultural foundation of capitalism in general and its distinctive variety of market driven consumption in particular* (Maycroft 2009). That is, planned and built-in obsolescence is a deliberate design and manufacturing strategy instigated by electronic manufacturers (and other consumable goods and objects manufacturers) to force consumers to continuously upgrade and or acquire new and different electronic devices that, in turn, justifies the continued production and manufacture of electronic devices and ultimately the generation of profits (Sutton 2014). Continuous upgrading and or acquiring of new and different devices relates to both hard and software aspects of electronic devices and includes batteries and device operating systems (Reller et al. 2009).

Reller et al. (2009) further argue that the short life expectancy of electronic devices is entrenched through the electronic device industry's structural arrangements where three to five major global corporations dominate and control the manufacturing and distribution of electronic devices worldwide. These corporations have yearly sale revenues in the same order or even greater than the gross domestic product of many countries (such as Egypt and Thailand), further enabling them to exercise market power over consumers and influence governments across the globe. In this economic environment individuals and households have little if any power to alter these arrangements if they wish to stay connected to, and participate in, today's digital world — that is, they must continue to upgrade and purchase new devices when existing ones fail. This is compounding the ever-expanding stockpile of surplus electronic devices within households and globally. More significantly it increases the rate of device throughput over shorter and shorter time periods within households (Reller et al. 2009).

1.1.3 Electronic material flows and sustainability

From a historical perspective the extent and speed of the uptake of electronic device technology, along with its embedding into everyday life is unprecedented, yet at the same time the current material flows of electronic devices are unsustainable. These materials flows are predicated on the existence, and continued extraction, of natural resources such as copper, nickel, silver, gold and indium at relatively low cost (Navazo et al. 2014; Dominish et al. 2017). Such low costs do not reflect the "creation" costs of the resources, relative scarcity and uniqueness, extraction costs combined with the remediating costs linked to environmental degradation of mining as well as certainty of supply. According to the European Union (EU) (2008) and Reller et al. (2009), it is unlikely that such low costs will continue, making electronic

device technology more expensive in the future. Against this background a more sustainable approach to electronic material flows would be to reduce the production and consumption of electronic devices. But sustainability could be improved too through capture of electronic devices in circulation that are currently not being employed and are unlikely to be re-employed again in the future.

Efforts are now focusing on how best to achieve this objective. To that end countries across the globe have and are introducing legislation, regulations and protocols to more effectively manage electronic materials waste (EU 2008; Baldé et al. 2015 and 2017). Australian jurisdictions are initiating similar strategies, as are industry groups such as the mobile muster consortium in Australia (Department Environment, Land, Water and Planning (DELWP) 2017).

Whilst progress has been made in capturing electronic materials in Australia there is still considerable scope for improvement. For example, Golev et al. (2016) estimated that there were over 20 million mobile phones not in use in Australia, or as Australian Mobile Telecommunications Association (AMTA) (2016) estimates there are 25.5 million old phone handsets being held. Furthermore, at the household scale there are huge disparities between electronic materials flowing into households and the numbers of devices flowing out of households. Indicating that individuals and households are retaining considerable amounts of electronic materials within their dwellings, leading to these materials being lost from the electronic materials flow system.

Current electronic device material flows are also unsustainable because of high levels of energy and water inputs required for the extraction, production, manufacturing and distribution processes (Navazo et al. 2014); Lienig and Bruemmer 2017; Pope 2017). Compared with re-processing existing electronic materials, the manufacturing process for new devices from raw materials is generally more energy and water intensive and generates its own forms of waste. Utilising already processed materials will not only be less energy and water intensive but will assist with limiting the adverse effects of greenhouse gas emissions causing global climate change, especially global warming. The following, using televisions as a case study, illustrates the resource advantages of capturing and recycling electronic products:

> *If 75% of the 1.5 million televisions discarded annually were recycled there would be savings of 23,000 tonnes of CO_2 equivalents, 520 mega litres of water, 400,000 gigajoules of energy and 160,000 cubic metres of landfill space. (Australian Bureau of Statistics (ABS) 2013)*

Further the sustainability of current electronic material flows is questionable from an environmental impact and waste management perspective (Musson et al. 2006; Osibanjo and

Nnorom 2008; Dominish et al. 2017). As the capture of electronic device materials post household use is relatively low, this suggests that many devices are going into landfill or are "out there somewhere" in the environment. Where this is the case then toxic substances contained within devices have the potential to leach into soil and water systems, resulting in adverse effects on ecosystems. Re-use and capture of electronic materials provides the opportunity to reduce the potential for adverse environmental effects of electronic materials whilst, at the same time, ensuring that electronic materials remain within the materials flow cycle.

In addition to these unsustainable aspects of unfettered electronic material flows there are growing concerns about the human health effects of electronic device production and waste disposal (Baldé et al. 2015 and 2017; Reller et al. 2009). Production of electronic materials produces toxic fumes which have adverse effects on human health, but adverse health effects arise too through incorrect disposal of the devices by society. These effects include impaired mental development and lung, liver and kidney damage due to the release of carcinogens into the environment (Baldé et al. 2015 and 2017).

1.2 Statement of research problem

The fundamental problem this research addresses is that current flow patterns of electronic device materials are unsustainable. More specifically, I aim to discover how electronic material flows through households can be reduced and, as a result, become more sustainable. I explore how best to minimise device acquisition at the front end of the electronic materials flow process, as well as how to re-use and or capture electronic devices at the point of retirement. Ultimately the goal is to minimise future resource extraction and ensure a closed loop electronic materials flow system. Figure 1-1 illustrates the electronic materials flow system for mobile phones, highlighting resource extraction, production and supply of materials, the consumption of devices, accumulation, recycling and disposal and the centrality of consumers in this process.

Thus far, households are discussed as a central focus of the research, raising the issue of why households are relevant to understanding the sustainability of electronic materials? The answer, households are critical societal units that shape and perform social organisation and economic activities. As such, they are major sites of material consumption and waste generation, making households the ideal placed-based unit through which to investigate how and why electronic material flows occur in society as people undertake their everyday living (Head et al. 2013; Mansvelt 2005). This thesis is, therefore, predominantly situated within the human geography – consumption geographies disciplines. Section 1.6.1 discusses the concept of household in more detail.

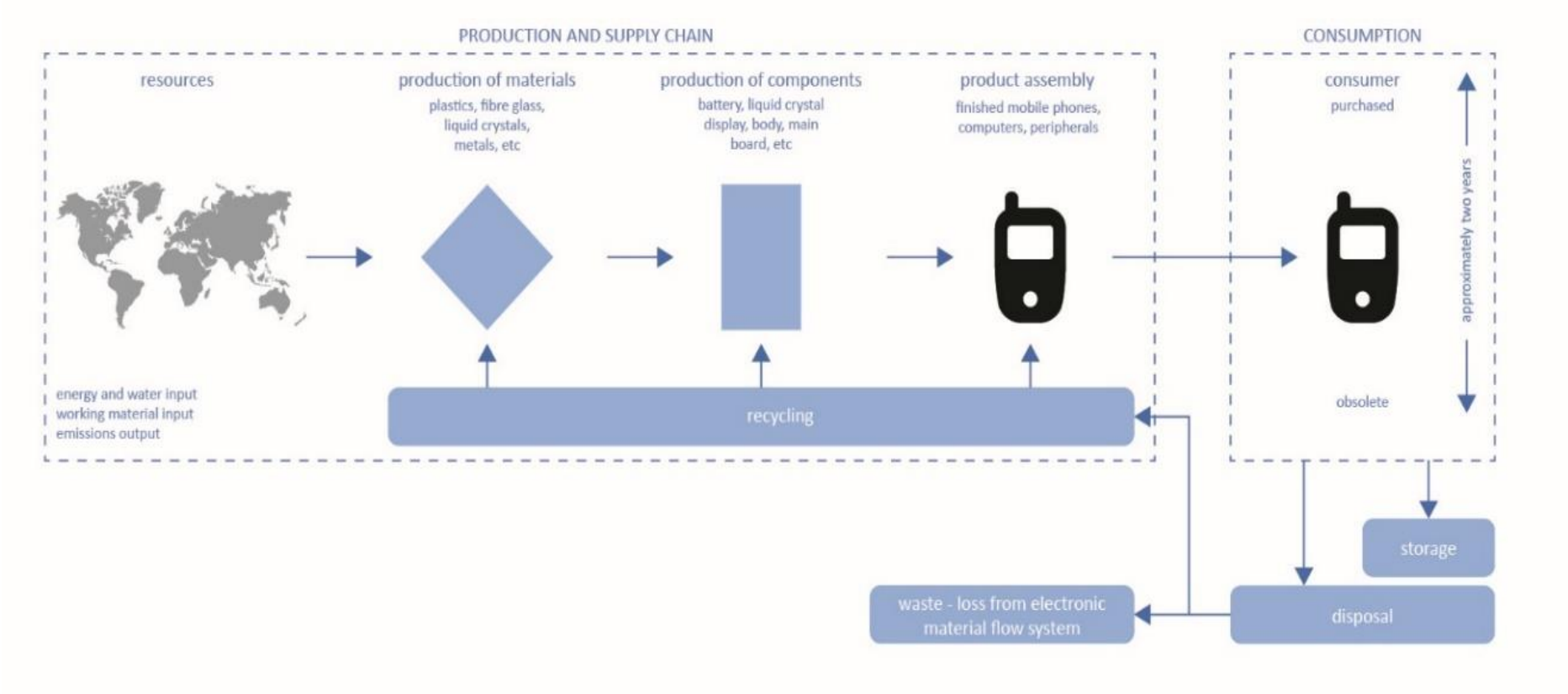


Figure 1-1: Materials flow in the life cycle of mobile phones

Source: Adapted from Reller et al. (2009)

In the last decade or so programs have been implemented by several countries that seek to divert electronic devices from landfill, preventing potential dumping into the environment and enabling the recycling of materials embedded within electronic devices. These programs are important from a resource management perspective, but they do not adequately address consumption rates of the devices in the first instance, how people use their devices, or how to encourage existing device re-use as an alternative to the recycling stream. Thus, there is a need for alternative programs that reduce electronic materials flows by targeting the complete materials cycle within households. These programs would, therefore, consider consumption of devices at the front end of the cycle, how and why devices are used, and how and why devices are retired from use and dispensed into the external electronic waste system.

Such an approach is consistent with the industrial ecology and circular economy literatures that focus on minimising materials and energy inputs and throughput whilst at the same time maximising the capture and re-use of materials within a "production system" (Jelinski et al. 1992). These are therefore, important approaches that inform the broader parameters of this research. They do fall short however, as an approach for gaining a fuller understanding of the social aspects of what goes on within households and how this influences electronic device acquisition, use, retirement and divestment. I, therefore, argue it is important to build on and complement these approaches with an approach that is socially orientated as well.

In recent decades, a growing body of social change literature has focused on how best to reduce consumption rates and material churn factors within society and households, using food, water, clothing and energy as case studies (Shove and Walker 2014; Shove 2003; Wilhite 2014; Claudio 2007; Bulkeley and Gregson 2009). These studies have as their centre of analysis, everyday practices occurring within households to explain how and why materials and resources are used and move through households (Gregson et al. 2007; Gibson et al. 2013; Evans 2018, 2012 and 2011). They draw heavily on the theoretical framework of social practice theory, proposed by Shove, Reckwitz, Strengers and Warde. As a theory, social practice deliberately moves away from examining individuals, their behaviour and attitudes to explain the causes of complex social phenomena and outcomes and as the agency for initiating social change.

Given the relatively limited success of current strategies and programs to reduce household consumption of electronic devices and improve the rates of device capture, it is opportune to explore alternative social change approaches for understanding why the success rates are limited (Head et al. 2013; Moloney and Strengers 2014). Critical to any alternative change approach is the need to more fully understand what goes on within Australian households as

they interact with their portable electronic devices on a day-to-day basis. To date, there is little research and detailed information that specifically explores the nexus between portable electronic devices, household practices and householders within a household setting from the point of acquisition through to divestment — that is, the complete electronic material flow cycle within Australian households (Evans 2018, 2012 and 2011). Or stated another way, there is limited discussion in the literature on integrating a materials perspective, such as an industrial ecology perspective, with a social practice theoretical approach at the household level in a seamless, system-based analysis. This thesis addresses this issue by assuming acquisition, use, retirement and divestment of electronic devices are markers or discrete transition points on the electronic material cycle within households. I explain the transition terms more fully in section 1.6 below.

1.3 Research purpose and questions

The aim of this research project is, therefore, to understand how and why Australian householders interact with portable electronic devices in their everyday lives. The research explores what practices occur within Australian households around the acquisition, use, retirement and divestment of electronic devices, why those practices occur and how and why they change with time. Within this context, the research objectives of this thesis are to:

- understand the social practices associated with portable electronic devices that occur within Australian households, with a focus on acquisition, use, retirement and divestment;
- canvas options to inform policy development on how best to encourage more sustainable practices around Australian householders acquisition, use, retirement and divestment of portable electronic devices; and
- contribute to the body of knowledge about contemporary social practices within households and sustainable resource use.

The overarching research question is:

How do Australian households acquire, use, retire and divest portable electronic devices in their everyday life and why?

In seeking to answer this question three sub-questions were addressed:

1. *How do Australian householders use their portable electronic devices and why?*

2. *What factors influence Australian householders to acquire and retire their portable electronic devices?*
3. *What factors influence how Australian householders manage their portable electronic devices after device retirement to the point of divestment and why?*

1.4 Contribution and significance of research

This research is significant for several reasons. Firstly, it demonstrates that a multi-disciplinary placed-based analysis undertaken at the household level is critical to fully understand complex social, technological and resource scarcity issues that exist in the everyday. The research, therefore, contributes to broadening the literature associated with human and cultural geography studies, particularly consumption geographies and material studies; sociology, particularly sociology of consumption, technology and media, households and social change; and, sustainable resource and environmental studies, specifically at the household level.

Secondly, it provides valuable insights and understandings into the ordinariness of people's everyday living linked to, and associated with, the historical emergence and subsequent all-pervasive existence of portable electronic devices in households. Furthermore, the research identifies a range of social practices that occur within Australian households, linked directly to the movement of devices along the material flow cycle: acquisition, use, retirement and divestment. At the time this research was commenced (2014), only a limited number of studies had been conducted using this approach.

Additionally, the research demonstrates that, as a theory, social practice theory is a valuable analytical tool for building an understanding of how people live their everyday lives and the role of portable electronic devices in that life. As part of this process the thesis reinforces that practice theory is an effective social change theory for instigating social change through highlighting the need to re-assess the influence of each practice element individually and the practice elements in their totality to achieve more sustainable electronic material flows through households. Consequently, the findings will provide valuable insights and information for future policy discussions around how best to raise consumer awareness about portable electronic devices and hence develop more effective electronic waste management programs.

Lastly, the research and thesis make a tangible contribution to the broader research agenda relating to rare metals waste management as a deliverable to the Wealth from Waste project, sponsored by Commonwealth Scientific Industrial Research Organisation (CSIRO) and involving Monash University, three other Australian universities and Yale University in the United States of

America. This project, in its entirety, was initiated to explore advanced metals recycling in Australia (Dominish et al. 2017).

1.5 Research methods and design

To address my overarching research question — namely, how and why Australian households acquire, use, retire and divest portable electronic devices — I employed a qualitative research approach. This provided me with the scope to explore and ultimately explain the everyday dynamics and activities of Australian households. As such the insights provided by householders in their own words were a critical data source for understanding and explaining portable electronic device acquisition, use, retirement and divestment.

The research centres on a case-based approach, involving 36 Australian households that enabled the studying of issues in an intensive and in-depth manner in a personal everyday setting — that is, within individual households and with individual householders (Hancock and Algozzine 2011; Simons 2009; Yin 1993). Approval for this research and methodology was granted by Monash University Human Research Ethics Committee (MUHREC) in 2015 (No CF15/2 – 2015000001).

A more extensive discussion of the research methods and design employed is contained in Chapter 3, Part Two.

1.6 Key terms

1.6.1 Household

The term household is interpreted and applied by researchers, government and people in varying ways (Casimir and Tobi 2011). These variations largely reflect the various contexts or purposes within which the term is applied. For example, government policy makers rely heavily on fixed and quantifiable interpretation of household to facilitate the development, implementation and evaluation of government programs (Reid et al. 2010). In contrast, research professionals frequently adopt various interpretations, resulting in no consistent definition of the term (Casimir and Tobi 2011).

For the purposes of this research I draw on literature which interprets households as a scaled-site and place of human behaviour and sustainability practices (Gibson et al. 2013; Soderholm 2010; Lane and Gorman-Murray 2011; Reid et al. 2010). Households are understood as spatial units or sites of analysis that sit between the individual and society's higher levels of organisation. They are considered as a meso-level unit, with individuals as micro-level units, whilst a state, national or international identity is considered as macro-level units. Households are therefore the site where formal and informal interactions occur between the micro and

macro levels and where these interactions play out in the everyday life of people and "things". Thus, as Reid et al. suggest, a household can be defined as:

> *.. the social unit occupying a single physical space, normally "the house" but more accurately described as a place/space of residence and is therefore best seen as both a social institution and a diverse range of physical living arrangements. Accordingly, the impact of a household on the environment varies depending on its size, occupants, inputs and outputs. (Reid et al. 2010:318)*

For the purposes of this research this interpretation of household has considerable theoretical and analytical merit, especially in relation to how households interact with materials and technology and for understanding household acquisition, use, retirement and divestment practices. Its strengths are that it interprets household as a social institution as well as its physicality and spatial dimensions and how the household unit impacts on the environment and, for this thesis, how it shapes electronic material flows. But it also provides scope to draw into my analysis the influence of individuals as most individuals reside within household arrangements. As such, both the household and individual are informed by the world outside of the household boundary. This is the working definition of household for this thesis. The issue of how households are shaped by influences outside of the household boundary, their external contextual arrangements is discussed fully in Chapter 2.

1.6.2 Portable electronic device

What constitutes a portable electronic device is debatable and subject to ongoing changes. Indeed, new and totally unknown forms of electronic device technology are likely to appear in the future, making it even more difficult to categorise the term precisely. However, in this research portable electronic devices are interpreted as easily transportable, generally hand-held, multi-functional tools and largely (but not solely) individually used devices. At the outset of the project I focussed principally on mobile communication devices, most notably:

- mobile phones (smartphone and other, android)
- tablets (iPad and e-readers)
- laptops.

However, as the research progressed it became apparent that sticking rigidly to this group of portable devices was limiting because households were using a plethora of electronic devices and technology, not just communication devices. It also became apparent that there was integration occurring between portable electronic devices and other electronic devices and equipment found in households to enable device-use maximisation. Consequently, other

personal electronic devices such as desktops, global positioning system devices, digital cameras and digital audio players were considered. This issue of integration, interdependency and seamless connection between devices is explored in Chapter 2, along with Chapters 4, 5 and 6. Irrespective of expanding the working definition of electronic devices beyond communication, portability and multi-functionality remained primary criteria due to the influence of these characteristic on use, retirement and divestment practices.

1.6.3 Practices

The interpretation of the term practice and practices varies considerably from person to person, situation to situation and from the everyday to academic endeavours. Consequently, in the everyday world there is no precise definition or interpretation. For the purposes of this research, I draw principally on Reckwitz's (2002) interpretation of a practice, which states:

> *A 'practice' (Praktik) is a routinized type of behaviour which consists of several elements, interconnected to one other ……..*
>
> *A practice is thus a routinized way in which bodies are moved, objects are handled, subjects treated, things described, and the world is understood (Reckwitz 2002 pp. 249-250).*

For the purposes of this research, practices are interpreted as active routines that contribute to everyday household living results and outcomes, regardless of whether these present as positive or negative for carriers of practices (households and householders) and the practices after the practice is performed. I explore the concept of practice further in Chapter 3, Part One where I develop my theoretical framework.

1.6.4 Material flows and points of transition

The discussion in section 1.2 highlights that improved electronic materials sustainability is dependent on reducing electronic device flows into and out of households. Understanding how best to reduce household electronic material flows warrants an integrated theoretical approach that incorporates a material perspective, industrial ecology, with a social perspective, social practice theory (Chapter 3, Part One covers this in detail). This is analytically achieved in the thesis by assuming acquisition, use, retirement and divestment are markers or discrete transition points on the electronic material flow cycle within households. These points are also considered as household practices. It is assumed that the space between each of these transition points constitutes a phase in the material flow cycle. The integrated and parallel process of household electronic material flows and social practice transition points is illustrated in Figure 1-2.

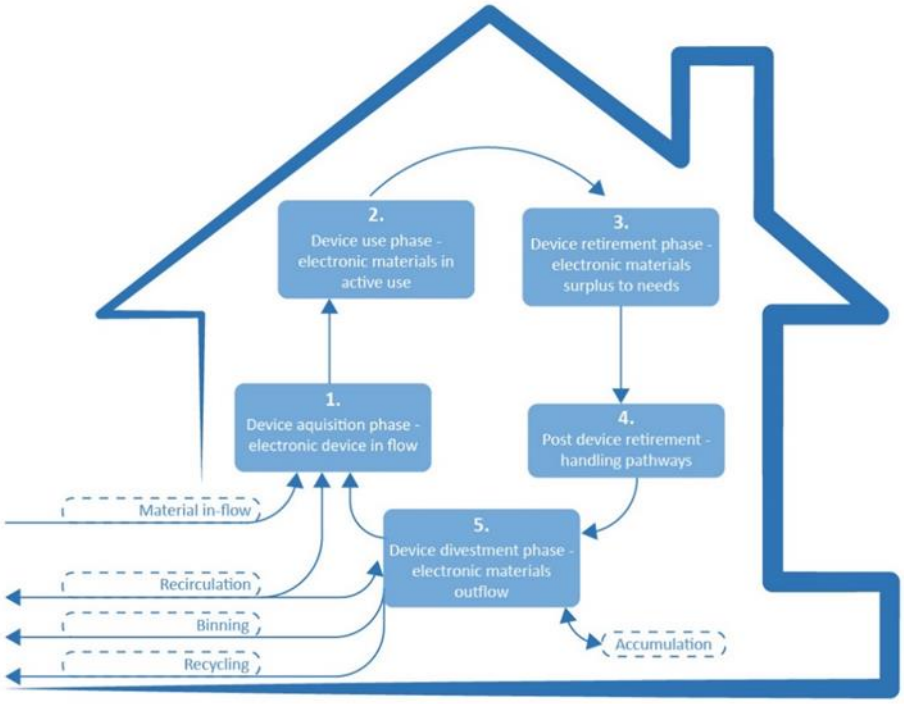


Figure 1-2: Integrated and parallel process of household electronic material flow and social practice transition points

I now briefly define each of these transition points, commencing with acquisition.

Acquisition

Acquisition refers to the first transition point of the electronic material flow cycle and relates to obtaining devices from some source, be that source external to a household such as a retail store, second-hand store or market or friends, or internal to a household such as hand-on and hand-down or gifts. The practices of device-acquisition may or may not involve monetary transactions.

This thesis adopts acquisition as the first transition point as it more precisely denotes the actual "act" of obtaining a device. In contrast, the term consumption, used widely in consumer and waste management studies, is considered too expansive in its theoretical coverage and in many cases could be interpreted as including the practices of appropriation and use of electronic devices and even waste management.

Use

Use is the second transition point on the electronic materials flow cycle and covers all the various acts or performances of practices involving the use of electronic devices. In this thesis use-practices are considered dynamic and constantly evolving over time, place and

demographics, making the possibilities of use-practices involving electronic devices within households, endless. Chapters 4, 5 and 6 focus specifically on device-use within different sets of household practices.

Retirement

Retirement refers to the practice of discontinuing the use of an electronic device, even though the device still performs its designed functions adequately. It marks the third transition point on the material flow cycle and is considered a standalone practice and is separate to what occurs to devices post this point. The term was adopted to reflect the meaning attached to the concept of retirement in the labour force where workers retire from their workplace, still having capacity and capability to perform functions but, it is highly unlikely that they will ever be "used" again. The term has similarities with researchers in the fields of consumer and waste management who use the term, hibernation (Murakami et al. 2010; Wilson et al. 2017; Gregson et al. 2007; Evans 2011; 2012; 2018). However, for this thesis hibernation was considered more of a transient term, whereby a device is brought out or put back into a "den" when or when it is not required.

Post-retirement handling pathways

This term is used to capture the fourth transition point and to demonstrate that upon retirement, electronic material management does not follow a single, linear handling pathway within and out of households. The concept of pathways is consistent with the concepts of conduits, surplus to needs, and the gap-space proposed by Gregson et al. (2007) and Evans (2018, 2012 and 2011) and which has historically been referred to as, disposal.

Four post-retirement handling pathways are used in this thesis and which constitute transition point four. The first pathway, in-situ accumulation of devices refers to any form of retired electronic device that is held within the confines of a household dwelling, including structures such as sheds and garages and is frequently referred to as stashing, hoarding and stockpiling. In this instance, the term in-situ accumulation is preferred as it highlights that devices are stored in a "place", a specific location within a household setting. It has the effect of stagnating the electronic material flow across short to medium to long-term time horizons.

Handling pathway two is recirculation of devices and involves retired devices being: incorporated into a different device with a different function through do-it-yourself practices; used by other people after a device is handed down or on; and on-sold through a monetary or barter exchange process. Recirculation, as a practice, does not contribute to the loss of electronic materials from the materials cycle — devices still exist in an active-use phase. Recycling is the third handling pathway and is a commonly used term to denote formal

management activities of no-longer in use materials and objects for re-use in some form or for reprocessing. For the purposes of this thesis it refers to households voluntarily dropping off and or sending devices to external third-party recycling facilitators such as MobileMuster. If implemented genuinely, by all involved, this provides the ideal pathway through which a closed-loop electronic material flow is achieved but not within households. Post-retirement handling pathway four is intentional binning. This refers to the conscious placement of retired devices into the mainstream domestic waste collection system, with electronic materials invariably lost from the materials flow cycle completely.

Divestment

Divestment sits at transition point five of the electronic materials flow in households and refers to the "act" of dispensing with devices to a location or entity outside of the household dwelling or the relinquishing of a device by a householder. It is a broad-based term, which links to the post-retirement handling pathways discussed above but provides a clear demarcation of what devices are in, and what devices are consciously removed from, households, namely the exiting of devices from households.

1.7 Thesis outline

The thesis is divided into eight chapters. This introductory chapter (1) has set the scene for the thesis by detailing the research problem, questions and significance and clarifying key terms and concepts.

Chapter 2 is an interrogation of relevant literature structured around three themes. First, changes in Australia's Information-Communication System, its infrastructure, devices, and materials, along with governance arrangements and how these have affected the engagement of households with portable electronic devices. Second, Australia's pursuit of economic growth, the role of households as units of consumption in this pursuit and the consequences for material flows of goods, including electronic devices. Thirdly, a description of who has what devices, how they are used and divested as a guide for electronic material flows through Australian households. The chapter draws specifically on secondary data sources such as the Australian Bureau of Statistic information, and reviews relevant academic literature. The chapter highlights that the arrangements outside of household boundaries are important in influencing how and why Australian households acquire, use, retire and divest portable electronic devices. Also highlighted is that change is constantly occurring within those arrangements. The chapter ends by arguing there is limited information available on what goes on within households as

householders engage with electronic devices in their everyday lives and how and why electronic devices flow through or stay within households.

Chapter 3 is divided into two parts. In the first part I present my tailored social practice theoretical framework, with social practices as the unit of analysis for the research. Drawing on the literature review and my evaluation of social practice theory literature, I adopt a practice configuration based on four elements: meanings and understandings, materials and infrastructure, context, and knowledge, skills and competencies. Industrial ecology and circular economy perspectives are noted as the overarching theoretical framing of the research to reinforce the important relationship between material flows and sustainability. Part Two details the methodology which builds on the social practice theoretical framework and its focus on everyday practices by using a qualitative case-based approach. Issues of research design and methods, data collection techniques and my analysis approach are outlined. Three household living domains involving the use of portable electronic devices are identified in the analysis: social and economic capital; leisure and entertainment; and, cultural capital. Each of these domains provide the focus for the first three analysis chapters.

Chapter 4 explores the household living domain of social and economic capital and addresses two of the research questions: what factors drive the acquisition of devices; and, how and why do householders then use the devices. It delves into three outcome areas and the practices within these areas that contribute to household social and economic capital: building social capacity; securing income and resources; and, managing material and financial resources, and identifies why and how devices are used in these practices.

In Chapter 5 the focus is on how and why householders acquire and use portable electronic devices in the living domain of leisure and entertainment. Two outcome areas of leisure and entertainment are examined: improving everyday quality of life; and, maximising the enjoyment of travel. How and why devices shape the practices contributing to these outcomes are examined. I then explore unintended consequences of the practices, associated with the use of portable electronic devices: intensifying and ratcheting-up of existing and or related practices.

Chapter 6 examines how and why householders acquire and use portable electronic devices in the household living domain of cultural capital. I examine three outcome areas of cultural capital: institutional education; day-to-day learning; and, awareness and social status and the practices supporting these outcome areas

In the next chapter (7) the analysis shifts to exploring practices involved in device-retirement and post-retirement of devices in households (Gregson et al. 2007; Evans 2012). The chapter is divided into three sections. Section one addresses the broad-based practice of device retirement through the lens of the four practice elements: context; materials and infrastructure; knowledge, skills and competencies; meanings and understandings. Section two examines electronic device handling processes post retirement within households. It details four handling pathway processes employed by households and then focuses on how practice elements and their configuration influence the divestment of devices (the material flow of devices) by households.

This is then followed by the conclusion, Chapter 8, where I overview the key findings, outline the implications of this research for policy and highlight the contributions of this research to knowledge development.

2. Australian households: Contextual systems and electronic device flows

> *We live by object time: by this I mean that we live at the pace of objects, live to the rhythm of their ceaseless succession. Today, it is we who watch them as they are born, grow to maturity and die, whereas in all previous civilizations it was timeless objects, instruments or monuments which outlived the generations of human beings. (Baudrillard, as quoted by Pope 2017)*

2.1 Introduction

This chapter establishes the Information-Communication System (IC System) in which Australian households operate and argues that these macro-level arrangements influence how and why households and householders interact with portable electronic devices. I illustrate that change is constantly occurring and this dynamism has implications for what household practices occur, how they occur and why and when households and householders acquire, use, retire and divest portable electronic devices in their everyday living. Areas where change is constantly occurring are infrastructure and governance arrangements of Australia's IC System, electronic device technology; economic development and associated urban development; and, population and household demographics. It is these factors I argue that are contributing to the ever-increasing material flows of portable electronic devices through Australian households. For this chapter and the thesis more broadly, these factors constitute the contextual system in which Australian households operate in society and hence the contextual arrangements for electronic device flows within households. Context being a theme I address in detail in Chapter 3, Part One.

I conclude this chapter by arguing that macro-level explanations for how and why Australian households acquire, use, retire and divest portable electronic devices are important but fall short in one critical area. They are too high-level to adequately explain and understand the dynamics of the "nitty-gritty" of everyday household living, and how such living activities influence the flows of electronic devices through households. Thus, in Chapter 3, Part One I argue for an analytical approach that incorporates all levels of social arrangements, including those outside the boundaries of households under the umbrella element of context. In doing so I present social practice theory as my theoretical approach for investigating and explaining everyday household practices involving portable electronic devices, set within the concepts and principles of industrial ecology outlined in Chapter 1.

This chapter is divided into four sections. Section one examines changes in the IC System, its infrastructure and materials and how these influences the interaction of households with

electronic devices. In section two changes in the governance arrangements of Australia's IC System are detailed, as well as the influence of these changes on the acquisition, use, retirement and divestment of devices by households. Then in section three I examine Australia's changing economic and urban conditions, the interlinkages between these conditions and households as consumption units, resulting in a readymade platform for the rapid uptake of portable electronic devices. Finally, in section four, I examine portable electronic device flows through Australian households by detailing who uses what, how devices are used and the status of not-in-use devices in Australian households.

2.2 The Information-Communication System: Infrastructure and materials

Portable electronic devices are one operational unit in the IC System that involves complex infrastructure networks and materials, organisational arrangements, "the market", households and householders. Knowing what constitutes this system, especially how households engage in it and the role of electronic devices in the system, is necessary for understanding how householders interact with portable electronic devices in their everyday worlds and the social practices that evolve and are performed. This section develops such an understanding by describing the infrastructure-network structures of the IC System, and by exploring technological changes in portable electronic devices and their effects on everyday household living.

2.2.1 Network and system components

The current IC System consist of two main components. One is the hardware infrastructure network which covers the physical structures such as satellites, towers, fibre optic cabling and connection devices/boxes to buildings. It also includes the physical devices used to generate and exchange information and to communicate such as mobile phones, computers, smart televisions, Wi-Fi boxes and flash memory devices.

The second component of an IC System is its soft infrastructure. This is the software or invisible elements of the communication and information exchange processes that facilitate or enable the capabilities of the devices to be used by householders. The soft infrastructure covers the network operating system, such as 3G or 4G and the type of transmission mode (for example cellular or broadband), along with a device's operating system and supporting software programs such as Windows.

Integration of these two components is a necessary condition for the IC System to operate effectively. Under current technology this integration is achieved through a single platform where voice, data and video-radio services are collapsed into the one network, digitalised and data is transferred from one point to another via fibre optic cabling technology and in some

circumstances wireless and copper wiring. Previously the IC System operated across and was delivered through multiple platforms such as those for data, voice services e.g. telephone and video and radio (e.g. television).

The interaction of the different components of the IC-System are illustrated in Figure 2-1. It highlights the role of electronic devices in the information-communication exchange process and where in that process households have a degree of autonomy and influence in how devices are used in everyday household practices.

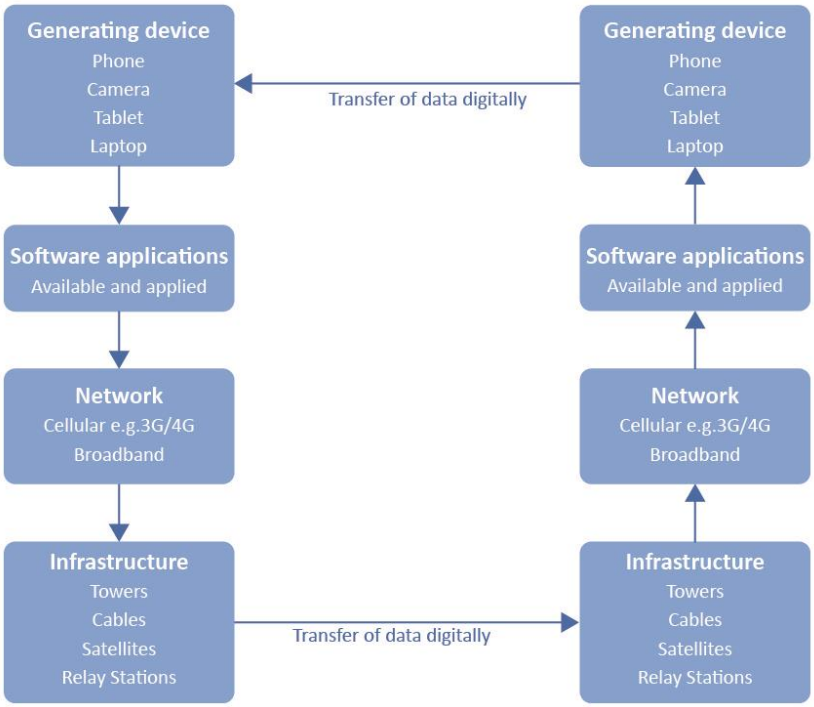


Figure 2-1: Diagrammatic representation of the Information-Communication System – Peer to peer interaction

Source: Adapted from ACMA (2013), **Broken concepts: A 2013 update on the Australian communications legislative landscape**

2.2.2 Changing technologies and tools shaping everyday life

Over time the tools that people have used to participate in information-communication activities have changed considerably. Since the early 20th century these activities have centred on fixed-line telephone and cabling and the use of sound waves which are converted to electrical signals via a transmitter in the telephone. Today, portable electronic devices provide the point and

mechanisms through which householders physically interface and participate in the IC System described above.

Within the realm of portable electronic devices change has been and continues to be a constant feature. Since the emergence of the first portable phone around the 1960s there has been unprecedented change in device physical appearances and useability, functionality and the social acceptance of the devices. There has also been changes regarding the types of portable electronic devices available to householders, an issue I return to later in this section. Device changes are summarised in Table 2-1 below.

One aspect of device appearance and useability directly affecting the preparedness of households to use portable electronic devices is size and weight. Since the advent of the first mobile phone, "the brick" around the 1970s, the size and weight of phones (and other devices) have become smaller and smaller and lighter and lighter. These changes are not only reflected in width and height but also depth — the scope of these changes in devices is illustrated for mobile phones in Figure 2-2. Such physical changes are directly linked to technological advancements in materials used in the production of electronic device but also in how these materials are manufactured. Combined they have led to a shift from relatively heavy, high volume and relatively low value materials to extremely light-weight, small volume and high value materials (Agar 2003). With this shift to high value materials, the need to maximise the capture and re-use of these valuable materials from household electronic devices is an increasingly important social, economic and environmental issue.

From a householder's useability perspective, the reduction in size and weight meant that electronic devices became increasingly more portable and durable, a key attribute that is now enabling householders to transgress time and space constraints. Until the 1980s most household phones were bulky, fixed land-line devices and were located permanently in one central area in a house, usually a hallway.

Phones were used by multiple household members in the same location within the house. All household members could see and hear what was going on with other household members — there was no personal privacy or communication space (Agar 2003; Green 2006; Sheller and Urry 2003; Church 2010). Houses were configured to facilitate the use of the phone for all, with household activities supporting such layouts. In contrast, householders now move with their electronic devices anywhere, both within and outside their dwelling. Consequently, both devices and householders are no longer anchored to the one geographic location when participating in

information-communication and entertainment activities. Personal privacy and individual needs are now more easily secured (Weilenmann 2003).

Table 2-1: Changing features and attributes of electronic devices over-time

Area	Changing electronic device features and attributes over-time	
	From	**To**
Physical appearances and useability	Large, bulky and ugly	Aesthetically pleasing, streamlined and small
	Heavy	Lightweight
	Clumsy and ergonomically difficult	Ergonomically friendlier
	Portability difficult	Highly portable
	Stand-alone and non-power dependent	Power and battery dependent
	Mechanical and or electrical	Electronic and electrical
Functionality	Standalone	Connectivity and integration capabilities. Converged and integrated technologies
	Limited functionality: voice and text communication with basic games	Multi-faceted functionality: ranging from entertainment, communication and data-information exchange and processing
	Limited capacities and capabilities	Unlimited capacity and almost unlimited capabilities. People or model currency are the constraint
Social embedding	Small number of adopters	Broad scale adoption at household and global scale
	One or two device types in use	Multiple device types and devices in use, especially at household scale
	Used within the domain of private space	Used in public or private space — no difference between the two domains
	Cost prohibitive	Affordable
	Socially accepted at the time	No longer delivers against social expectations and needs. Older devices become socially unacceptable because of innovations in device technology and differences across generations re acceptability of devices and practices

Figure 2-2: Evolution of mobile phone devices – design, physicality and materiality

Source: https://www.google.com.au/search?q=images+of+today%27s+mobile+phones

Functional changes are less tangible than those relating to physical appearances, but they also continue to have a significant effect on how and why householders acquire, use and cease using portable electronic devices. Several interconnected technological changes are important here. The advancements and developments in the soft infrastructure of electronic devices which includes operating systems, software programs, games and applications (Agar 2003; Couldry 2012). Changes in the soft infrastructure have been rapid, especially in the last five years and have been largely driven by, and responses to, the arrival of the smartphone.

One outcome of improved soft infrastructure and hence improved functionality of devices for householders is that householders are now able to personalise how they "drive" their devices, including laptops, e-watches, smartphones and tablets. The capacity to personalise and individualise device-use through personal programming of software and applications by device-users is a relatively recent phenomenon and is continuing to grow at a rapid rate (ACMA 2016; Couldry 2012). For example, in Australia, the adoption of mobile apps increased in recent years, with 4.45 million smartphone users aged 18 years and over downloading a mobile app in 2012. By comparison in 2011 this figure stood at 2.41 million, an increase of 85 per cent (ACMA 2013).

Another technological change factor driving the improvement in device functionality is the advent of, and the rapid and expansive engagement with, the internet. For example, in Australia 7.3 million households, or 86 per cent of households had internet access in 2012-2013 with more than three quarters of the households having internet access through broadband connections. This has a major influence on the consumption of different types of electronic

devices, especially their technological currency, as well as where and when householders use their devices and for what purposes (ACMA 2013 and 2016). But overlaid with the advent of, and engagement by households with, the internet is greater levels of retirement and stockpiling of electronic devices that provide poor internet accessibility.

Convergence is a further technological innovation improving the functionality of portable electronic devices. In simple terms it is where there are different forms of technologies, virtually performing the same role or function and which are achieved through a single device or platform. For example, there is no clear demarcation between telecommunications, the Internet and mass media — their functions and roles blur into the domains of each other.

There are two areas where the impact of convergence is observable at the household level. The first relates to the process of the merging of radio communication, telecommunication, broadcasting and the internet platforms into the one technology, the single platform (ACMA 2013; Cowan 1983; Agar 2003). The second area is the shift to a single physical device and its operating system for accessing and using information-communication and entertainment functions. Both have made the functionality and use of current devices more streamlined, convenient and more powerful. Previously functionality was dependent on multiple devices to achieve multiple functions and uses. For householders the improvements gained through convergence have been, and still are, significantly enhanced by the decline in size and weight of devices enabling greater portability as discussed earlier.

Convergence is not a recent technological development. In fact, it has been a constant feature of communication systems throughout history. What differentiates current convergence processes compared with other periods in history is the extent and reach of its impacts on how households live their everyday lives. (Agar 2003; Bijker 1987; Bijker and Law 1997, Balbi 2009; Balbi 2013; Castells et al.; 2007; Berker 2006; Crowley and Heyer 2015; Haddon 2004; Horst 2006; Jessop 2006; Lievrouw and Livingstone 2002; Lievrouw 1998). To highlight this change. Householders now have the capacity to easily and conveniently perform a whole raft of household and personal activities into and through a single device, including:

- staying connected with people in real time;
- sourcing and participating in self-generated and managed entertainment; and
- performing a whole raft of household activities that previously would have involved travel. For example, shopping, paying bills, borrowing books from a library and market researching.

Closely linked to convergence is integration. This technological innovation involves the use of two or more electronic devices by householders to achieve one overall goal, thereby improving the overall functionality of single devices. Two examples of integration directly relevant to households are worth noting. One, the use of digital cameras to do photography. Devices enable the seamless transfer of camera data onto a laptop, use the laptop to manipulate that data and then send the final image from the laptop to a printer or a third person. The second is the use of a laptop to download and or stream movies, to be played back through a large television screen that is linked to an independent sound system. All in all, some argue integration makes a householder's experience of media and entertainment more exciting and enjoyable, thereby enabling this format to compete with mainstream external multi-media and entertainment venues because of its ability to enable households to determine when, and with whom, they wish to enjoy the entertainment (ACMA 2016).

The emergence of lighter weight and more durable devices combined with the subsequent improved portability has had a flow-on effect too, triggering major improvements in device-design, especially for the smaller hand-held devices such as phones, tablets and laptops. This has reinforced the ongoing trend towards smaller and more streamlined devices, greater portability and improved aesthetics. A by-product of this process is the arrival of device-appearance and branding as a social status discriminator amongst household members and more broadly within society (Rogerson 2010; Watkins, Hjorth and Koskinen 2012; Sheldon and Bryant 2015; Deloitte 2017).

2.3 Shifting responsibilities in Australia's IC System

In this section I turn to changes in the governance arrangements over recent decades associated with Australia's IC System. These arrangements, mentioned in Chapter 1, are based on the objectives of smaller government, privatisation of public assets and shifting day-to-day living responsibilities to individuals. All have directly impacted on Australian households. Especially, in terms of how householders source IC System providers and services to undertake their day-to-day information exchange and communication activities. These impacts are now explored.

2.3.1 Institutional and governance changes

Various scholars have examined the effects of infrastructure governance arrangement changes in recent decades on society (Graham and Marvin 2001; Coutard 2008; Spiller 2013). Graham and Marvin developed the concept of splintering urbanism, an umbrella term capturing government deregulation of publicly-owned infrastructure networks, including communication, water and energy. They argue that the deregulation process results in the unbundling of

infrastructure networks, that is the network is broken up into fragments and discrete functional operating units with multiple private ownership or operating arrangements.

Further, Graham and Marvin argue the process results in the decline and presence of publicly provided infrastructure and collective approaches such as those for communication and information exchange. Instead the new governance arrangements are individualised — the situation Australian households operate within today. To illustrate this contrast in the 1950s-1970s not all households had telephones, with those that did willingly sharing their phone with others and in some cases the neighbour bore the cost of the call. Today's information-communication world is characterised by multiple devices and individual ownership or possession, with little or no sharing of devices between individual users.

To understand more fully how this process has affected Australian households two specific elements of Graham and Marvin's splintering urbanism theory are worth considering in more detail. Firstly, the modern infrastructural ideal included urban governance systems that were monopolistic, integrated and standardised systems of network provision (Australia's arrangements prior to the 1990s). In the case of telecommunications, all household users are charged at a standard flat-price rate, regardless of time spent on the call for all local calls — a one size fits all approach. Under these arrangements the telecommunications provider had a monopoly to supply communication devices and appliances to households. By comparison, today's households are charged on a user-pays basis according to time, distance and or the consumption of data memory space. They are also no longer obliged to source information-communication services, and devices and equipment, from a single provider. They have greater choice with respect to providers, services desired and hardware they wish to use, or some may argue greater control over their consumption of information-communication services and devices.

Secondly, the process of unbundling and bypassing is also important to understand. This runs in parallel with the modern infrastructure ideal. It involves the application of emerging technologies, such as digital technologies to facilitate or create different forms of infrastructural arrangements. This results in the dismantling of existing "integrated networks and cities" systems and governance arrangements. The outcome is a splitting of existing integrated infrastructure into different network elements and packages. An example of this process faced by Australian households was the breakup of Australia's telecommunication sector into two business entities as part of deregulation: one providing the infrastructure-network (the hard infrastructure); and a second providing the communication services (soft services directly to

consumers and households). As a result, Australian householders now take greater responsibility (or are indirectly forced to) for navigating the interface between infrastructure provision, data allowance, device choice and device-use.

A further effect of this unbundling process is the ability of infrastructure and service providers to completely bypass potential users and or give preferential treatment to other users through decision-making based on differential pricing policies, infrastructure and services roll-out linked to geographic areas, timeframes and other factors. Examples include the construction and maintenance of road systems, with decisions frequently based on parliamentary electoral campaigning agendas for safe seats compared with marginal seats. The recent Victorian government's rail-level crossing removal program roll-out, supposedly based on vehicle crossing figures rather than suburb socio-economic profile is an example. Similar situations are observable in the construction and location of new hospitals and government offices (Alizadeh and Farid 2017).

In terms of communication, a focus of this research, the impact of the unbundling process is clearly observable in how infrastructure providers selected localities and, hence, the timeframes for the delivery of components of the IC System and access by households to the types of services provided by the IC infrastructure. For example, not all households have high-speed data, and for some areas, the cost of data is high compared with other comparable households in other areas, whilst in other areas households are faced with download caps that restrict their ability to maximise their data use. The outcome is considerable differences across Australian households and their capacity to participate in the digital economy (Alizadeh 2017; Alizadeh and Farid 2017). Alternatively, as Alizadeh and Farid (2017) suggest, existing inequalities across households are created and or perpetuated in how information and communication infrastructure is rolled-out.

Inequitable access to IC services by households is particularly pronounced in the roll-out of Australia's mobile communication services and National Broadband Network (NBN). In the case of mobile communication services preferential treatment was given to households in urban centres in the first instance, followed by rural regional towns and then rural areas and finally to topographically difficult locations — the so-call black-spot mobile reception areas, which is still a work-in-progress. Households in lower priority areas are, therefore, at a disadvantage compared with urban households and which ultimately has implications for householders in the acquisition, use and retirement of electronic devices within households as determined by where they live.

For the NBN roll-out preferential treatments and priority was given to localities that provided the government of the day with political and electoral advantages, or as Alizadeh and Farid (2017) argue the roll-out was based on pork-barrelling politics — localities providing the "best political return" to political parties (the winning of seats) and return to government at an election. Alizadeh and Farid (2017) go on to argue that this clearly has resulted in inequalities across households with respect to access to the NBN and high-speed data. They further note that the Commonwealth Government's decision in 2013-2014 to roll-out a mixed technology network has had, and will continue to create, inequitable access to data services between Australian households and perpetuate existing social and economic inequalities in Australian society. To quote:

> *The early NBN roll-out gives the release sites a regional competitive advantage against other localities that have to wait up to several years to receive the telecommunication infrastructure.*
>
> *The latest decision to continue the NBN using a mixed technology intensifies the socio-economic and political implications of the national broadband project which has now transformed into a patchwork of final speeds and different quality of service across the country. (Alizadeh and Farid 2017, p. 250)*

The above highlights how changes in Australia's IC System governance arrangements over recent decades have driven households to become more proactive in managing how and what information-communication infrastructure and services they wish to access and consume, including what devices they wish to use to access services. But it also highlights the social and economic inequalities that have and are arising from how IC System infrastructure in Australia is provided to households, especially what household groups in society have more effective access and capacity to use the system compared with other groups.

The current governance arrangements in Australia for the information-communication sector, in which households are active participants are as follows. The provision of the current IC System is through a single platform that provides universal access to communication services, especially the internet. Importantly from a householder's perspective the entire system is now provided and serviced through a plethora of private companies and businesses operating in a "free-market". For example, consumers in Melbourne can choose between at least 40 broadband providers and around 30 service providers for mobile phone services. Overall, households are under the control of the IC System industry players and it is difficult for them to opt out of the system. This contrasts with previous decades when the government was an active and dominant player providing telecommunications as an essential service or public good. Today, the Australian Commonwealth government's role through its agency the Australian Communication

and Media Authority is one of licensing and regulating private providers that Australian households engage with and use.

2.3.2 Adapting to changed circumstances

Changing governance arrangements have re-shaped how Australian households participate in the IC System and undertake everyday household living. They now have considerable choice on which IC infrastructure and service providers to use and as part of this (at least in theory), tailor the arrangements to meet their individual needs. For example, choice around data capacity allowances and data speed, within the realms of what is available to them, given where they live.

As indicated earlier households do have choices and the ability to tailor services but their choices also have limitations or restrictions. Householders face technical limitations depending on whether the device and infrastructure capabilities are adequate to maximise the use of services. A second limitation can be financial capacity to exercise and maximise their choices. Another limitation is whether householders have the necessary competencies, skills and knowledge to navigate device functions, the governance arrangements, especially the cross-over between the network technology services (ACMA 2013; Australian Institute of Family Studies (AIFS) undated; Technology to Care undated). With the growing disparity of income and wealth between Australian households, it is likely that the ability to successfully access and use the IC System will reflect and reinforce existing inequalities created by the system itself and more broadly. These inequalities will be reflected across the entire electronic material flow processes within Australian households.

2.4 Development, change and the consumption nexus

Australian households have, since British colonisation, resided within a constantly changing economic system (Sinclair 1976; Boehm 1993). Understanding the consequences of these changes provides valuable insights into how and why Australian householders currently conduct their everyday worlds in the context of their interaction with the IC System. Given these changes, the aspects I wish to focus on are: Australia's economic development agenda, the positioning of households in that development and the rise in the propensity of households to consume and by implication generate waste; and, how demand for portable electronic devices is manifested amongst household consumers.

2.4.1 The dynamics of Australia’s economy

Australia's existing urban settlement and household living patterns are, in part, a product of Australian governments’ economic development objectives since British colonisation. Initially,

these objectives supported agricultural commodity exports as the principal sector in the economy. During these times, a large proportion of Australian households existed in remote or regional areas, the geographical areas of agricultural production (Sinclair 1976; Boehm 1993). Conspicuous consumption of goods and services by households during these times was a relatively uncommon practice, with the main exception being, the consumption activities by wealthier farming and the more affluent city-based households (Weston et al. 2001).[3]

From the late 1900s until the 1960s and 1970s manufacturing industries overtook agriculture as the dominate sector in the economy. This was associated with a process of urban expansion involving increasing numbers of households in major cities and towns, as well as increasing household consumption of manufactured goods. Consumption of goods and services as a display of social capital status amongst the general population was beginning to gain traction. In this period too, the service sector was relatively insignificant to the economy, with consumption of services by Australian households being a small part of household expenditure activities (Sinclair 1976; Boehm 1993).

Throughout these periods all sectors of the Australian economy were underpinned by high levels of government protection and regulation and consequently the Australian economy and households existed in a vacuum, immune largely from the ebbs and flows of the world economy (Beer 2012; Daly 2007). These structural and micro-economic arrangements provided Australian households with access to low-cost finance and land. Combined, they increased the rapid urbanisation process of Australian towns and cities, especially after the 2nd World War. The Australian ideal of the "¼ acre block, a house and family" became both a reality and a dream to pursue (Davison 2008).

Reinforcing this trend was generous government assistance for home ownership through tax relief and managed-loan interest rates. Additionally, the availability of low-cost energy in Australia encouraged further urban (suburb) expansion and an increasing reliance on motor vehicles as the principal, if not sole, form of transportation for households (Beer 2012; Spiller 2014; Daly 2007). Importantly, the need for good communication networks became critical as a means of overcoming the isolation of households in these newly developing urban areas. This issue of overcoming isolation and remaining connected is a common theme addressed throughout this thesis.

[3] The term conspicuous consumption is a term derived from Veblen's **Theory of the Leisure Class**, 1899. It is about individuals demonstrating they have the necessary wealth to consume goods and achieve social honour, status and distinction (Corrigan 1998).

However, changes to these arrangements did occur. In the 1970s successive governments introduced many structural changes to the economy, including the reduction and dismantling of government support to the manufacturing and agricultural sectors. One such change was the reduction of tariffs on overseas manufacturing goods coming into the Australian economy, making manufactured goods more readily available and affordable to Australian households. This linked neatly to the continuing urban expansion process and the increasing construction of houses, which required fit-out with goods such as washing machines, televisions, stoves and hot water services. The consumption of more day-to-day material goods such as radios, toasters, electric jugs, fashion and services such as entertainment also became a more common practice.

In the 1980s, further structural changes were made to the Australian economy. The financial sector was deregulated, including the floating of the Australian dollar against overseas currencies. Further reductions in tariff protection were introduced as were several micro-economic reforms (Daly 2007). Consequently, Australia, its economy and households were pushed into the global economy, resulting in households having access to even more consumer goods (Boehm 1993). A situation which encouraged more conspicuous consumption (Veblen 1899) by households/ers.

These changes have also meant that all sectors of the Australian economy, including households had greater and easier access to capital and finance. Whilst economic changes were associated with a decline in the bulk agricultural industries (such as wool and grains) as well as the manufacturing industries like cars, footwear and clothing, and white goods, they did create an environment that enabled Australian households to further pursue their growing obsession with the consumption of non-essential goods and services (Boehm 1993). Or, as Cook et al. (2013) and Ritzer and Jurgenson (2014), suggest access to freely available finance enabled households to undertake non-essential consumption activities, such as the latest television, computers, electronics, holidays and other non-essential goods through the practice of mortgage-enabled consumption. This consume now, pay later philosophy has underpinned much of Australian households' rapid uptake of all things electronic in recent decades.

For Beer (2012) and Daly (2007) the cumulative effect of macro-economic changes enabled the service sector, especially the financial and business services, to dominant the Australian economy. The rapid economic growth in Australia's major cities, especially Sydney in the first place, followed by Melbourne, fuelled further the growth in household and consumer expenditure. Beer (2012), referring to O'Neil and McGuirk (2002), argues that from the early 1990s Australia entered a new phase of economic prosperity based on the financialisation of the

economy and a decline in the cost of finance. But for Beer these changes were only possible because of major innovations in the communications and information management sectors and changes in the governance arrangements around this sector (discussed above). These facilitated the instant transferring of information, data and monetary transactions across organisations, places and globally, and had important implications for Australian households in how they accessed and used IC systems (Beer 2012). I return to this issue later in this chapter.

The above overview illustrates how change in the Australian economy has influenced the expansion of residential settlement arrangements and fuelled a culture of household consumption practices. The rise of mining from the late 1980s early 1990s is also noteworthy. As a growing and important sector in the Australian economy the mining sector underpinned Australia's rapid economic growth during the late 1990s and into the 21st century — the so-called mining boom.[4] This newly arrived economic prosperity further enhanced Australian households' preparedness to consume goods and services — well beyond essential needs to live. This trend was further compounded by successive governments providing personal income tax reductions, thereby increasing households' discretionary income for consumption (Hamilton 2003; Hamilton and Dennis 2005).

2.4.2 Migration, infrastructure expansion and consumption

Overseas immigration to Australia has long been a driver of economic development. Over the last 100 years or so successive Australian governments invested heavily in immigration programs which drove economic expansion, growth and decentralised settlement patterns (Productivity Commission (PC) 2006; Kelley 1965). High levels of household migration within Australian cities and between rural and regional and cities continues to be common practice. Often this was, and still is, in response to changing economic conditions and industry re-structuring (PC 2006; Sinclair 1976; Boehm 1993).

Immigration as well as internal migration have had important implications for Australian households. To begin, there was an increasing need for the provision of adequate infrastructure, such as telecommunication networks, into urban and regional areas where many newly arriving overseas migrants settled. These movements frequently involve the consumption of additional goods and services by households and ensuring they have in place adequate communication networks to remain connected with family, friends and their immediate world, such as business and government services in which they operate, when establishing themselves in new locations.

[4] This excludes the significance of gold mining in the 1850s to Australia's economy and standalone endeavours such as the Broken Hill mine.

And secondly, many Australian households now have members who were born overseas or have relatives or friends still living in overseas countries (ABS 2017). Access to communication tools, services and infrastructure is therefore important for many migrant households and geographically dispersed Australian families to ensure they remain connected with family and friends. Third, immigration has contributed to Australia's economic growth through consumption generated by newly arrived households and some may say by the social support industries facilitating migrant re-settlement (Sinclair 1976; Boehm 1993).

2.4.3 Material consumption and accumulation

Material consumption has accompanied phases of economic development (Hamilton 2003; Hamilton and Dennis 2005; Pope 2017). As mentioned, different periods or waves of household consumption have characterised Australia's economy and economic growth. This has resulted in an accumulation and stockpiling of material goods consumed by households. The corollary of these arrangements is that households are sites of material waste generation, storage and disposal, including acting as sites in this way for electronic devices (Bulkeley and Gregson 2009; Kennedy and Wilken 2016; Gorman-Murray 2007; Head et al. 2013; Lane 2011).

The extent of household accumulation was a relatively unknown phenomenon prior to the 1970s as in many instances repairing of goods was a common practice (Trentmann 2009; Gregson et al. 2009; Lane and Gorman-Murray 2011; Mansvelt 2005 and 2009). Today, government, especially local governments are responsible for managing the disposal of this household hard material waste, the by-product of household consumption (Lane 2011). To illustrate this change — it was only in the late 1980s and early 1990s that household hard rubbish collection became a common occurrence in Australian cities and towns. Prior to then nearly all suburban and rural households had incinerators and or burnt their rubbish or disposed of it at the local landfill site (the tip). This period also corresponded to the period when waste collection and management was outsourced to the private sector (PC 2006). I discuss the management of "retired" household electronic devices shortly.

2.5 Obsolescence, inflated consumption and throughput

Reller et al. (2009) argue that three to five corporations dominate the production and supply chain of electronics, resulting in individual consumers having limited power to influence the entire electronic materials market. The main strategy employed by the electronics industry for increasing device consumption is planned obsolescence.[5] Interpretations of the term vary, but

[5] This strategy is use by producers and suppliers in other goods and services sectors, such as car, fashion and household furnishing.

essentially it refers to where a product is designed to have a built-in short life expectancy, causing consumers to make repeated purchases of goods and services or purchase completely different and or new devices (Zallio and Berry 2017; Puckett undated; Valant 2016; Maycroft 2009; Pope 2017).

The practice is not new. It can be traced back to the early part of the twentieth century (Chase 1925; Packard 1960; London 1932). Maycroft (2009) suggests it even pre-dates this period and goes back to at least the seventeenth century and the writings of Barbon (1690) in *Discourse on Trade*:

> *Fashion or the alteration of dress is a great promoter of trade, because it occasions the expense of cloaths before the old ones are worn out: it is the spirit and life of trade: it makes a circulation and gives value, by turns to all sorts of commodities: keeps the great body of trade in motion (Maycroft 2009 cited in Edwards 2005, p. 24).*

Planned obsolescence has attracted greater analytical focus in recent times due to its interrelationship with resource extraction, material consumption and waste generation, and environmental consequences. But it has social consequences as well (Pope 2017). The current interest and its implications for future manufacturing and consumption patterns is highlighted by the French government's recent action to incorporate a working definition of planned obsolescence into national legislation, making the practice an offence. The European Parliament too is expending more effort into understanding planned obsolescence and its impacts, including planned obsolescence in electronic devices as part of its circular economy approach to reduce materials flows within and between member country economies (Valant 2016). As yet, no Australian jurisdictions has flagged an interest in regulating against planned obsolescence for electronic device technologies (DELWP 2017).

From a consumer and household perspective planned obsolescence is a rather insidious practice as it is difficult to pin point the direct cause and effects of the practice as it plays out in the consumer market. Further, different types of planned obsolescence techniques are employed. Table 2-2 outlines four types of planned obsolescence and provides a description of each, along with examples of how electronic device consumption is encouraged. Noting, however, that there is a feedback and interrelationship process continuously occurring between each type of obsolescence. This makes it even more difficult for households to resist the imposed need for the consumption of newer and or different electronic devices.

This brief account of planned obsolescence highlights how contextual factors influence individual household electronic device consumption and waste patterns and, in a two-way feedback process, shapes the way households live their everyday life through the performance of

practices. I pick up on this theme again in Chapter 7 where I discuss the retirement and divestment of devices.

Table 2-2: Planned obsolescence with electronic device examples

Type of obsolescence	Description	Examples of encouraged consumption of new and or additional electronic devices
Functionality	• Relates to making a product obsolete with the launch of a new product, or of the same product with functional improvements. These products still perform the same basic functions as the old product but with a perceived improvement in efficiency and functionality	Switching to devices that: • provide facial recognition rather than digital coding access • are touch-slide keypad products compared with press button devices • are "smart" e.g. smartphone from "basic" mobile • are digital and one-stop device, e.g. digital camera from film camera and smartphone or IPod for camera functions from basic mobile • provide more seamless integration with other devices and software, e.g. from PC products to Apple products
Desirability	• Where a product becomes outdated because of its appearance and design, making it less desirable to consumers • Often referred to as psychological obsolescence (Newman 1957)	Consumers switching to or acquiring a new device completely to: • enable them to meet peer expectations and pressures associated with social status, fashion, material goods, design and aesthetics and way of life • provide greater colour options for device casing e.g. gold or silver • experience the latest, unique or boutique device, e.g. tablets and e-watches and often enable consumers to have a suite of electronic devices, which is also a desirable objective
Quality	• Deliberately reducing the lifespan of products, developing techniques or materials of inferior quality, anticipating breakage or wear to reduce durability and longevity	• batteries in electronic devices. These have a lifespan of approx. 2-5 years before it becomes impossible to re-charge the battery for normal time periods of use • componentry and manufacturing structural process and techniques make it difficult to extract and replace existing batteries and or repair other parts of devices. Or if technically possible, it becomes too cost prohibitive compared with the consumption of a new device • device operating systems and software programs, requiring regular updating until a device is no longer capable of supporting the software systems any longer or systems are incompatible with each other to maintain operations
Surplus to the necessity	• Relates to the over-elaboration, over-designing or over-programming of products e.g. the consumption of extras or new products for which there is no real additional benefit • It involves the "nesting" of products and services within a	• purchasing of device peripherals such as printers, USB sticks, speakers, digital cameras and cabling to support original and or new functions of devices • internet access, whilst not a tangible product involves the consumption of additional hardware, software and services such as data • Australian service providers bundling together devices and data into the one fixed-term service agreement, usually a 2-year period. Encourages purchasing of new

Type of obsolescence	Description	Examples of encouraged consumption of new and or additional electronic devices
	higher network of products or services with the goal of increasing consumption of the initial product or service in the first instance but associated support equipment and software	devices (as old ones are paid off) and additional data services when negotiating new agreements • nearly all people in Australia, aged 5-7 years and above have a personal mobile electronic device. It is questionable as to whether this scale of ownership is necessary

Source: Adapted from Pope (2017); Maycroft (2009); Valent (2016). All of which draw heavily on the work of Parkard (1960)

2.6 Electronic device flows in Australia

Australians like many people around the world have embraced portable electronic device technology. The extent and speed that this occurred has been and continues to be unprecedented. To illustrate with mobile phone uptake in the first instance. In 2013 approximately 17.5 million Australians over the age of 16 years had a mobile phone, around 92 per cent of the population (AMTA 2013; ABS 2013). For the last decade, smartphones, with internet capabilities have become and continue to be popular with Australian households. For example, in 2012 it was estimated there were approximately 8.67 million smartphones in use (ACMA 2013). In 2017 it was estimated that around 84 per cent of Australians own a smartphone which is around 16 million people (Australian Broadcasting Corporation (ABC) 2017). At the household level, this equates to around 5,432,000 million Australian households having a smartphone or round 70 per cent of households. It is common for householders to have at least two or more smartphones. For example, in 2011 approximately 3,647,200 households or 47 per cent of households fell into this category (ACMA 2013).

Recent decades have seen households becoming less reliant on fixed landline phones and fixed internet connections. Mobile connectivity is now commonplace. This has created an ongoing relationship between internet connection, device uptake, type of device acquired and how it is used and by who. As the ACMA suggests approximately 31 per cent of Australians rely solely on mobile phone only internet access (ACMA 2016). This trend is particularly common amongst users living within “shared-styled” accommodation such as group households with 63 per cent of people living in this type of household relying solely on mobile only internet access (ACMA 2016).[6]

[6] The trend is also becoming increasingly common as more and more elder Australians move into assisted living accommodation and rely on their mobile phones rather than landline for communications with family, friends and organising their personal affairs.

Internet subscription to support device functionality is continuing to expand with 13.7 million subscribers at the end of 2017, an increase of 2.1 per cent over the six months from the end of December 2016 (ABS 2017). According to the ACMA (2016) a device hierarchy exists in the use of devices by people for accessing the internet and performing on-line activities. Four key devices are used as a suite of devices but in the following order:

- mobile phone the most popular — 77 per cent of adults;
- laptops — 75 per cent;
- desktops — 61 per cent; and
- tablets — 54 per cent (ACMA 2016).

For tablet devices the extent of uptake has been less extensive compared with mobile phones. These devices first emerged in the 1960s but only became mainstream household objects from the late 1990s to early 2000s. From a functionality and portability perspective they sit between the capabilities of smartphones and laptops and by 2013 there were approximately 4.37 million tablets in use in Australia (ACMA 2013). The consumption of these devices continues to grow in Australia, but the strength of that growth has stabilised in recent years and is expected to plateau by 2018 (ACMA 2014). Interestingly, Australia has a higher ownership rate of tablet devices compared with the United States and the United Kingdom. For example, by 2014, 50 per cent of Australians, 42 per cent of Americans and 44 percent of British people owned tablets.

Information on the exact numbers of laptops within households is difficult to obtain. What is known is that 69 per cent of Australian households have one laptop whilst 10 per cent of households have three or more laptops. One explanation for this is that laptops are increasingly being used to supplement and or replace desktop computers. Alternatively, each household member is acquiring and using a laptop in addition to other devices (ACMA 2013 and 2016; ABS 2013). This scenario is likely where children use laptops to participate in secondary school and vocational and tertiary education.

The ACMA highlights that demographic factors, including income, household type-living arrangements, geographic location and gender, influence the uptake and use of portable electronic devices (ACMA 2013 and 2016). These factors are detailed in Table 2-3 and focus specifically on smartphone and tablet devices.

Age is an omission from this table. But both the ABS and the ACMA claim that age is an important influence on device use, and by implication device numbers and type. Both agencies

highlight that the 18-24 and 25-34 age brackets are the major users of devices for a wide range of uses. People in these brackets make up around 74 to 78 per cent of users.

Table 2-3: Demographic profile of smartphone and tablet users in Australia

Demographic characteristic	% using smartphones	% using a tablet
Income per annum		
<$50,000	44	19
$50,000 to less than $100,000	62	29
$100,000 or more	77	45
Living arrangements		
Live alone	34	10
Partner no children	47	21
Single parent	48	22
Partner and children	62	34
Shared household	69	28
Gender		
Male	54	27
Female	51	23
Location		
Metropolitan areas (capital cities)	54	28
Non-metropolitan areas	39	17

Note 2-1: Smartphone figures represents proportion of total mobile phone users whose handset is a smartphone. Tablet figures relate to the proportion of the Australian population who used a tablet to access the internet in the six months to May 2012. For Australians aged 18 years and over

Source: Adopted from the ACMA-commissioned survey, May (2012)

What is unclear from this information is whether age relates to how devices are used (the purpose) or the frequency of that use. Further the information suggests that the use of mobile phones steadily declines with age such that for the age bracket 65 plus only 15-17 per cent have a mobile phone.

To better understand how and why Australian households interact with portable electronic devices, it is important to investigate further how age impacts on the complete material flow of electronic devices through households and in what ways (ABS 2010 and ACMA 2013). Another consideration is whether the pattern is changing as smartphones become more and more embedded in households regardless of age. I suggest the later scenario is more likely to be the case.

Another electronic device commonly used by Australians is e-readers. These first emerged in the late 1990s and are principally single-functional devices used for reading e-books. They are like tablets but functionally less sophisticated. E-reader purchase and operating costs are less than tablets and are usually brought outright and have greater battery life compared with tablet and laptops. Whilst they are common personal devices exact numbers in circulation are difficult to determine. Nevertheless, from an electronic material flow perspective they do contribute to the volume of portable electronic devices in households.

Prior to the 1990s portable audio cassette players, known as Walkman, were in common use. These were one of the first devices providing householders with mobility whilst listening to music or audio recordings. These were quickly replaced in the late 1990s with the advent of digital audio players (commonly known as MP3 players), smaller devices and which gave greater portability and mobility, data capacity and functionality compared with a Walkman. They took off rapidly with the arrival of Apple's version of the product, the first iPod in 2001. By 2008 consumption of the device had peaked globally at approximately 55 million units. Today, the functionality of iPods has expanded considerably, to a point where their functionality is similar to smartphones, including access to the internet, texting and enhanced game facilities (Statista 2018).

In the last five years or so other personal portable electronic devices such as e-watches and fitness bands (Fitbits) have arrived and penetrated the market. In addition, new electronic products such as electronic textiles and drones are arriving on the market, with new innovations likely to increase further the volume of electronic devices to be found within households in the future.[7] Today, all major household appliances such as washing machines, fridges and temperature controls rely on electronic components for their functions.

Electronics, in some form or another are therefore all pervasive in Australian households (DELWP 2017). From an electronic materials flow perspective all electronic devices and electronic componentry supporting the functions of appliances and goods should be considered as part of electronic device consumption and stocks. Thus, hardware like battery chargers, keyboards, memory sticks and printers, which are contributing to an ever-mounting supply of electronic materials within households, should be included in considering the volumes of electronic devices in households.

[7] This ignores the likelihood too of artificial intelligent devices becoming more and more common in households and which contain many of the electronic materials found today in household portable electronic devices.

As mentioned earlier household electronic device consumption inevitably leads to in-dwelling electronic device accumulation and hence the issue of what to do with retired electronic devices. The scope of that accumulation is difficult to determine precisely. However, in their 2016 report, AMTA estimated that there are 25.5 million old mobile phone handsets in circulation and or accumulating within households, with accumulation likely to increase further in the future as more and different electronic devices are acquired by households. But, as Golev et al. (2016) indicate, accumulation and hoarding extend beyond mobile phones, a situation supported in DELWP (2017) report on e-waste in Victoria. Such assessments highlight still further the scale of electronic material accumulation within households. The scope of this issue is now outlined in more detail.

In Australia there are large accumulations of retired portable electronic devices. For example, according to the AMTA (2013) there are around 23,522,505 million mobile phones currently not in use. Within these phones, 4,878,742 million phones are held by one person, with around 1,393,926 million people holding four or more mobile phones that have been retired from use. This, combined with the continuing acquisition of new and different portable electronic devices by householders, is inevitably leading to greater volumes of electronic materials stockpiling in dwellings. According to DELWP (2017), e-waste is increasing at a faster rate than any other form of household waste. Households have become small-scale e-waste depots. Box 2-1 provides a snapshot of facts on Australian electronic device stockpiling patterns.

- Around 48 per cent of Australians are holding onto devices they no longer use
- Only 15 per cent of Australians return their devices for future re-use or recycling
- Australians generated 447 metric kilo tonnes of e-waste or 19.71 kilograms per inhabitant

Box 2-1: Snapshot of Australians electronic materials stockpiling

Source: Australian and New Zealand Recycling Platform (ANZRP) 2015

The above paints a picture of Australians being oblivious to the need to manage their personal electronic devices post retirement. Some individuals are, however, participating in electronic device recycling as organisations, such as the AMTA who are making inroads into the collection of retired devices. But their successes have been limited with a considerable gap between device purchase numbers and the number of electronic devices captured through formal schemes such as Australia's MobileMuster (Golev et al. 2016) — a situation not all that dissimilar to other developed countries. As Baldé et al. (2015 and 2017) mention, in 2014 global quantities of e-waste was 41.8 million tonnes and only approximately 6.5 million tonnes were collected through official take-back schemes (Baldé et al. 2015 and 2017).

2.7 Conclusion

Four main themes emerge from my review of relevant literature on changing communications technology and infrastructure and its implications for Australian households and their acquisition, use, retirement and divestment of portable electronic devices. Firstly, electronic material flows in households are influenced by the socio-economic systems and the governance arrangements around those systems and that these are constantly changing over time and place. These ultimately require households to adapt through changing the way they undertake their household activities involving the use of portable electronic devices.

Secondly, electronic materiality, devices and infrastructure are constantly evolving, which in the first instance alters the material component of how households undertake their everyday life activities. Types of device changes include physical appearance and useability, functionality and social acceptance and status. Combined these have provided householders with increased mobility (they are able to operate anywhere and anytime), increased functionality providing greater diversity of use and, the ability to personalise and individualised devices and the scope to display social capital status. Further, society has transitioned from a position with limited acceptance of devices in public spaces to broader acceptance — to the point where devices are now a requirement to participate in society and as a member of a household.

Thirdly, household characteristics do influence electronic device acquisition and use, a situation largely consistent with households in comparable countries. However, little is known about how Australian household characteristics influence retirement and divestment. Again, reflecting circumstances in comparable countries.

Fourthly, households are major units of consumption in Australian society. A position manufactured and perpetuated by government policies since British colonisation and one continuing to be supported by the IC industry inflating the need for portable electronic devices and the need for households to constantly turnover devices. As consumers of portable electronic devices households are therefore the site where the throughput of devices both volume and rate can be influenced, especially at the points of inflow and outflow.

So, what do these conclusions mean for understanding how and why Australian households acquire, use, retire and divest portable electronic devices? Critically for this thesis, the conclusion highlights that contextual factors are important in shaping what activities and electronic materials occur within households. But knowledge of contextual factors falls short as an explanator for understanding what goes on within households in their everyday worlds as they undertake their day-to-day tasks involving the use of portable electronic devices and how

these shape households ongoing acquisition, use, retirement and disposal of portable electronic devices. In addition, my review of this broader literature signals a lack of research on how and why electronic products move from one transition point and phase along the material flow cycle — that is, what encourages the movement between acquisition, use, retirement and divestment.

In the next chapter I present my theoretical framework and its supporting methodology that I used to research what everyday practices involving the use of portable electronic devices occur in households and which shape the flow of the devices through households.

3. Understanding household practices and material flows: Theoretical and methodological approaches

> *In the boxes and arrow figures so prevalent in organisation theory, the boxes are always labelled while the arrows are often unadorned by any text, as if they speak for themselves. In practice theory, by contrast, the emphasis is on the arrows, on the relationships and performances that produce outcomes in the world. To put it another way, practice theory theorises the arrows so as to understand how actions produce outcomes. (Feldman and Orlikowski 2011, p. 17)*

3.1 Introduction

In Chapters 1 and 2, I detailed the rapid and unprecedented uptake of portable electronic device technology in recent decades by individuals and households across the globe. This contributes to mounting stockpiles of these devices within households, both in the numbers of devices in-use and those retired from use. Further, I argued these devices at some point in their life move into a waste stream. Chapters 1 and 2 highlighted that, to date, only a small proportion of the devices produced and used are captured for re-processing, leading to a loss of potential electronic resource materials for future use. As households are the primary site for electronic device-use in everyday living they are consequently an important place for investigating electronic material flows.

Chapter 2 also demonstrated that the IC System and other contextual arrangements such as the pursuit of economic growth have a significant influence in shaping Australian households' acquisition, use, retirement and divestment of portable electronic devices. Furthermore, it was demonstrated that the IC System and contextual arrangements are dynamic and change over time, frequently leading households to adapt to ensure they participate effectively in society. Inevitably, any such adapting involves changes in how households live their everyday life and the use of electronic devices in that process.

The purpose of this chapter is to articulate a theoretical framework, in this case, a tailored social practice theory and, secondly, to detail the qualitative methodological approach taken. The chapter is divided into two parts. Part One revisits the key themes from the broader literature to inform and justify the adoption of social practice theory as my theoretical framework. I articulate the key concepts, constructs and logic of the theory and describe how practices are the operational unit of analysis. Then building on my analysis of the literature in Chapter 2, I argue for, and present, a social practice framework inclusive of context as a practice element. The framework is then tailored to build on the principles and concepts of industrial ecology and circular economy. Part Two of the chapter provides details on my qualitative, case-study

research methods approach, covering household selection, data collection techniques, along with the analytical process I employed.

3.2 Part One: Theoretical framework

3.2.1 Developing the theoretical framework

Chapter 2 identified four key themes that provide insights into how and why Australian households acquire, use, retire and divest their portable electronic devices. These centred on macro-level arrangements — that is, arrangements outside the boundary of the household unit and how they shape the material flow of devices through households. In addition, individual householders are faced with contextual arrangements that are household specific to their personal living arrangements such as household income, demographics and geographic location. Thus, for my theoretical framework the notion of context incorporates contextual arrangements outside of the household unit boundary as well as the context of each householder. However, contextual arrangements by themselves are insufficient to fully explain the movement of electronic materials through households, as well as what goes on in the everyday worlds of households — a primary objective of this research.

In the first instance, the themes do not provide the scope to gain a detailed understanding of what activities go on in the everyday life of individual households involving electronic devices. Theories that seek to explain people's relationships and behaviours to electronic devices would seem more theoretically suitable. However, a review of the social behaviour literature that explores people's behaviour and their interaction with technology, especially electronic devices, indicates otherwise. This literature largely focuses on singular-causal explanations such as an individual's attributes for explaining electronic device use. It is also frequently quantitative in its methodology (Wilska 2003; Rogerson 2010; Ongondo and Williams 2011). For example, some research examined how individuals use mobile phones for participation in social media and then measured their preferences for specific forms of social media. Other literature has explored how mobile phones have become standard and acceptable personal communication tools in public places (Church Undated). Other literature too has discussed the use of mobile technologies by younger people as an indicator of how age and socio-economic status that, in turn, drives device adoption rates across demographic groups within society (Wilska 2003).

Whilst providing valuable insights into device use and the relationship of people with devices, the approaches focusing only on individual behaviour are unsuited for examining what goes on within households in their day-to-day living. That is, the nuances of household everyday life and how and why these shape household acquisition, use, retirement and divestment of electronic

devices. In the case of my research such insights are critical, highlighting the need for an alternative analytical approach. An approach that incorporates everyday household practices as its focus or unit of analysis.

Secondly, the broad, high-level themes identified in Chapter 2 offer limited insights into what practices occur within households that propel electronic material flows through households, from the point of consumption by households, their use, why devices are retired, through to final divestment into the external e-waste system, the complete material cycle. Having such insights is necessary if electronic material flows through households are to be understood fully, reduced, with the goal of achieving sustainable management of electronic resource stocks. Which as discussed above is an overarching objective of this research.

An alternative conceptual approach and one which would more readily address material flows in households is the use of industrial ecology and circular economy principles and concepts. Material and energy flow are central to any analyses within these theories, to the point that flows are quantified. The theories focus on flows of materials into a system; flows of materials out of a system; the minimisation of materials coming into the system; maximising the capturing and holding of materials within that system; and, minimising material throughput such that future materials and energy and water consumption is minimised (Lienig and Bruemmer 2017; Allwood et al. 2010; Lifset and Graedel 2002; den Hond 2000; Korhonen 2002). Figure 3-1 illustrates these processes and concepts, highlighting the circularity of material flows in the broader system and its sub-systems of extraction, production, consumption and waste management systems and the interdependency between each of the sub-systems.

Industrial ecology and circular economy investigations are chiefly concerned with economy-wide issues and or production-supply chain processes of specific industries such as the electronics industry and or a manufacturing organisation (Dominish et al. 2017; Reller et al. 2009). Only limited application of this approach to a household-level analysis has been undertaken. The principles and concepts are, I argue, readily transferable to household-level analysis as a way of understanding the material flow of electronic devices through households. This thesis therefore, adopts industrial ecology and circular economy principles and concepts as its overarching theoretical position. At its most basic, a theoretical position grounded on the principle of the minimisation of material flows into, through and out of households.

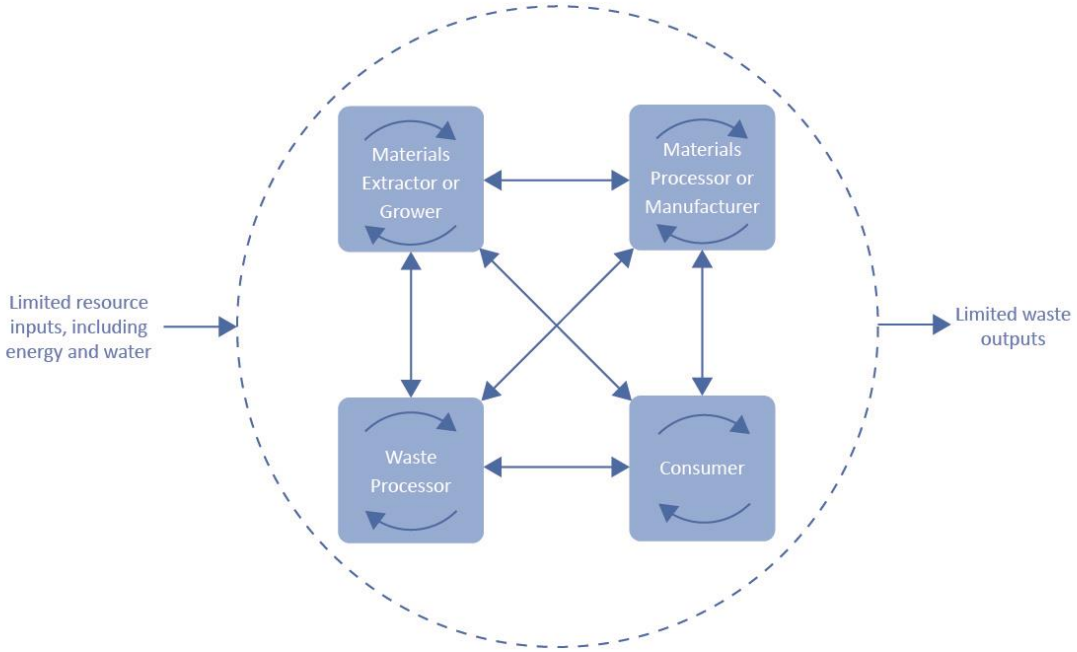


Figure 3-1: Industrial ecology system – detailing input and output material flows and the circular movement of materials

Source: Adapted from Jelinski et al. (1992)

But there are limitations for this thesis with industrial ecology and circular economy approaches. Most notably they fail to incorporate social considerations into the analysis of how materials move through systems and why (den Hond 2000). Further they are limited in their ability to explain the everyday practices that are occurring within Australian households and how these influence electronic device acquisition, use, retirement and divestment and why — the primary objective of this research. Thus, in addition to using industrial ecology and circular economy principles and concepts as the overarching theoretical positioning of the research, a social perspective is also necessary to inform the theoretical framework.

For this thesis a social practice theory has been adopted to underpin my theoretical framework, with social practices as the unit of analysis. This enabled everyday household practices to be included into the theoretical framework rather than focusing solely on individual behaviours. At the same time, it provided the scope to accommodate the principles and concepts of industrial

ecology and circular economy to frame the resource-energy-material flows through households. I return to this issue below.

In the next section, I discuss social practice theory in greater detail, explaining its key constructs and logic. I then present a tailored theoretical framework to support my analysis throughout the research. This framework principally adopts social practice theory but, at the same time, builds on the principles and concepts of industrial ecology and circular economy.

3.2.2 Social practice theory

Social practice theory emerged in the 1980s in response to the limitations of economic-policy and behavioural change programs described in Chapters 1 and 2. It emerged in response to social scientists increasingly questioning the relevance of classical social theories, such as Marxism and functionalism and their ability to adequately explain social arrangements and individual actions in the 20th century. For example, many social scientists were arguing that shifting to a socialist political system would not resolve the world's social, economic and environmental problems (Warde 1990 and 2014; Corrigan 1998).

Further there was a recognition that consumption theories, the precursor to much of social practice theory, were conceptually limited in their abilities to explain the relationship between technology, structures, materials and energy consumption and how best to initiate and achieve social change (Warde 2014; Shove 2003; Head et al. 2013). Consequently, social practice theory is based on two overarching analytical objectives: one, to better understand what goes on in the everyday life of people rather than focusing on investigating individual behaviours and decision-making; and, two, through this greater understanding to be better placed to initiate more effective social change when previous social change initiatives have been found wanting. In recent decades social practice theory has been used as the theoretical framework for investigating a wide range of environmental and social issues, particularly the sustainability of energy and material flows and waste management such as food and clothing at the household level (Shove and Walker 2014; Shove 2003; Wilhite 2014; Gregson et al. 2007 and 2009; Tudor et al. 2011; Gram-Hanssen 2010). Such applications reinforce the relevance of the theory as an analytical approach for this thesis.

So, what is meant by a social practice? More importantly, how is it conceptualised and applied in research? I begin by addressing and defining what is a social practice.

Whilst there are various definitions for practice, Andreas Reckwitz's description is frequently used as the basis for discussion throughout the social practice literature. According to Reckwitz:

> *A 'practice' (Praktik) is a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. A practice — a way of cooking, of consuming .... forms so to speak a 'block' whose existence necessarily depends on the existence and specific interconnectedness of these elements, and which cannot be reduced to any one of these single elements.*
>
> *A practice is thus a routinized way in which bodies are moved, objects are handled, subjects treated, things described, and the world is understood (Reckwitz 2002 pp. 249-250).*[8]

Regardless of the interpretation, most social practice theorists argue that practices are dynamic entities. As Warde (2005) explains:

> *However, practices also contain the seeds of constant change. They are dynamic by virtue of their own internal logic of operation…. (Warde 2005 p. 141)*

Importantly for this thesis, as I outlined in Chapter 1, practices exist as active routines that contribute to everyday household living results and outcomes, regardless of whether these present as positive or negative for the carriers of practices or the practices post-performance.

Further, practices exist as independent entities and are independent of people. From a theoretical perspective the only role that people play is to act as carriers or practitioners of the practices (Shove 2003; Reckwitz 2002). This is where social practice theory digresses from other social theories as practices are taken as the unit of analysis or enquiry rather than individuals and individual behaviours (Shove 2003; Shove et al. 2012).

One analytical goal of social practice theory is to understand how practices emerge, how they become attached and detached to the people who carry them and how systems and structures of practice form and disintegrate overtime. Only then is it possible to understand social processes and activities. It is this subsequent understanding that can then be used to initiate social change. This aspect of social practice theory provides not only analytical strength but also strategic thinking for how best to initiate change; that is, what changes are necessary in current practices to achieve social change. This analytical objective is consistent with the aim of this research to better understand existing social phenomena associated with portable electronic device acquisition, use, retirement and divestment within households to achieve more sustainable electronic material flows.

The centre-piece of a social practice framework is a set or bundle of elements. The number and types of elements making up a practice differs according to the theorists. For example, Shove

[8] An alternative interpretation based on the work of Schatzki (2001) sees practices as an array of activity in which the human body is the nexus.

and Pantzar (2005) incorporate three elements whilst Strengers (2010) incorporates "rules" as an element to constitute a bundle of four elements. Key differences across theorists as to what elements constitute a practice are presented in Table 3-1. In the main, all adopt variants of three specific elements: competencies, knowledge and skills; meanings and understandings; and, material objects. I return to, and build on, what constitutes a bundle of practice elements in section 3.2.3.

Building on Shove et al.'s (2012) articulation of a practice, household practices emerge through two key processes. Firstly, how they are constituted and configured, which involves the integration and forming of the practice elements (see above) into a bundle. This integration and forming of the practice elements into a bundle unit is only possible when a practice evolves and is performed, the practice-as-performance process (Figure 3-2). Further this process is an important prerequisite for a practice to exist and evolve. Shove et al. (2012) and other social practice theorists argue that the performance of a practice is not the sole prerequisite for a practice to exist in everyday life. It also involves the practice performance resulting in a practice-as-entity — in other words some sort of tangible activity.

Table 3-1: Four practice theorists: Approaches to what constitutes practice element bundles

	Theorists				
Elements	**Shove and Pantzar (2005)**	**Strenger (2010)**	**Schatzki (2002)**	**Warde (2005)**	**Reckwitz (2002)**
	Competencies	Practical knowledge	Practical understanding	Understandings	Body
					Mind
					The agent
					Structure and process
		Rules	Rules	Procedure	Knowledge
	Meanings	Common social understanding	Teleo-affective structures	Engagement	Discourse and language
	Products	Material infrastructure		Items of consumption	Things

Source: Adapted from Gram-Hanssen (2009)

Using the practice of texting as an example. This involves the integration of elements meanings and understandings (a need to communicate and text for some perceived reason), materials and infrastructure (phone, software and the IC System) and knowledge, skills and competencies

(embedded knowledge and know-how in the devices and the ability to use and understand devices) to form or generate "a text", the text becoming the practice-as-entity during the texting transaction. Further, the constitution and configuration of practices is not static as the process is renewed at the time of each performance. Or as Warde (2005) comments: *performances in the same practice are not always the same*.

For practices to gain traction and take effect in everyday life a second process is necessary. Here practice theory logic dictates that for a practice to exist and survive it must continually capture and hold a practitioner or carrier (a person) who is willing and capable of doing the integration of elements. A diagrammatic interpretation of the dynamics of social practices as proposed by Shove, Pantzar and Watson (2012) is illustrated in Figure 3-2 (page 53). It is particularly useful for illustrating the interconnectedness between practice elements and the role of "practice-as-performance" and "practice-as-entity" in practice theory. Further the illustration signals the broader practice processes and their importance for the practice system workings such as the importance of the relationship between practices and performance and how this leads to new elements and changes in practices. In effect, practices are dynamic.

As mentioned, practices (given the right configurations of elements) have the potential to change and renew themselves. Thus, an important question in social practice theory is how do practices and their elements emerge, develop, change and die? According to some practice theorists, for example Warde (2005), one of the most important methods through which practices are sustained is through regular performance — it is through this regularity that the practice becomes legitimised and embedded into day-to-day living. A change in one of the elements, for example the introduction of a new material object such as a mobile phone, may not necessarily result in the decline of a communication practice per se. Its critical point is when it/they influence/s performance. Shove (2005) further argues that practices emerge, self-perpetuate or decline through changes in the relative weightings of the different elements of a practice. It is within this process that Shove and Pantzar (2005) emphasise the importance of historical changes in the life of a practice. This is an important aspect and consideration in this research.

From a theoretical perspective social practice theory provides considerable analytical strengths and hence is well-suited for my theoretical framework. Firstly, it is a more conceptually, all-encompassing theoretical framework having woven concepts and principles of other social theories into its framework to give richness, flexibility and robustness. In this way, the theory delivers a greater and more practical account of what goes on in everyday life within a

household. This compares with a simple, singular and linear account that is delivered through other social change theories such as a rational choice theory or behavioural change theories. In addition, social practice theory has a significant theoretical advantage compared with the other theories because of its ability to incorporate time, place and change dimensions in its analysis (Frobler 2008; Gram-Hanssen 2009). I return to these issues shortly.

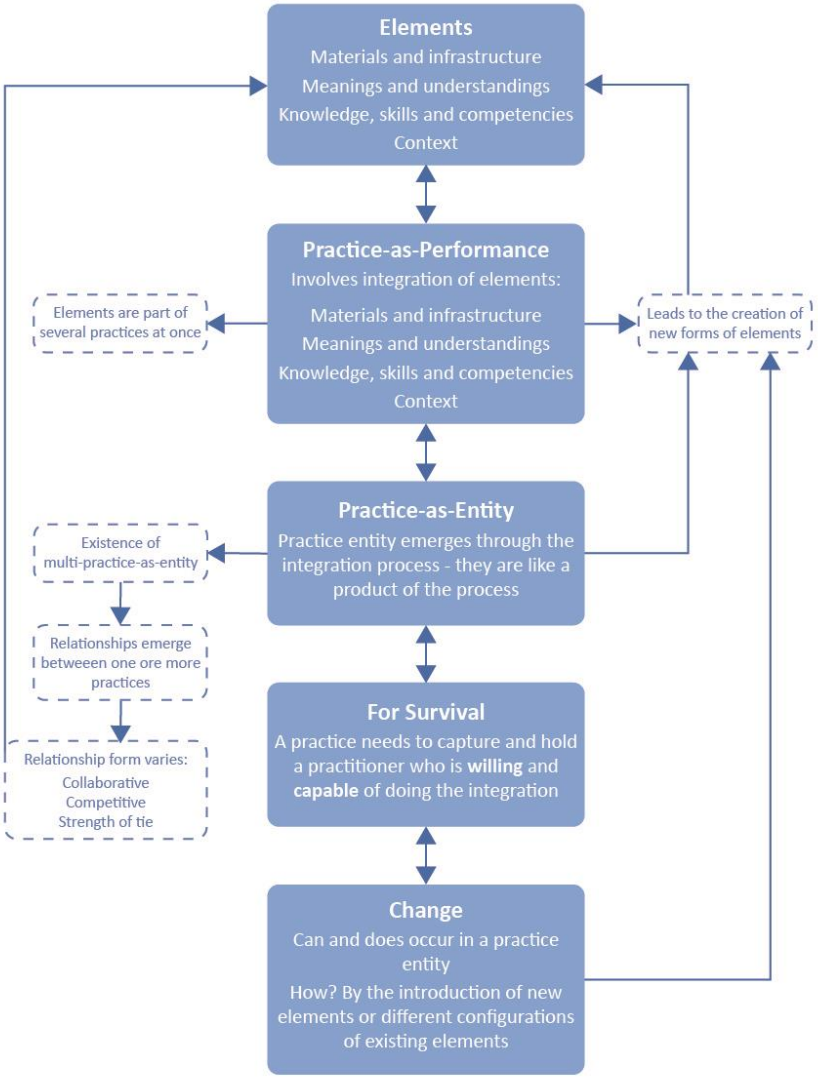


Figure 3-2: A practice, its dynamic processes and theoretical logic

Source: Adapted from material in Shove et al. (2007), **The design of everyday life**

A second strength of social practice theory is its focus on "practice" as the analytical unit rather than people as the unit of analysis. This enables the research to switch its analytical focus towards devices and activities within households rather than focusing on the behaviour of individuals and their lack of recycling electronic devices (Moloney and Strengers 2014). Or as Scheele and Papazu (2015) neatly state when referencing Shove and Spurling (2013):

> *Investigations …. then focus not on the question of "How do we change individuals?" but on "How do we make everyday practices more sustainable?". (Scheele and Papazu 2015 p.4)*

Thirdly, social practice theory provides a logical but unique theoretical framework that enables investigating how households are actively involved in a dynamic interplay between materiality, the acquisition of objects and services as well as how their needs, desires and aspirations present themselves and are met. More importantly, it enables a structured approach for investigating how and why this interplay drives specific forms of acquisition, such as why is it necessary to have multiple and different devices when one device may suffice and, consequently, how does this impact on householders' disposal of the devices once they are no longer in use or indeed drive other acquisition practices (Stengers 2010; Moloney and Strengers 2014).

Fourthly, social practice theory provides an analytical framework that enables the role of implicit, tacit and unconscious layers of knowledge, including embedded knowledge and know-how within objects, to be incorporated into an analysis in a systemic way. This is particularly valuable for understanding the role that knowledge, skills and competencies play in shaping whether householders are willing to act as carriers of practices and, consequently consume and engage with materials such as electronic devices. It also enables an understanding to be gained of how knowledge and skills influence the emergence and decline overtime of practices associated with the advent of electronic devices (Gram-Hanssen 2009).

3.2.3 Social practice theory: A tailored approach

Based on the above discussion social practice theory has considerable value as a theoretical framework for this thesis due to the notion that a practice:

- is dynamic
- is multi-dimensional and faceted rather than singular or one-dimensional
- is constituted through a set of practice elements, with elements being part of several practices at once; and
- becomes and is part of a relationship with one or more other practices.

With respect to the last aspect, the relationship which a practice has with other practices varies in form, with some relationships competitive and others collaborative (Figure 3-2 above).

These aspects give the theory considerable analytical depth, diversity and strength for identifying and understanding what goes on in the dynamic everyday world of households and the acquisition, use, retirement and divestment of portable electronic devices. However, I argue

that if the theory is to adequately explain electronic device flows within households, then two refinements are necessary. Firstly, given the analysis in Chapter 2 that demonstrated the IC System and other contextual arrangement factors, such as changing communication infrastructure provision and economic-political agendas, do influence or shape households acquisition, use and retirement of portable electronic then context must be included as an element in the theoretical framework for this thesis. Secondly, for greater clarity, the framework warrants a formalisation of how materials flow through households.

I now address the first of these refinements, contextual arrangements. A review of the social practice literature (Table 3-1) demonstrated that most proponents employ the notion of a bundle of practice elements consisting of competencies, meanings and materials. Many of these proponents assume that social practices occur in a context and at a point in time and space. This thesis readily acknowledges this thinking. However, in my view these proponents then transition to an analytical position where context becomes less visible, and they proceed with their analysis and findings by ignoring such arrangements — their analyses exclude the influence of context. Yet, as I have demonstrated in Chapter 2 and described above these factors are critical for understanding how and why households acquire, use, retire and divest their portable electronic devices. Considering this, I argue that context is an important analytical concept and, as such, I have included it as one of four elements in the set or bundle of elements adopted in the theoretical framework for this thesis.

My decision to include context is not unique as several other social practice theorists make similar arguments. Arguments for the diversification and expansion of elements in a practice bundle that constitutes a practice, including context as an element, for inclusion as part of a social practice are presented in Table 3-2 and discussed below.

This then raises the issue of what elements form the basis of my social practice theoretical framework. How should I interpret context for the purposes of my theoretical framework and this thesis?

My theoretical framework draws on the approaches of both Strengers (2010) and Shove et al. (2012) to the elements of practices but includes context for reasons described above. Strengers' (2010) notion of rules is incorporated too into the element, context. In my theoretical framework a practice bundle consists of materials and infrastructure; meanings and understandings; knowledge, skills and competencies; and, context. An explanation of each element follows, and a diagrammatical representation of the elements is presented in Figure 3-3 below.

Table 3-2: Expanding the notion of practice bundle elements

Author	Additional feature	Quote
Bartiaux (2012)	Geographic characteristics[9]	*… it is useful to add another component linking doings and sayings in the performance of a practice, namely the interpretation given to the geographical characteristics of the settlement where the practice is performed. … this interpretation and the other linking components — material arrangements, know-how and routines, institutionalised rules and the teleo-affective structure — are all oriented by the relational mode enacted in a given society. (p 4)*
Røpke (2009)	Context	*However, these observations do not sufficiently highlight the interplay between practices and wider social systems, their institutionalized features and material infrastructures. As Randles and Warde note: Practices do not float free of technological, institutional and infrastructure contexts. Social patterns such as the division of labour, gender relations, and unequal access to resources, as well as political, economic, legal, and cultural institutions are constituted by practices, but they also provide a context for the performance of practices that is necessary to include in empirical analyses. (pp.2492-3)*
Warde (2005)	Context	*Practices have a trajectory or path of development, a history. Moreover, that history will be differentiated, for the substantive forms that practices take will always be conditional upon the institutional arrangements characteristic of time, space and social context, for example of household organisation, dominant modes of economic exchange and cultural transitions. 'Why do people do what they do?', and 'how do they do those things in the way they do?' are perhaps the key sociological questions concerning practices, the answers to which will necessarily be historical and institutional. (pp.139-40)*
Glover (2015)	Element characteristics: Topography, Intensity, Trajectory and Form	*The following framework, then, was borne out of a recognition during the research that existing practice theory frameworks did not offer a sufficiently rich description of what 'elements' were, and how they might differ on one or more respects. … I begin with the contention that elements constitute any given practice arrangement are not homogenous entities themselves. While particular elements can be present across diverse practices, it is likely that these elements will manifest differently across different settings. This stems from the inherent historicity of practices ……. elements are themselves multi-dimensional entities … (p.267)*

Element One: *Context*. This refers to the broad operating environment in which a practice and its carrier exist as an entity. Frequently it is referred to as an operating environment. Context, as Røpke (2009) explains above, gives effect to practices as well as practices giving effect to context. It covers the economic and governance arrangements, prevailing political and philosophical positions, legislations and regulations (the law), enforcement regimes, business

[9] Geographic characteristics could be interpreted as context, too.

and household internal operating rules and protocols (e.g. contracts), time and locality, resources and economic capital, household demographic and characteristics, social arrangements, dwelling ambience and household geographic locality. This working interpretation of context as an element builds on, but is more encompassing, than Reckwitz (2002) element of "structure and process" presented in Table 3-1 above.

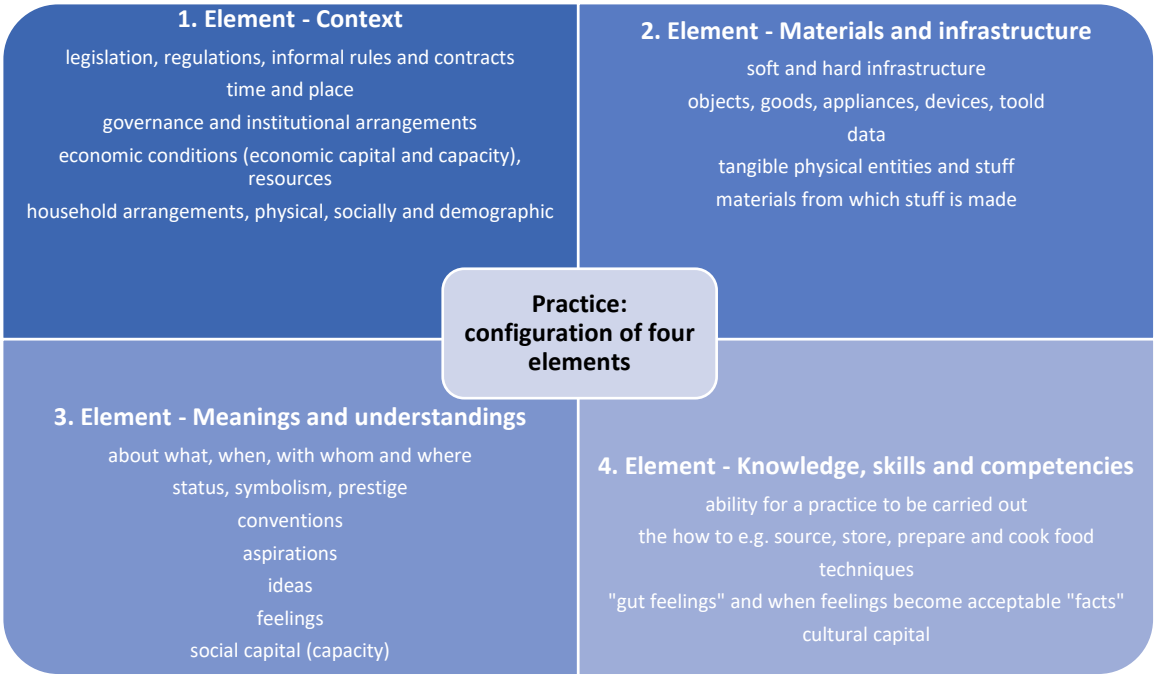


Figure 3-3: The practice bundle of elements: Configuration adopted for theoretical framework

Element Two: *Materials and infrastructure*. This relates to objects, electronic devices and associated peripherals, technologies, soft and hard infrastructure, including operating systems, software and applications, data, information-communication services, primary materials in the production of devices systems, energy and power and the internet and Wi-Fi. In addition, it includes material objects such as desks, repairing tools, tables and kitchen benches and household physical infrastructure arrangements e.g. flat or apartment compared with stand-alone house.

Element Three: *Meanings and understandings*. This refers to expectations about the right and wrong ways of doing things and usually involves concepts such as norms, customs, traditions, conventions, social status and social capital, and public opinion, which all help shape what is acceptable and unacceptable practice in the social world as well as for the continuation of specific practices. An example is when mobile phones first emerged it was not an acceptable practice to use them in public amongst people. Since then, the meaning of acceptable use has changed to a position that it is now acceptable to use mobile phones anywhere and at any time.

Element Four: *Knowledge, skills and competencies*. This element is about learnt social know-how concerning how, when, where and with whom a practice is performed. It is built through everyday experiences and is embodied in individuals and their cultural capital, objects and systems and, if ingrained sufficiently over time, practical knowledge becomes "feeling". For example, knowledge of feeling clean is associated with a need for ongoing and regular showers (Strengers 2009). An example for portable electronic devices is that today the need to be entertained must include constant, yet passive participation in live-streamed electronic games, movies or programs.

To conclude this part of the chapter, I provide an overview of the complete theoretical framework which informs the conduct and analysis of this research. This I do by assuming the practices associated with each of acquisition, use, retirement and divestment are transition points on the material flow cycle within households. It assumes the space between each of the transition points are phases in the material flow cycle. Taken together, these two assumptions present two areas of interest for this thesis: understanding what goes on within each of these points on the material flow cycle; and, understanding how movement between each of these points is triggered — the transition from one point on the material cycle to another and how practices (or lack of practices) shape such movements. The parallel processes of household electronic material flow and the transition points from one social practice to another within households is illustrated in Figure 1-2, Chapter 1.

3.3 Part Two: Methodological approach

3.3.1 Introduction

Next, I present my methodological approach. This builds on the use by social practice theory of practices as the unit of analysis as discussed above. Practices therefore became the corner stone of how I conducted my research, with the methodology having three key requirements: consistency with and support of the social practice theoretical framework; providing the capacity to investigate the everyday life activities of Australian households; and, the capacity to identify electronic materials movements through households. In finalising my methodological approach, I was also conscious of Shove's (undated) comments that there is no such thing as a methodology template for undertaking social practice research, as Shove explains:

> *Taking "practice" as a central conceptual unit of enquiry generates a range of distinctive questions. The choice of methods depends on which of these questions you want to take up and pursue. Using practice theory is thus not directly tied to certain methods, but the choice of methods is – as always – dependent upon your specific research question (Shove undated).*

These comments by Shove re-affirm the methodology for this research should be purpose specific rather than being informed by adopting a standard, generic approach that is intended to be readily transferable to other research projects.

In the remainder of Part Two, three methodological considerations are addressed. Firstly, my research design and household recruitment methods. Two, data collection and recording techniques covering both secondary and primary data sources. And finally, the data analysis process used.

3.3.2 Design and methods

To address my overarching research question: how and why Australian households acquire, use, retire and divest portable electronic devices I employed a qualitative research approach. This provided the scope to explore and ultimately understand and explain the everyday dynamics and activities of Australian households rather than focus on the behaviour of individual members of households. The research draws on the research traditions of situating myself in *the place of interest* (a household) and takes an explanatory approach by answering the how and why of the social phenomena of the nexus between electronic devices and household practices. As such the insights provided by householders in their own words were a critical data source for understanding and explaining portable electronic device acquisition, use, retirement and divestment within households.

The research centres on a case-based approach in which each household forms a case. This provided scope to study issues of interest in an intensive and in-depth manner in a "natural" setting — that is, within individual households and with individual householders. In addition, the approach provided scope to investigate complex systems and processes and made it ideal for investigating household systems and the dynamics of practices on a case-by-case basis, thereby enhancing the breadth and richness of data and ultimately my research analysis (Hancock and Algozzine 2011; Simons 2009; Yin 1993 and 2003; Berg 2004; Baxter and Jack 2008; Opdenakker 2006).

Approval for this research and methodology was granted by Monash University Human Research Ethics Committee (MUHREC) in 2015 (No CF15/2 – 2015000001). A Victorian government Working with Children check was obtained because of the potential to interact with young people 18 years and under, within households.

Research scope

Because of the resources that were available for this research project through a collaboration between the CSIRO and Monash University, I had an unique opportunity to undertake for the first time in Australia an in-depth qualitative case study of Australian households focusing on how they acquire, use, retire and divest portable electronic devices — the full movement process of devices through households. This enabled me to cover a broad geographic spread of households, including those in Adelaide, South Australia, Swan Hill, regional Victoria, Sydney, New South Wales and Melbourne, Victoria. The locality of each of these areas within Australia is illustrated in Figure 3-4.

In all 36 households and 62 individual participants were interviewed. The breakdown of participant numbers for each location are presented in Table 3-3. Approximate population numbers for each location are also included.

Figure 3-4: Locality of four study areas (Note: Not to scale)

Table 3-3: Geographic distribution of households

Geographic spread of households and householders				
	Location	Population (approximately - 2016)	No of households interviewed	No of participants
	Adelaide	1.3 million	9	18
	Swan Hill	21,000	8	13
	Sydney	5 million	9	11
	Melbourne	4.5 million	10	20
Total	4	n/a	36	62

Note: Sydney had one late household withdrawal due to serious family illness, which would have made 10 households, which was the original intention

Recruitment and selection of households

As mentioned, I visited and interviewed 36 Australian households. These interviews were identified through a planned recruitment and selection process that I developed. Two strategies were considered for this purpose. One would have involved me conducting the recruitment and selection process through my own resources and would have involved cold canvasing and tapping into personal and extended networks and public information exchange spaces. This strategy was disregarded because of its time intensiveness and the potential that a diverse range of households would not be identified.[10] The alternative strategy was the use of a recruitment company. The company was tasked with recruiting a broad-representative group of 50 households, from which I could then select a subset of at least 20 households with a minimum of five in each of the three cities and the regional town that formed the geographical focus of the study. The choice of a recruitment company was to expedite the recruitment process quickly and efficiency as well as to gain access to their considerable expertise and resourcing to enable the recruitment of a diversity of households in several cities/towns.

Under the brief I provided, the recruitment company was required at the time of initial contact to inform the householder of what to expect and what the household visit would involve before indicating whether they would be interested in participating. It was also the consultant's responsibility to inform the householder they would receive a voucher as recompense for their input, once all their involvement was completed.

[10] My analysis in Chapter 2 demonstrated that households are all different. No one household is the same as the next. Hence one of the objectives for household selection was to maximise the diversity of households included as case studies.

The selection of households for participation involved two inter-related criteria: geographic location; and socio-demographic profiles. The criteria adopted were determined through a literature review (Chapter 2) that focused on material from the Australian Bureau of Statistics and the Australian Institute of Family Studies. The selection of households was also based on Australia's urban settlement patterns, centres of economic activity and migratory patterns of Australians identified in the analysis in Chapter 2. Current information-communication arrangements and waste management legislation were also considered for each locality.

The rationale for selecting the four geographic locations used is presented in Table 3-4. The demographic characteristics used in applying the second criterion are listed in Table 3-5. Also shown in Table 3-5 are the number of households selected for each location and dwelling type under criterion one and the number of householders involved under the various considerations covered in applying criterion two.

Table 3-4: Rationale for locality selection

Location	Rationale
Adelaide	• A capital city but smaller than Sydney or Melbourne • South Australia (SA), compared with other Australian jurisdictions, has led the way in container deposit legislation for recyclable containers.[11] Adelaide was selected to learn if householders here were more interested in minimising and managing their waste
Swan Hill	• A regional-rural city, relatively isolated from other major regional centres and hubs • It was selected to understand whether access to information-communication and waste services and infrastructure in a smaller city influenced device acquisition, use, retirement and divestment. • It was assumed that provision and access to such services would be limited compared with larger urban areas and hence would provide a comparative analysis point
Sydney	• A major city of Australia and provided a useful geographic and demographic comparison with Melbourne, also a major city with a large population • It is a major financial centre of Australia with income and wealth levels generally higher than in other areas of Australia • The city was selected to understand whether this greater "affluence" influences the acquisition, retirement and divestment of devices by households. • Provided a further level of comparison with Adelaide and Swan Hill • Households were also selected based on a spread across the city to understand if suburb locality influence device practices
Melbourne	• Australia's second largest city and hence provided a comparison to Sydney • Like Sydney has a spread of income and wealth across its suburbs

[11] Since this research was commenced, the Northern Territory government has introduced similar container deposit legislation to that of South Australia. In 2017 the New South Wales government introduced its *Return and Earn* scheme.

Table 3-5: Recruitment and selection outcomes

Household - Recruitment and selection criteria		
Criterion 1: Household characteristics	**Categories**	**Numbers**
Geographic location	Greater Adelaide	9
	Greater Swan Hill	8
	Greater Sydney	9
	Melbourne	10
Dwelling type	Detached or semi detached	29
	Flat or apartment	7
	Garage	20
Criterion 2: Demographic characteristics		
Age (householder)	Children under 15 years	21
	Householder 15 to 35 years	25
	Householder 35 to 65 years	41
	Householder 65 plus years	9
Income (household)	Less than $50,000	10
	$50,000 to $150,000	16
	$150,000 plus	10
	Both parents working	9
Work (householder)	Full time	32
	Part time	11
	Not in paid workforce	21
Gender (householder)	Male	52
	Female	52
Geographically dispersed family and friends (household)	Overseas	24
	Interstate	32
Household type – living arrangements (householder)	Single person	5
	Couple only	9
	Single parent	4
	Partner and children	24
	Shared household	2

The recruitment company used these criteria to identify a list of potential households from each location. Because of ethical-privacy requirements I was unable to initiate contact with potential participants. Rather initial contact came from the householders themselves. Once contact was

made I sought clarification on their household characteristics and demographics before making a final decision on their suitability for inclusion. In nearly all cases householders who made contact were included.

When developing the criteria for the selection of households it was anticipated that most households would meet more than one of the criteria. This proved to be the case. Consequently, there was no unique or stand-alone type of household.

In addition to the recruitment of households for the project I also set-up, and conducted, a key informant interview with a small, electronic device repair business owner, Mr Jupiter. The purpose of targeting Mr Jupiter was to investigate whether electronic device repair practices were common practice amongst households, thereby picking up on the issue that repairing of devices would aid and or reduce the throughput of electronic devices through households.

3.3.3 Data collection

My primary mode of data collection was through field-based visits and interviews with residents of households in Adelaide, Swan Hill, Sydney and Melbourne. Three main data collection methods were used: observations; semi-structured questions; and, self-reported data generated by householders that completed a daily-use diary. A copy of the interview and diary questions are included in Appendix 1.

The data obtained from household interviews was recorded as follows. All the interviews were audio recorded and subsequently transcribed in full. Visual data was also collected. This involved taking photographs and making sketches to highlight specific areas and themes of interest within a household. This proved to be a more supplementary method of data recording and less critical for the analysis tasks of the research. Electronic data was also collected through emails with participants and the diary templates. In the end this data was of less importance for the analysis but critical for the success of the data collection process in total. All data was managed according to the good practice data management protocols as required by Monash University (MUHREC).

I also undertook several pilot interviews which proved to be important for the development of the data collection and analysis. Whilst setting up the recruitment process with the marketing company I drew on my networks to recruit two to three households for trialling household visits. I was particularly keen to target younger households or householders prior to final selection of households because I was uncertain as to how many younger people would be willing to participate. Two younger households agreed to participate, one where both household

members were interviewed and the second where only the person in their late 20s living in a group household was interviewed.

The use of pilot interviews enabled me to evaluate and refine: the relevance of my questions; the process around the household visit; where to conduct the interview within the household; and, where best to position participating householders. I was also able to determine more accurately the time frame required for a visit and to assess the energy and concentration times of participants for a 1.5 to 2-hour session. An important outcome of these pilots was a shift of focus from specific and targeted questions to a more open-ended question approach, thereby improving the engagement of households throughout the interview. The questions used were consistent with those approved by the Ethics Committee, but the important aspect became how the questions were asked and, depending on the responses provided, the ability to ask follow-up questions during the interview time.

The task of data collection and collaborating with households involved three main stages: pre-visit consultation; the household visit; and, household visit follow-ups. I briefly describe each of these.

The task of setting up household visits commenced after householders made direct contact with me after being contacted by the recruitment company. The response timeframes by householders for contacting me varied, ranging from two hours to five days, indicating a relative quick turnaround from the time the householder was contacted by the consultant to the time the householder contacted me. This quick response time by householders was an outcome of the detailed briefing undertaken by the recruitment company during their initial canvasing phone call. Some householders mentioned they felt comfortable with the company's approach and indicated that this was a major reason why they offered to participate.

I first contacted householders after they left messages on my university phone. These I responded to within 24 hours as I was keen to maintain the communication momentum and keep householders engaged. Further, by responding quickly to their interest, I could build trust with them as we moved into the interview stages. These phone calls also provided the opportunity to ask householders about their level of understanding of the research. Their responses indicated they had been well briefed by the recruitment company with some stating they had investigated the Wealth from Waste website for further information.

The phone call was also a means to re-state what the involvement of householders would entail, specifically the overall length of the involvement, interview time and when the interview would

take place. Householders were also informed that other household members were welcome to be involved. Many householders took up the offer to participate. Given the diversity and richness of the data obtained, the involvement of more than one member of a household proved extremely beneficial.

Again, using this phone call opportunity, I recorded householders' personal details on a template, including the proposed interview address and the householder's preferred days and times for a visit. After this phone call I completed the template electronically and in hard copy form, which was later included in the field package prepared for each household. This completed template proved to be invaluable as a reference point during field work (both hard and electronic versions), providing both contact and address details as well as an overview of the household characteristics. It also proved a useful cross-referencing document to check off the household characteristics obtained during the actual interview.

The time for this initial phone conversation ranged from half an hour to approximately an hour — depending on the householder's inclination to have a conversation. This phone conversation gave me the chance to gain a picture of the householder and how they may respond to me during the house visit. It was also I believe an important exercise to minimise the potential attrition rate of householders. An email was sent within 24 hours to confirm the proposed interview details that were agreed. Where emailing was not an option the householder was contacted two days prior to the scheduled interview to confirm the interview arrangements.

Next, I describe my data collection during the household visits. On my arrival introductions were made and, when accompanied by a research assistant, this person was introduced. Householders were asked if they were comfortable with the person remaining for the interview. All householders agreed to this request. Householders were given the opportunity to nominate their preferred location for conducting the interview, with most choosing the kitchen or dining room table as the place for the interview. Based on my pilot household visits this was also my preferred format. Several households expressed a preference for conducting the interview in the living-sitting area.

With participants settled I expressed my appreciation of their involvement but also stressed that this research was not a survey-based interview. Rather I explained my focus was to obtain their personal descriptions and insights and that there was no right or wrong response. At this point consent forms were signed by all household members participating. This part of the household visit and interview was not audio recorded.

The time taken for this introductory activity varied across households. In some instances, it was completed in five minutes, whilst in other households it ran for at least half an hour. An issue to emerge following the first couple of interviews was that I needed to be conscious and not to allow this part of the process to transition into the more detailed interview stage.

Where interviews were conducted away from Melbourne and hence without the support of the research assistant I was dropped off at each household by a third party who returned at a predetermined time set prior to entering the household. This ensured that I addressed the university's Occupational Health and Safety requirements.

With consent forms signed I conducted, in association with the householder, a tour and walk through of the dwelling to identify where the portable devices, as well as other electronic household devices, were maintained, used and stored. This included garages and sheds (if relevant). Where a couple participated it was usually the female partner who took on this role and for households with younger people it was the younger person who showed me their rooms with a parent in the background. This later approach was consistent with that outlined in the Consent Forms for younger people.

The tour and walk through usually took approximately five to ten minutes. The value of undertaking the tour and walk through prior to conducting the formal interview stemmed from the degree of ownership over the process it gave participants. If, on the other hand, I had commenced with the detailed questions (as was the case in one instance) it could have been interpreted as delving a lot more into their personal lives, causing embarrassment and consequently making the householder less inclined to share the physical layout of the dwelling.

Overall, I found all householders extremely willing and enthusiastic to allow me to see how they lived. They willingly opened cupboards, drawers, boxes and attics to allow me to see their stuff. As a result, I would like to acknowledge the contributions made by all the householders interviewed. Without this it would have been difficult for me to gain such an extensive appreciation of the electronic materials and stuff in households and where these are situated within the physical dwelling space.

The interview was the most critical data collection method for my research. All interviews were semi-structured and involved the use of open-ended questions (see Appendix 1) which facilitated an interactive and conversational approach with householders. I found the interviews to be extremely informative, providing an extensive amount of rich descriptive material as well as a forum where the householder was not under pressure and could feel at ease. This allowed

the householder to feel comfortable in my presence and as a result willingly and enthusiastically shared a lot of their household and personal information.[12] An added benefit of this format was the opportunity given to individual household members to feed off each other's responses. I believe this provided greater insights compared with interviewing each household member individually.

The times for interviews varied, ranging from 45 minutes to approximately two hours. Factors that influenced these times were the involvement of children, the participation of couples, circumstances unique to a household at the time visited. For example, having made the commitment to participate one household did not wish to renege on this commitment even though their family circumstances had changed drastically over the previous two days, causing them to have other more pressing family commitments, which clashed with my visit to their house. In this case the interview was modified to a question and answer format rather than an unstructured conversation and completed within an hour.

At all interviews I took detailed field notes, which, whilst time consuming at the time, proved to be beneficial. Interviews were all audio recorded, which since has proved to be a valuable data source. All recordings were transcribed by me (I return to this issue during the discussion on my analysis approach). I found the transcription to be a useful exercise as I re-immersed myself in the interview detail and began identifying emerging themes and issues. Whilst there are clearly benefits from personally transcribing recordings there are downsides. Most notably the time required. However, if any of my research in the future involved audio recordings my preference would still be to do the task myself wherever possible. Furthermore, in the case of my field work for this thesis five householders declined to allow a third-party to transcribe their interviews. They did however, consent to all other conditions on the consent form.

A further data collection method adopted was personal observations. These were conducted during the entire time spent at the household. It included observations of household members and covered body language, household material status and the social and interpersonal dynamics between household members, as well as the physical layout of the dwelling such as dwelling type and where devices and appliances were located within the house. Observations were also useful for gaining an appreciation of a householder's entertainment, leisure and

[12] Based on my experience conducting the interviews it appeared many householders felt privileged to be asked to participate in the study and as a result shared information with me they may not necessarily share with other "strangers".

hobby interests — many of which are associated with the use of portable electronic devices — enabling a subjective assessment of the households' socio-economic status to be made.

At the completion of the interview I discussed the next steps of my research with the householders, indicating that I may be in touch in the future for additional information. Instruction were also provided on how to complete the diary exercise, along with the householder nominating their preference for completing the diary in hard or soft copy version. Diaries were returned in either written or electronic versions with ten households not returning diaries, even after follow-up communication. All participating households received a recompense voucher as promised. Acknowledgement letters were sent to all households after the interview expressing my appreciation of their time and input as well as one accompanying the voucher letter.

Data was also collected through householders completing a time-based diary, for one weekend day and one weekday for each of their devices. Diary questions are presented in Appendix 1. The purpose of this techniques was to gain an appreciation of device-based practices across time, especially differences across working days compared with weekends and across daily timeframes rather than relying on participants' memories at the time of interview. This is consistent with the advantages of diary use for data collection as advocated by Bytheway (2012), Alaszewski (2006) and Cucu-Oancea (2013).

In all, 25 diaries were returned. Overall, information from the diaries supported or reinforced the data obtained through face-to-face interviews but was more time-specific across the day. Only a couple of diaries contained new information not discussed at interviews. An example was when one householder included gambling activities in the diary but did not mention these activities at the time of interview, suggesting that there was an unwillingness to discuss the issue in front of other household members.

Overall, I would argue that the use of diaries as a data collection method provided a useful method for re-affirming the information already gained through the interview process, thereby validating the data. This is consistent with comments made by other researchers who have used diaries as a data collection method (Bytheway 2012; Radcliffe 2013; Alaszewski 2006; Cucu-Oancea 2013).

3.3.4 Analysis

Once the field work was completed the formal data analysis process began. This was an ongoing, iterative process and extended into the final drafting stage of this thesis. This section describes the data analysis approach I employed.

The set of open-ended questions used as the basis of the household interviews formed the initial analysis. These questions (Appendix 1) were categorised around acquisition, use, retirement and disposal, changes over time, and skills and capacity, and enabled the initial analysis of the data to commence prior to household interviews. These issues, and questions relating to them, fed into the more formal theme-based analysis process which I now turn.

My initial analysis took the form of informal reflections, immediately upon finishing an interview. These reflections were recorded in my field notes and often reflected my personal feelings around each household and householder interviewed, such as feelings about the neighbourhood of the household and the vibrancy and energy levels felt upon entering a household. An important use of these reflections was evaluating how effectively I conducted the interview and interacted with the householder, with the view of assessing whether my interview technique required attention to maximise the collection of relevant data.

Once each interview was completed I undertook the task of transcribing the audio recordings of the interviews. Whilst this was certainly a time intensive activity (as discussed above) I found it to be an invaluable activity as it provided me with the opportunity, whilst stop-starting the audio for transcribing, to commence my formal analysis process of the interview materials. Through this process I mentally and physically noted points of interest and similarities and differences across interviews.

When all interviews were completed, I commenced the task of reading through all the transcripts and highlighting commonly recurring words and themes and casting themes into groupings of five-counts. These were then combined into greater than five to obtain a feel for the most common themes. At this point the words and themes were not linked to acquisition, use, retirement or divestment or any specific household practice but rather into a wide-ranging boiling pot of household activities, aspirations and concerns. Through this process, I identified 128 groupings. These I recorded, printed and cut up into cards with one word-theme per card. These were then laid out across a large area and then grouped into higher level themes. Table 3-5 provides samples of these early 128 theme-based groups.

Table 3-6: Early analysis themes

Parenting	Transparency of costs	Conforming	Personal development	Household business management	Pace of living	Social connectedness
Choices and decisions	Safety	Devices	Internet	Budgeting and affordability	Incomes	Skills and expertise

Building on this process I then refined the groupings again into higher-level common themes. These were relatively random and again were not linked specifically to acquisition, use, retirement and divestment. This resulted in the identification of 11 higher order themes. Figure 3-5 below provides examples of how these themes were presented and linked to specific features. One figure was developed for each of the 11 broad-based themes.

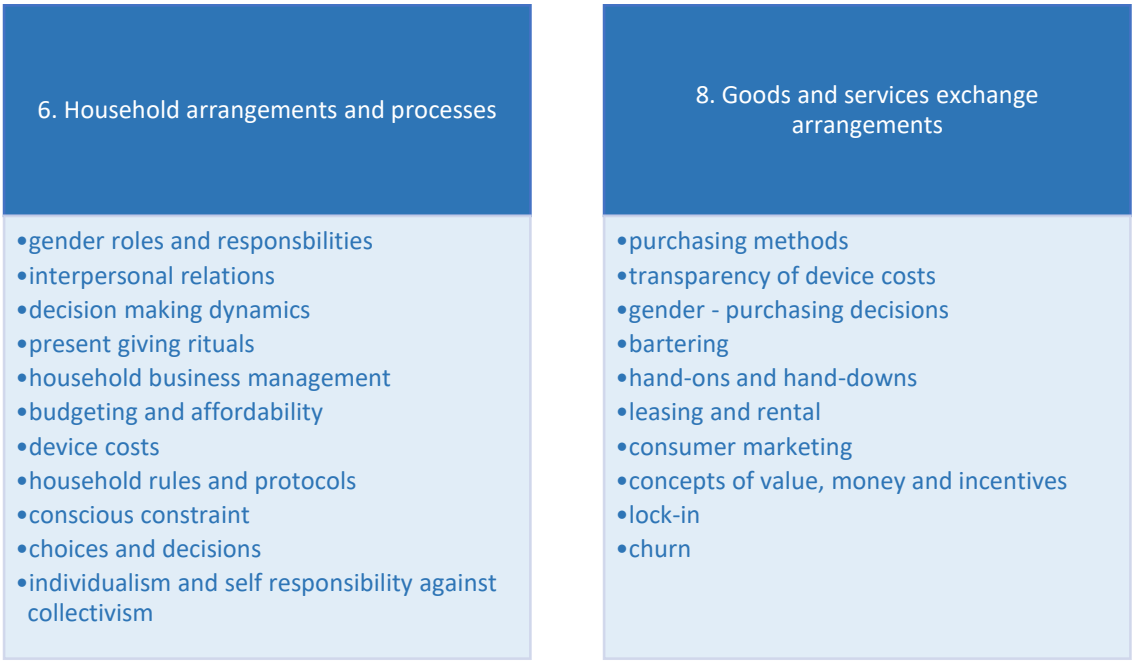


Figure 3-5: Example of theme and sub-theme analysis hierarchies

Whilst considerable consolidation of data themes had been achieved through this process the number of themes were still too extensive and insufficiently targeted to address my three research questions. Nor did they enhance my ability to address a range of questions such as:

- what were the factors driving households to acquire devices?
- what themes could be considered as practice elements?
- what activities were households using devices for?

- what factors influenced the way households did or did not divest devices?

Consequently, I further reviewed and refined the key themes into four categories. These are presented in Figure 3-6 below.

1. Emergence, existence and evolution

- Technology and infrastructure — internet, portability, smartphone, cable
- Workplace systems and access to public and private services
- Dwelling layout and device/appliance locality
- Geographic location
- Household composition
- Response and lapsed times condensed (instantaneousness)

3. Multiplicity, connectivity and lock-in

- Marketing, software currency, data capacity, device scope, device to device
- Multiple device needs and expectations
- Linking devices — cross over
- Marketing — data and device, purchasing and payment options and pricing/device costs
- Operating systems with software and interface with other devices — compatibility

2. Individualisation, collectivism and conformity

- **Social status, conformity and social acceptance aspirations**
  - Device design, materials and aesthetics
  - Device branding
  - Latest information technology
- **Personal and household expectations**
  - Device operating system, data capacity and software to support the desired needs of individuals and households
  - Device functionality, ergonomics and product durability
- **Personal and household lifestyle and living arrangements needs**
  - Ensure safety and security
  - Maintaining social and family connectedness
  - Undertake entertainment, hobbies and recreation activities
  - Pursue education and personal development
  - Maintain workforce participation and welfare access
  - Navigating stage of life wishes and experiences

4. Obsolescence, dis-use, hoarding and discarding

- **Decline in physical and systems features of devices**
  - device crashing and dying (viruses)
  - out of date functionality
  - design, sizing and ergonomics of devices
  - data and operating system capacity decline
  - longevity of batteries and informed knowledge of managing batteries
- **Where does device and data ownership and responsibility reside**
  - Whose device is it really
  - Plan expiring
- **Maintaining day to day activities**
  - Keeping as an insurance strategy
  - Portability and reliability
  - Household expenditure
- **E-waste arrangements**
  - Collection systems, repair facilities and availability of information
  - Value of devices and materials
  - Bulk of e-waste
  - Multiplicity of electronic materials

Figure 3-6: Themes re-defined and consolidated

Despite these four themes I still felt the analysis was missing the mark in terms of providing adequate scope to understand and explain the practices going on in households. They were largely centred on technical drivers as the overarching theme. Thus, the challenge for me was to identify how all my previous theme analyses could be re-arranged into household activities themes, thereby being more consistent with my social practice theoretical framework. Utilising these four themes and at times referring to the original 11 themes three areas of household living involving the use of electronic devices were determined: social and economic, leisure and entertainment, and culture. From a social practice theory perspective these living areas correlated with the concept of practice domain.

Identifying these three household living domains prompted a re-interrogation of the social sciences literature for linkages with other theoretical and analytical concepts that would overlap and integrate with each of these domains to provide structure to my analysis chapters that focus on device-use. This revealed an alignment with Bourdieu's (1986) notion of three forms of capital. The first, economic capital, which according to Bourdieu can be converted into money (cash) and institutionalised through different property rights arrangements. Economic capital underpins the other two forms of capital through a process of conversion from one type of capital to another and which according to Bourdieu involves the existence and performance of practices that are social in their orientation and performance (Bourdieu 1986). Economic capital is consistent with my first household living domain: social and economic.

Bourdieu's second form of capital is social capital which is also covered by my first domain, social and economic. This form of capital relates to social obligations, connections, institutional relationships and at its simplest, membership of a group. For Bourdieu, the amount of social capital possessed by someone is shaped by the size of social networks and the volumes of economic capital and the third form of capital, culture.[13] Further, social capital accumulation, the size of the network relationships is, according to Bourdieu, a product of investment strategies, individual or collective, consciously or unconsciously aimed at establishing or reproducing social relationships that are directly usable in the short and long term (Bourdieu 1986).

The third form of capital is cultural capital, which is distinguishable and exists in three ways, through:

- an embodied state whereby the capital lies within the mind and body, in much the same way as knowledge is held by individuals and groups;

[13] I would also argue that the amount of social capital possessed is influenced by the intensity of social interaction within social networks etc.

- an objectified state, the tangible form represented by objects and materials such as machines, pictures, books and clothing; and
- an institutionalised state, similar to objectified state but which relates to academic qualifications and training certificates. Through institutional objectification cultural capital can be converted to economic capital through ascribing of monetary value to the qualification and certificate.

Cultural capital is directly relevant to, and consistent with, my second and third domains: leisure and entertainment; and, culture.

Based on this outline, clearly these forms of capital correlate with my household living domains (practice domains). As such, the notion of the three forms of capital is adopted as the umbrella term and focus for Chapters 4, 5 and 6, all of which seek to understand and explain how and why electronic devices are used by households. Specifically, Chapter 4 adopts social and economic capital as its heading but examines the social and the economic in separate analyses. Chapter 5 assumes leisure and entertainment as an aspect of cultural capital, with Chapter 6 also utilising cultural capital as its heading.

In a parallel analytical process to that described above I returned to my interview transcripts and colour coded the transcripts to create a matrix covering the five electronic material flow points: device acquisition, use, retirement, post retirement and divestment. This proved beneficial as a way of identifying supporting quotes for each of the household activity areas as well as for acquisition, use, retirement and divestment and to conceptualise the electronic material flow discussed in Part One (section 3.2.1).

3.4 Conclusion

This chapter has outlined the development of the theoretical framework used to provide analytical structure and direction to the research process; and, detailed the research methodology employed to address the central research question: *How do Australian households acquire, use, retire and divest portable electronic devices in their everyday life and why?*

My theoretical framework uses a social practice approach with everyday practices, not individual householders, as the unit of analysis. Practices are understood to exist through a configuration of a bundle of practice elements. These configurations constantly change over time and place and re-establish themselves as modified practices, new practice entities, or cease to exist completely. Against this background, households and householders in this research are not the central unit of analysis. Instead, they are conceptually analysed as carriers of practices.

Adopting practices as the unit of analysis provides analytical flexibility and breadth because of their dynamism over time and place, multi-dimensional arrangements and the interrelationships between one or more practices, including the sharing of practice elements across different practices. All of which are ideal for developing a detailed understanding of everyday household living practices involving electronic devices.

However, in developing the theoretical framework, two issues emerged through the literature review that warranted two refinements to a social practice theoretical framework. Firstly, as demonstrated in Chapter 2, the Information-Communication System arrangements, along with arrangements outside household boundaries do influence households and the acquisition, use, retirement and divestment of portable electronic devices by householders. Accordingly, contextual arrangements are included as part of my analytical approach by the inclusion of context as a practice element.

Secondly, the unsustainable flows of electronic material through households is a key consideration for this thesis and critical for initiating change towards achieving more sustainable electronic materials consumption and use. These considerations highlight the need to formally link material flow considerations with social practice theory in a consolidated and tailored theoretical framework. This is achieved by incorporating the principles and concepts of industrial ecology and circular economy in order to frame my analytical approach at a higher level, thereby creating a tailored social practice theoretical framework. In doing so, I have assumed practices associated with each of acquisition, use, retirement and divestment are transition points on the material flow cycle within households and the space between each transition point as phases in the material flow (Figure 1-2).

It is this theoretical framework that ultimately informed my research design and methodology. It guided the planning of my research activities and tasks, with the objective of: identifying the existence of social practices within households; the form in which these occurred; and, how these contribute to electronic material flows through households. The methodology employed was qualitative, involving case-study techniques, and was used to plan, guide and complete the field-work — the data collection component of my research. It was also used to guide the data analysis process and assist in answering my principal research question.

Data collection involved face-to-face interviews with 36 households and 62 household members, conducted within their homes, spread across a diversity of household types and four geographic areas in Australia. Data analysis was ongoing throughout the thesis, iterative and theme-based. Three high-level themes were identified through the analysis under the domain of household

living: social and economic capital; leisure and entertainment; and, cultural capital. These domains, I argue, align closely with Bourdieu's notion of three forms of capital: economic, social and cultural and which are therefore used as the topic themes for the analysis in Chapters 4, 5 and 6 and the headings for these chapters.

The first forms of capital (living domains) I consider is social and economic, to which I turn to in the next chapter. But in doing so, I return to the message in the quote at the beginning of this chapter, namely: *practice theory theorises the arrows so as to understand how actions produce outcomes,* to signal that the purpose of the next chapter is to detail what arrows (practices) exist within Australian households and how do these arrows (practices) produce social and economic capacity outcomes. (Feldman and Orlikowski 2011 p. 17)

4. Social and economic capital

> *Where would we be without mobiles? Originally, they were very much about safety – parents wanting to know that their children were safe or could be contactable in an emergency. Now they are all pervasive and are entrenched in all aspects of living in a household, interacting with people and doing business. (Rita)*
>
> *Today my phone is really valuable for safety aspects because I live by myself. It is especially important because of where I live and my work patterns. That is time of day work – shift work and using public transport. (Annette)*
>
> *Life is faster because of technology. Wherever you go now everything is done with devices e.g. Post Office, banks and nothing is manual anymore, so you must join so to speak. This means that if there is no internet then you can't work, and our entire lives or systems would crash. The disadvantage of this is that we are too reliant on technology for our day-to-day living. (Shawn)*

4.1 Introduction

Adequate social and economic capital is necessary for households to respond and adapt to changes in their internal and external environments, regardless of whether those changes are perceived as positive or negative. Using the theoretical framework developed in the previous chapter as an analytical lens, this chapter examines what practices involving the use of portable electronic devices assist in building household social and economic capital. It therefore adopts Bourdieu's notion of social as well as economic capital separately and builds on the assumption that practices, when performed, reflect unique configurations of a set of practice elements: materials and infrastructure; meanings and social understandings; context; and, knowledge, skills and competencies.

The chapter predominantly focuses on portable electronic device-use and specifically examines practices that contribute to the outcomes of: building social capacity; securing income and resources; and, managing material and financial resources. These outcome areas and their supporting practices are presented in Table 4-1. With the focus on device-use, the chapter is principally concerned with practices performed around transition point two on the material flow cycle and the material flow phases between transition points one and two and between two and three (Figure 1-2). I demonstrate that, whilst all households engage in practices that support the building of social and economic capital, there are differences between households as to how and why those practices are performed and how these change over time. I further illustrate that there is a close nexus between practices involving the use of portable electronic devices as many straddle both social and economic capital, thereby supporting Bourdieu's argument that social capital can be converted to economic capital and vice versa.

The chapter is divided into three sections, with section one addressing practices involved in building social capacity.[14] Three practices are examined: maintaining family and social connection; managing personal safety; and supporting difference. Section two examines how and why portable electronic devices are used in practices contributing to the securement of income and resources. Practices examined include: responding to workplace demands; working from home; building IT resourcefulness and status; working for oneself; and, accessing non-workforce income. The last section investigates practices leading to effective management of household material and financial resources. Three practices are considered: managing effectively anytime, anywhere; adapting to income and resource shortages; and, shopping and consuming.

Table 4-1: Social and economic capital domain, outcomes areas and supporting practices

Household domain: Social and economic capacity	
Outcomes	**Practices**
Adequate social capacity	• Maintaining family and social connection • Managing personal safety • Supporting difference
Securing income and resources	• Responding to workplace demands • Working from home • Building IT resourcefulness and status • Working for oneself • Accessing non-workforce income
Managing material and financial resources	• Managing effectively anytime, anywhere • Adapting to income and resource shortages • Shopping and consuming

4.2 Building social capacity

In this section, I build on Bourdieu's (1986) notion of social capital, applied as social capacity, and argue that social networks and relationships at the individual and household levels support households live their everyday life successfully. I demonstrate how and why portable electronic devices are used in four practices that build social capacity, beginning with maintaining family and social connection.

4.2.1 Maintaining family and social connection

Based on the interview data, practices supporting maintaining family and social connections were performed in all households. For many households these practices were given a high

[14] The term capacity is adopted here to denote a more fluid state compared with capital which has the potential to imply a stock of capital. This, I believe is more consistent with the dynamics upon which social practice theory is grounded.

priority as they valued the emotional and social benefits gained from staying connected and engaged with people who were important in their lives, including partners, children (regardless of age), extended family, friends, peers and social groups. In fact, it was clear that most householders spent many hours of the day engaged in communication and information-sharing practices. For example, grandparents discussed how they maintained contact with their grandchildren to ensure the grandchildren remembered who they are, understand how they (as grandparents) think about the world and convey to the grandchildren *words of wisdom* and to share the grandchildren's everyday life experiences. Communication with grandchildren was not however, one directional, rather as some households discussed it was the grandchildren who initiated the interaction rather than grandparents. This demonstrated the importance of all family members having functionally compatible devices for interpersonal communication. In some households the lack of compatibility pushed grandparents to acquire devices that were compatible, even though their existing device still functioned adequately. This is a factor driving the inflow of electronic materials into households and the retirement of existing devices and to which I return to in Chapter 7.

The intergenerational contact observed raises the issue of why households and householders constantly pursued the practice of maintaining family and social connections. In part the answer lies in my analysis in Chapter 2 and ABS Census data (ABS 2017) which outlined that Australian households are highly mobile, with mobility encompassing movement within Australia, to other countries in a transient-short to medium term professional and living arrangement, and to Australia through permanent migration from another country. Each of these scenarios were identified in the interviews. For example, several householders interviewed were grandparents, with their children and grandchildren geographically isolated and separated. Fourteen of the 36 households involved in the research were included in this grouping, with grandchildren, and hence children living in areas such as the Middle East, remote New South Wales, Queensland, New Zealand, United Kingdom, Singapore and China. It is this mobility and subsequent separation of family members and friends that helps to explain the practices of maintaining family and social connections using electronic devices.

One aspect of device technology that has been pivotal for the performance of these practices is the advent of social media platforms. Many householders spoke about their use of these platforms (and the internet) for interpersonal communications and as a way of overcoming time, place and cost limitations. These householders discussed how Skype, Facebook, Snapchat, Instagram and LinkedIn provided them with the ability to communicate 24/7, regardless of

locality with family and friends during special events such as birthdays, celebrations and travelling.

Differences did exist across households around how they stayed connected using electronic device technologies, including both hard and soft infrastructure use. Many of these differences are explainable through the influence of practice elements, most notably contextual factors such as income and resources and knowledge, skills and competencies levels, across households in the performance of the practices. For example, in several households, income and resources were limited and reduced the capacity of householders to acquire more recent and multi-functional devices with the latest camera and photo functions or social media platforms. I further argue that limited resources in these households made it difficult for them to participate in activities outside of day-to-day living, perceived as worthy of photographing, such as travelling overseas or interstate for holidays and hence the need to share photos and experiences.

Differences across households can also be explained through differences in the levels of knowledge, skills and competencies around understanding and using devices (including software, the internet and access to data). In turn these differences appeared to be linked to age and workplace roles (past and present). For example, a 60 plus year-old householder indicated he struggled with using his mobile phone because his work (prior to retirement) was not dependent on mobile phones or computers. However, a similar aged householder who held a position that was dependent on the use of computers and other electronic devices, was highly competent in his electronic-device use capabilities.

Differences across households in the use of electronic devices, along with the use of social media was also evident due to the preparedness of householders to engage (the values attached to) with the technology and associated practices. In some households, conscious decisions were made not to engage with the technology and instead rely on existing channels of communication such as landline phones and desktop and emailing and, therefore, to participate in these practices rather than social media-based activities.

4.2.2 Managing personal safety

Managing personal safety practices contributed to building household social capacity and involved the use of devices to facilitate communication and exchange of information activities. Four factors shaped the performance of these practices. Firstly, the risks associated with households and householders being separated by time and place as they undertake their day-to-day living. Thus, the meanings households placed on the need to minimise potential adverse effects imposed by being separated by time and place did influence the use transition point and

the electronic material cycle. However, variations did exist across households and between individual household members and their preparedness to manage any such potential risks and which do have an impact of the electronic material flow across households.

Peggy's situation provides one case study. Peggy had migrated to Australia and on arrival was living by herself in a relatively remote area of Victoria. Her family at this time was still living in her country of origin and both she and her family had, for various reasons, deemed her day-to-day personal safety to be at risk. For Peggy and her family, communication with each other on a regular basis was important to keep her morale high and to monitor her safety. As Peggy explains:

> *This (laptop) was mainly brought for doing email activities as I found it is more convenient than a computer because of its portability which was important at the time because of the type of accommodation I was living in. Emails were the most important things because of the remoteness in Australia and in the country of origin. We were separated and needed to able to communicate a lot and anytime. The separation was for about six months before we were united. I had to have email to be able to communicate and maintain sanity – phone could not provide this and was very expensive compared with receiving emails. (Peggy)*

Christina provides another example of separation by time and place as a factor influencing perceptions around personal safety risks. Christina had moved to Sydney from the country for education and later employment opportunities — separating her from her family in regional New South Wales — and hence was unable to tap into her past safety back-up support networks. She explains the impact of separation by distance as follows:

> *Got my first mobile phone when in my first year of university and had moved from the country to the city (Sydney). My parents wanted security that I could contact them at any time. This was especially important when I started doing part-time work late at night. (Christina)*

Place-based arrangements and the perceived need to plan against safety threats also played out in the case of Tamara. Tamara lived in an outer Adelaide suburb, a suburban scenario that reflected the discussion in Chapter 2 on urban expansion and the social isolation of householders in newly establishing areas. Such areas are frequently without adequate communication and transport systems — Tamara's household living context. For Tamara it was these conditions that pushed her into purchasing her initial phone as a strategy to ensure her personal safety, as she explains:

> *First acquired my phone around 14 years ago. I was home and relatively isolated — did not drive — and in last stages of pregnancy and wanted an emergency resource. Once upon a time a pager may have been hired but chose a mobile phone because of the ongoing benefits of having a portable communication device. (Tamara)*

A second factor driving the performance of practices to reduce safety risks is demographic, especially age and gender.[15] For example, most children from approximately seven years of age have a mobile phone or similar device (iPod) as a way of ensuring their safety whilst undertaking their everyday activities. Electronic devices have become the ideal risk management tool for households, especially for those with children. As Kathleen's comments below highlight:

> *Each child got their mobile when starting high school. The thinking behind this was to provide some degree of flexibility in terms of travel arrangements, school and other outside of home activities. What was particularly important was being able to handle an emergency situation, move around in a secure way and for logistic organisation. This is particularly important as the older children use public transport, e.g. bus travel and stay back at school. (Kathleen)*

For some households addressing the issue of children's safety because of separation by time and place and the use of devices to minimise those safety concerns did, in fact have positive benefits. These households acknowledged the issues of safety such as young householders being separated from home by travelling on public transport, alone, but at the same time, they believed this was an essential part of everyday life and "growing up". Devices in these scenarios enabled younger householders to build personal independence and confidence by feeling sufficiently safe (with having a mobile) and to begin travelling along using public transport.

A third factor (and one related to the above) is associated with personal safety linked to work and other place-based commitments, e.g. volunteering and children's recreational activities. These commitments frequently separated households and householders, especially parent/s and child/children by time and place.[16] This separation made it difficult to be fully aware of the safety of household members when they are not at home or at times even when they were at home. For these households, devices are the ideal mechanism for overcoming such concerns in real time. Examples discussed by householders on how competing demands were managed included family members notifying others when they were likely to be late and when they arrived at their destination. In several households this involved having informal operating rules around when and why individual members must inform other household members of their whereabouts. But it also meant that adult household members had greater flexibility to continue with their everyday work, other activities and leisure practices, whilst having some confidence

[15] Householders did not directly comment that gender was an issue driving the need to plan against safety threats. I would argue, however, that in several household discussions this was implied. Certainly, in the broader community, females are considered as being more vulnerable to safety threats than their male counterparts with safety and security applications now available for females. As to whether possessing a mobile phone and using these applications mitigate these threats is still to be determined.

[16] A similar scenario existed in some households interviewed as they were separated from their elderly parents. Some households used mobile devices to stay in connected whilst others relied on landline phones due to the ability of their elderly parent/s to use electronic technologies.

that younger members were safe. I explore the issue of the relationship between the workplace, the use of portable electronic devices and income and resources in section 4.3.

The final factor driving managing personal safety is unexpected events such as natural disasters (earthquakes, bushfires and floods), international conflicts, disease outbreaks, pollution and transport, workplace accidents and medical emergencies. All have the potential to separate and or isolate householders by place and in some instances time. This issue was mentioned by one farmer who expressed concern about accessing warnings on potential floods and bushfires through his mobile phone and a household in Melbourne that had poor mobile phone reception because of a "communication black spot". In both instances the households were keen to minimise the impact of such risks on household members and for the farmer his livelihood.

The above clearly demonstrates that contextual factors are major drivers influencing the performance of practices designed to manage personal safety. It also highlights the importance of devices and their supporting hard and soft infrastructure in the configuration of the practices. However, it is also apparent that the meanings and understandings ascribed to the issue of personal safety, as well as the responsibilities of households to protect their members, are important drivers in how the practices are configured. For example, in several households there was a belief that family members, especially children were at risk of experiencing some form of harm because a parent or adult was not always accompanying the young person. There was also a perception that dangers and threats were forever present, be they from other people or the physical environment, and which would result in harm to household members. The implication is that individuals should not be subjected to danger and harm and that individuals are unable to protect themselves from danger and threats and or manage uncertainity. This view is frequently discussed in the popular media under the umbrella of over-protective parents as well as by Malone (2007) and Troy (2015).

This discussion has demonstrated the influence of meanings and understandings, materials and infrastructure and contextual elements in the configuration of managing personal safety practices. But as I have also demonstrated the performance of the practices are dependent on households and householders having the necessary knowledge, skills and competencies to understand and use electronic devices for these purposes as well as how to use other infrastructure such as public transport and interpret safety threats.

4.2.3 Supporting difference

Some households in my research faced health and disability challenges. For these households the level of support necessary from within the household for one member (and in some cases

two or more members) was greater than would be expected in ordinary households. In this section I adopt “difference” as a dimension of the element, context and argue that minimising such difference is a practice that contributes directly to building social capacity.

Three findings emerged through interviews relating to supporting difference practices with implications for how they are configured. Firstly, the needs of household members with differences encouraged extensive use of electronic devices and associated hard and soft infrastructure. Secondly, the households had committed to and placed considerable meaning and emphasis on providing the best opportunity for family members with difference, such that the members would be able to participate in society and achieve the best possible outcomes during their lives. Thirdly, wider contextual arrangements have a significant influence in how these practices are performed, including factors such as the rigid structures of mainstream education systems. These issues are explored further below.

In one household both children were autistic, with one young household member edging towards the more severe side of the spectrum. This young person struggled to progress in the mainstream schooling system and consequently the young person’s parents, Alan and Tamara removed their son from mainstream schooling. They subsequently registered him as a home-schooled student and the mother, as a home-school facilitator, and acquired and was using additional electronic devices to support the son as well as herself in the home-schooling activities. Table 4-2 details the value of electronic device technologies for home-schooling a young person with differences, as gleamed from the data, supported by comments made by the mother. This case study demonstrates the interconnection between supporting difference practices and those of home-schooling practices, with both practices sharing practice elements such as materials and infrastructure (devices and the internet) and meanings and understanding, a willingness to support difference and undertake home-schooling and achieve the best possible outcomes for the household member.

Jenna in Sydney provided another example of supporting a family member with difference. She discussed how her brother has become dependent on electronic devices to support his everyday living, especially as a method of giving meaning and structure to his day-to-day tasks and, as a way of navigating the workplace as a person with difference:

> *My brother has an iPad and uses it at home but mostly at work. It is a valuable device for his living as he has autism and mild Down Syndrome. He also has three iPods and these are used for music. He has a ritual for how and when each iPod is used. (Jenna)*

Table 4-2: Value of electronic devices for home-schooling

Device	Parent comment	Value for home-schooling
Software	*Minecraft — game based on blocks like digital Legos. Used to support maths and spatial awareness. (Tamara)*	Can be tailored to support individual needs and interests
Tablet	*..extremely useful for education applications that are relevant to home schooling requirements. Young person uses tablet to fill the void because out of school and provides him with social connection, especially things like Skype. He also uses it for entertainment, such as games and it creates a space for him to remain calm and it is his. (Tamara)*	Multi-functional small tool, highly portable providing easy access for building social capacity skills
Laptop	*Used extensively for home schooling and is an extremely valuable asset for day-to-day living for the young person. (Tamara)*	Provides a more reliable and permanent educational tool
All devices	*Without the devices it would be very difficult to do home schooling — would have heaps of papers otherwise, too. (Tamara)*	Streamlines educational activities, reduces ongoing costs and household clutter

The case of Eric is a further example as he too placed considerable priority on the need to support his son, such that the son was able to live a normal life and participate in the mainstream workforce and build individual and household social capacity. Eric discussed how the functionality of electronic devices with the 'finding and monitoring software application' enabled him to support his son. Successful performance of this practice was however, dependent on Eric having adequate knowledge, skills and competencies to use electronic devices and associated software to enable the practices to be continually performed. Eric explains:

> *I also use the application of find a friend which seeks out where a mobile phone is located at a particular point in time. I have found this useful for supporting my son with his medical condition. (Eric)*

By way of summary for this section, I have argued that households are able to respond and adapt to changing internal and external circumstances by building social capacity through the performance of three practices: maintaining family and social connection; managing personal safety; and supporting difference. Similarities exist in the performance of the practices across households as well as differences. Differences arose through the influence of contextual factors such as age, personal situations and income; the meanings and understandings that households place on the importance of social capacity and the value of electronic devices; and, the levels of knowledge, skills and competencies households possess to use devices and build capacity more broadly. Portable electronic devices, along with the internet, social media platforms and

software, are the key materials and infrastructure element in the configuration of these use-practices. Evidence was also identified of interconnection between the three groups of practices.

The next section investigates the practices that support the outcomes of adequate income and resources, an outcome that is consistent with Bourdieu's notion of economic capital. How and why electronic devices are used in these practices is also examined.

4.3 Securing income and resources

Access to adequate household income and resources is necessary for households and their members to operate effectively and participate in the economy and society more generally. What constitutes adequate household income and resources is highly subjective with factors such as household numbers, the age of members, the number of children, lifestyle aspirations and household dwelling type influencing the level of household income and resources required for day-to-day life. Practices supporting the securement of adequate income and resources are therefore critically important for household sustainability and their equitable participation in society. Against this background I examine how and why portable electronic devices are used in the securement of household income and resources and focus on: responding to workplace demands; working from home; building IT resourcefulness and status; working for oneself; and, accessing non-workforce income.

4.3.1 Responding to workplace demands

Most household income and resources are secured through participation in the paid workforce. This was clearly the case in this study with most households having one or more members participating in the workforce (I explore other sources later). Workplaces are situated within the broader national and global capitalist-profit making economic and political systems discussed in Chapters 1 and 2, with individuals participating in the workforce having limited economic power and influence. Further, today's workplaces have IC Systems as a key organisational platform, with electronic devices such as desktops, smartphones, tablets and laptops combined with access to the internet providing essential equipment that forms part of this platform.

These arrangements provide considerable economic and industrial benefits to employers and management such as improved workplace productivity, greater control of employees and the ability to shift operating costs and employment risks onto employees (Nykodym et al. 2012; Computer Weekly News 2015).[17] Many householders spoke about this phenomena during

[17] Examples include sub-contracting, hot desking, cost shifting onto employees through practices such as requiring employees to supply their own devices and other equipment e.g. car.

interviews, especially how the availability of electronic devices, both workplace-issued and personal had resulted in their or other household members everyday life becoming captured by employers. These arrangements generated competing demands between workplaces and household life. Data analysis revealed that householders adopted various practices to navigate these competing demands, all of which are dependent on the use of portable electronic devices and in most instances the internet. One such practice relates to responding to workplace demands, which I now examine in more detail.

Many householders discussed how their workplaces had expectations around the need for employees to respond immediately to work requests, regardless of time or place. In these circumstances, portable electronic devices and their functionality provided managers with the ideal tool for contacting and communicating with householders, demanding a response from employees and monitoring the progress of that response. These demands created an outcome where the workplace encroached into a householder's personal time and space and, more importantly, established a need to respond to those requests instantly (Ninaus et al. 2015; Wajcman et al. 2008; Castells et al. 2007). This issue was raised by many households as a practice that had taken hold in the last decade. The extent of device embeddedness into a householder's life and the notion of instantaneous response is one well captured by a Melbourne resident Dean:

> *Today though I feel that everyone thinks you should be contactable 24/7 – even for work as workplace managers do contact you constantly. For example, there is a belief amongst them that we know it's [mobile phone] attached to your body so we will contact you. (Dean)*

Terry too, highlights this issue of device enabled instantaneous responses from employees to managers and how this has changed over time when he explains:

> *I have seen changes in how work and personal life interface through the use of devices. With the advent of computers, especially emails and now smartphones, there is an expectation from bosses that staff will respond instantly, that is staff will drop everything and follow through on requests or deliver on a task.*
>
> *I feel that was there is this constant pressure for speed. All information and data must be transferred immediately – response times must be fast. (Terry)*

Holly, a professional working in the Non-Government Sector (NGO) in Sydney and in her late 20s to early 30s provides a more extensive account of the impact of workplace encroachment into home-life and the role of electronic devices in this process:

> *Having a phone for use at work and provided by work has both positive and negative aspects. Generally, more on the negative side as being provided by work raises expectations around being available and making decisions 24/7 and as a result I work*

> *well beyond my contracted hours. I feel that this is becoming the norm in the workplace under these conditions. There is a massive expectation on you.*
>
> *Another thing that access 24/7 through mobile devices is contributing too is the condensing of time for decision making with technology providing quite different definitions of time.*
>
> *At work I have a laptop with a screen and keyboard and mouse. Part of having a laptop at work is that the organisation has a strategy of encouraging staff to work at home. The laptop certainly provides scope to do this because it is easy to transport and pack up and light. (Holly)*

The picture above clearly demonstrates portable electronic devices support workplace objectives and that these do adversely affect the everyday lives of householders, as employees. Equally, however, many householders discussed how portable electronic devices enabled them to navigate this encroachment into their households and personal lives and re-define and prioritise workplace demands in the context of the everyday needs of households. This finding is consistent with other social research studies examining the impact of electronic devices in the workplace and the pressure placed on households and family life as a result (Wajcman et al. 2008; Castells et al. 2007).

Data analysis revealed householders use several strategies to assist in the balancing of competing work and household life demands. The first is what I term, “got it so use it philosophy”. In this strategy householders use work devices and work-time for personal and household purposes. For example, many spoke about their or their partners’ use of workplace desktops to pay household bills, in many instances because the ergonomics of the larger screen reduced the likelihood of making transaction errors on-line. In the case of Brenda, she maximised the use of her workplace desktop (and workplace data) to view YouTube videos for personal and professional purposes. In perhaps a more overt approach to “got it so use it”, Marc outlines his thoughts:

> *Electronic communication devices changed working life and interface with home in that I now have everything at my fingertips so why not use it, especially when this is provided by the firm. (Marc)*

Another strategy is proactive disengagement. Christina’s household (a couple household in their mid-30s) provides an example of this strategy as her partner maximised the effects of physical separation of work and home by leaving his work-issued device at home when on leave. Further his laptop is not transported between work and home on a daily workday basis to limit the incentive to perform work-related tasks such as checking emails at home in the morning or at night. As Christina explains:

David (partner), especially likes to try and keep the use of his devices (work and personal) separate. Because of this he leaves his Blackberry at home when not working e.g. when on holidays. This is really important to him (and us)

The laptop stays at home and doesn't move between work and home. Work starts in the city at 8.00am and goes through to 7.00ish pm on a work day. (Christina)

4.3.2 Working from home

Several householders explained how they had arrangements in place with their employer to work from home and, in the process, be better able to balance work-life responsibilities and the issue of separation of time and place dimensions in that balance. Portable electronic devices, the internet and appropriate soft infrastructure are critical enabling technologies for the success of these practices. Interestingly, according to some householders, success of these arrangements was also dependent on the willingness of employers and householders to countenance such practices and the meanings and understandings ascribed by employers to homes as productive workplaces.

Erika, living in Melbourne, provides one example of how working from home prevented the potential for the disruption of home-life activities. Erika's work responsibilities covered all of Victoria and she used her phone to manage all aspects of her role, particularly field staff management, who operate outside standard work hours. For Erika, her mobile phone and laptop enabled her to perform her work role and responsibilities within the confines of her home, outside mainstream office hours whilst continuing to attend to her household responsibilities. This was especially important for Erika as she was the primary household manager, a single parent but with caring responsibilities for her father and younger extended family members.

Bridging differential time and place demands between the workplace and household was also a major concern for Leslie. She and her partner have three children, all with a raft of school and outside of school activities. They also have high expectations on ensuring the household runs effectively but within the context of her and her partner being able to commit and perform to a high level in the workplace. This involved being at home but, at the same time, available on-call in cases of emergencies. For both Leslie and her partner, the mobile phone has become the substitute for what was once a pager as she explains:

I do a lot of on-call work as does my partner. We both use phones as a new form of pager. (Leslie)

Several householders also utilised working from home as a strategy for overcoming the difficulties associated with operating across multiple workplace sites and a lack of a conducive workplace environment to support work-tasks, such as concentrating in a noisy office. Lloyd

provides an example of such a scenario. His work straddled IT and software programming with that of accounting and, because of this crossover, the need for a space to concentrate without constant interruptions was essential. For Lloyd the only place where this was possible was at home. As he explains:

> *My preference is to use devices and work from home. When I am at work I am constantly being interrupted with requests for desktop assistance as well as for software support. This makes it impossible to do the programming activities at work and so I use home to do the coding and programming.*
>
> *At work I find it particularly difficult to manage things as I find that I am splitting functions I am required to do and the others from general IT maintenance task — hence the keenness to work from home as there are no interruptions.*
>
> *I also use the computer for logging into work and doing work functions, keeping their system operating as well as the platform for developing software programs for work activities relating to accounting and taxation. Connection to work is done remotely. This is especially important to me, otherwise I would be at work 24 hours a day and often 7 days a week. (Lloyd)*

Work for several other householders involved operating across multiple field sites, between the workplace office and the field and or warehouse. These householders were highly mobile employees who only entered the main workplace on limited occasions. A common thread in these instances was the pressure for employees to provide and deliver high quality client services, regardless of time, place and environmental conditions, often leading to the performance of work-related tasks at home as a way of circumventing travelling time back to or from the office.

Two householders work experiences provide examples of these arrangements. The first is Adam, a field customer service officer in the manufacturing sector and who is totally dependent on his smartphone (self-purchased) for servicing his customers 24/7:

> *I use my phone principally for communication, mainly work purposes. Because work is multiple locations the phone is important i.e. 85 per cent is factory based, and 15 per cent is field/on site based. I use the phone for phone calls, emails, navigation and as an internet access device. It is like a mobile office to me. (Adam)*

Marc, working in the construction industry and across multiple sites is another example. He explained his use of devices for value-adding for clients by providing instant calculations without returning to the main office. However, for him, this frequently involved the completion of his work responsibilities at home after work hours:

> *This is a work laptop and is principally used for that purpose. It is used for emailing clients, drafting, doing construction calculations and is portable enough to take into the field. It means I am able to use the vehicle bonnet as an onsite desk for the laptop – a mobile office.*

> *My mobile phone is used everywhere and at all times of the day "always on me", allowing clients to contact me in "change of plans scenarios" such as rain and high winds stopping work. The phone is small enough to take onto confined construction spaces. (Marc)*

4.3.3 Building IT resourcefulness and status

Based on the above discussion employers use electronic devices to dictate timely work outputs from employees. It is also evident that householders use electronic devices to navigate the boundaries between work and home as a way of reducing the adverse effects of work on everyday household life.

Data analysis demonstrated that electronic device-use in the workplace provides householders with several positive spin-off effects which help build their households economic capital, both in terms of using information-communication technology and improving the everyday capacity of households to perform activities in the present and for the future. Three areas were identified where workplaces enhance household and personal resourcefulness capacities with electronic devices: cost savings; the transferability of workplace knowledge and skills into the household domain; and, personal and professional development. These are now considered in more detail.

Householders use workplace equipment and systems to support and supplement their day-to-day household resource needs and perform household practices such as paying bills. Use of work devices in this manner provides a significant cost saving for households as all costs associated with purchasing, replacing and divestment are borne by the workplace-employer as well as the operating costs of devices. In addition, even if there is informal pressure for householders to supply their own electronic devices (which appeared to be the case in many circumstances), there is still the need to ensure that they function effectively in the workplace which can still provide cost savings for the householder. For example, these householders can claim aspects of the device capital and operating costs back from the employer and or through the tax system.

Another benefit gained by householders from using workplace devices is the opportunity these practices provide for doing market research on devices to determine what device would best suit their household needs based on their personal experiences of using work equipment. Further, the decision-making environment is not pressured, providing households with the opportunity to make informed decisions, in their own time, about which device to purchase.

Cost savings were achieved by several householders by having remote access to work systems from home and access to a greater range of software applications, thereby reducing the need for the household to purchase software as Marc hints at here:

> *[What is important is] Device functionality, ease of use and interface capability and potential with other devices and software. (Marc)*

Householders information-technology knowledge, skills and competencies, including the use of electronic devices played an important role in householders successfully performing workplace practices. But many householders suggested that participation in the workforce enabled them to further develop their existing information-technology knowledge, skills and competencies, especially the use of electronic devices and associated software and applications and, as a result, build household resourcefulness and economic capital. In turn, improved resourcefulness enabled the households to operate more effectively. These positive spin-off effects were noted by householders of all ages who were engaged in the workplace.

Margaret (a retired professional) provides an example of the transferability of knowledge and skills from work to the household context and of the influence of age and demonstrates how gaining a basic level of knowledge and skills in the workplace builds an appetite for more sophisticated and different types of devices and technology for use in the household. This creates a compounding and cumulative effect of building resourcefulness and confidence in the use of electronic devices and software before finally taking this technology on board in the household context:

> *First mobile phone was a work issued phone for work purposes only and so could not use for private calls/use. This phone gave me a taste of what mobiles could provide and its uses as well as how to use it in a practical sense. During this time, I did get a phone for myself but was it the very basic format. This coincided with around the same time I retired from the workforce.*
>
> *Also, after I retired I did a stint working on a contract basis – this reinforced the taste for mobile devices and it was really at this point that I invested in a more complicated phone as I got a taste for how it could be used.*
>
> *Also, at this time – retirement and working on contract that I identified a need for a laptop.*
>
> *At the most basic got the skills through office-based work. Partner who worked in the field has more limited skills. (Margaret)*

In contrast to Margaret, Terrence's comments refer to the value of work-derived knowledge and skills and their inherent value for a household when describing his workplace experiences and the necessary knowledge and skills required and their transferability to the household:

> *In my workplace and more particularly the areas where I worked I been surrounded by IT systems and computers pretty much for entire career — also seen the major changes from Fortran and computer cards for programming through to the devices today and the range of software off the shelf.*
>
> *I believe that because of my work experiences I can speak the language so to speak and this has helped transition into the environment at a personal/home level. Also, in*

> *the workplace there was an expectation by the organisation that you learn and develop the necessary skills and competencies to use – CSIRO certainly fitted this but also supported you to acquire the skills. (Terrence)*

However, there is an interesting twist to this theme. At least two householders believed that their work-type, manual, field-based activities limited their exposure to and the ability to gain an awareness of devices and, hence, their ability to develop the necessary device and IT system skills to fully maximise device functionality to support their day-to-day household activities. As Randell mentions:

> *For the mobile phone the main use is for making calls in and out, followed by using the mobile as an alarm clock. I find I don't really have the skills for texting — even though phone has the function. I feel that some of this might be due to career being spent working outside/outdoors and hence there was limited scope for the use of the phone. (Randell)*

Workplaces are frequently characterised by formal hierarchical reward systems based on salary packages tied to the hierarchical level. Based on the data, the workplaces of some householders reflected this type of system, with this system underpinning how these householders secured their income. However, there were instances where householders indicated that a more informal reward system, tied to the work issue of device-type and the permitted private use of the devices also existed. In turn these arrangements shaped the householders' professional status and indirectly the availability of resources to support their everyday life.

For example, the workplaces of some householders issued, or did not issue, staff with devices based on the hierarchical position held, with managers frequently issued with additional devices such as tablets compared with other employees who are "pressured" to provide their own devices for work purposes. In saying this, the householders were not implying that the invasion of the workplace into the personal lives of managers was any less significant than for mainstream employees. Rather the message is that devices are used as a subtle and informal reward system, which is readily seen both within the workplace and outside and which does have an impact on the economic capacity of households.

A second example is the status householders derive for their personal and professional lives through having the latest, most aesthetically pleasing and technically advanced devices and software. As Marc describes:

> *The majority of apps are for work purposes. Professionally – if you do not have a phone that enables you to take files on then you are considered out of date and unprofessional. (Marc)*

Another example is how electronic devices are an important tool for pursuing professional standing, employment opportunities and professional networks. In the case of one household

this was a totally new world as the primary income earner, an engineer, was about to be made redundant in the coming months, after a decade or more of having a secure job. He faced the prospect of job searching and was coming to the realisation about how important mobile phones would be as a tool, in the job searching process. As Kathleen, explains:

> *My husband sits his [mobile] on the dresser but I hope in the future he will take it with him because of job searching. (Kathleen)*

Erica, in her early 20s had similar thoughts. She saw electronic devices as critical for pursuing employment opportunities and building an independent household income of her own. In her case, the technical functionality of a digital camera and the graphics power of an AppleMac computer were vital for seeking employment as she explains:

> *The camera ... is linked to employment and is important for my design work.*
>
> *A computer is important because of the greater speed at which you can operate. Functionality and capability increased massively – one device does all things. Being able to digitalise things helps to streamline things much more compared with hard copies. In this way computers are really valuable for storing and working with photos. A major interest and need for work and for me and my work.*
>
> *The main uses … for chasing employment opportunities. Preference is for email rather than Facebook for this as it is more private and secure. (Erica)*

The use of portable electronic devices for developing household cultural capital is discussed further in Chapter 6.

4.3.4 Working for oneself

Compared with the above where householders are paid employees, several households secured income and resources by working for themselves as self-employed business people and included one householder running a family farming business and two single-person households operating home-based businesses. Regardless of the reason, the householders who worked for themselves, were all operationally dependent on portable electronic devices, particularly smartphones and tablets with the farming business using a desktop too.

Other aspects of the materials and infrastructure element proved to be significant when working for oneself. This was especially apparent in the farm business scenario as having a reliable internet platform and mobile phone reception 24/7 was critical for electronically and remote-controlled farming practices involving machinery and technology. It was also important for the two other businesses based in the service sectors where reliability of information systems and devices was essential for successful service delivery practices.

Clearly, electronic devices have become a significant tool through which householders are able to operate their own businesses successfully from within the household and that this significance applied to any industry sector. The devices provide self-employed householders with multi-tasking and flexible capabilities at their finger-tips (anytime and at any place) which is important when operating as a sole operator and the ability to perform all normal business functions almost simultaneously.

The practices of working for oneself illustrate some interesting comparisons between working in the paid workforce and working for oneself and how and why electronic devices are used in these practices. In the case of working in the paid workforce (sections 4.3.1 and 4.3.2) devices are often used by employees as tools to mediate the control and power of employers whilst continuing to secure an income to support everyday household activities. By contrast, self-employed householders predominantly use electronic devices to create autonomy and control within the business operating unit, that is dictate the terms and the way the business operates, including managing those stakeholders it engages with. For example, in the case of the farmer interviewed, he could separate his business activities from his personal-family life and leave his farming practices out in the field and if necessary shut down the practices. This type of operating mode, driven by digital information systems and electronic devices contrasts remarkably with how farming practices were performed previously. Darren brilliantly describes these changes, their extent and how they have become embedded into farming practices:

> *Mobile phones are having a major impact and taking over from things like the tractor radios which are going out. Tractors now are like major communication hubs in their own right.*
>
> *Another important change is that you can access things from anywhere. This is especially important for farming activities and you don't have to wait until you get home (back to the house) and it can be done in the paddock so to speak to check out and find out about things.*
>
> *In addition, the phone is a real asset for organising maintenance of machinery. For example, I can use the phone to connect to the technician. A case in point is tuning machinery such as the tractor whilst in the field. I am the medium for the technician to instruct and delivery the service. It saves time, resources and money. All the computers on the machinery can all be governed by computers linked into the phone.*
>
> *With the smartphone you are able to check the weather 24 hours a day which is critical information as a farmer when planning the daily and weekly activities.*
>
> *In essence the smartphone gives us access to the internet and can check emails when out and about and all day long and can also check market conditions which is important for the business. Today the smartphone is like a mobile office and is the centre piece of running your business from a small tool like a phone. (Darren)*

The data also demonstrated an interesting interconnection between the practices of working for oneself and the practices of maintaining family and social connection. For example, the practice of working for oneself, involving the use of electronic devices, provided Olivia with considerable flexibility for managing the competing needs of a small baby, securing income and resources and managing her business as she explains:

> *The tablet came with a package. At the time it was very opportune because I was setting up my own business, including a website so business advisor suggested that the tablet would be very useful because it provides more functions and is more portable than a laptop. The small business has been going for about 12 months so devices becoming increasing important. My pregnancy and childbirth has influenced the speed of business set up and so in a way how I use the devices but also how frequently. (Olivia)*

One unexpected finding was the incidence of small-scale hobby businesses conducted by householders with the use portable electronic devices. Two householders discussed this type of practice, a practice designed to provide them with a personal interest, cash resources and, hence, support for their day-to-day household and personal economic life. For example, Annette discussed how she uses her laptop, the internet and social media via Facebook to distribute the stories she has written. Electronic devices also provided Annette with the facility via Facebook to sell her craft work. This gave her the capacity to reach a greater pool of potential buyers and hence increase the amount of pocket money to be gained. For Annette, living as a single person on income support payments, any additional dollars she gained is a welcome addition to her household resources. Darlene echoes Annette comments when she says: *I use the laptop for running my cake icing hobby – for pocket money* (Darlene).

As indicated above households secure their income and resources (economic capital) through participation in the paid workforce or through self-employment. Not all householders secured their income and resources through these practices. In the next section I explore the circumstances of these households.

4.3.5 Accessing non-workforce income

Households relying on alternative means of securing income and resources besides working and working for oneself fall into two groupings: households relying on government and community support programs for income; and households drawing the aged pension and or, were living off superannuation retirement funds. What is important here is that, in both cases, electronic devices were essential tools for householders to access online systems and services and monitor their income payment and superannuation performance. For example, householders spoke about the requirement for a smartphone, or similar device such as a tablet, to check-in regularly with the government agency and to notify the agency of any changes in personal circumstances

and to access support services. These arrangements are neatly summed up by Annette, an Adelaide householder:

> *The phone is needed to receive SMS reminders from government departments and medical people around Centrelink responsibilities and prescription renewal. So, in this respect the phone is like a personal management tool for my life. (Annette)*

Summarising this section. I have argued that portable electronic devices are used at the material flow transition point two (Figure 1-2) in the performance of five practices that support the securement of household income and resources (economic capital): responding to workplace demands; working from home; building IT resourcefulness and status; working for oneself; and accessing non-workplace income. Variations existed across households in the performance of these practices, due to the configuration of the practices when performed, with all elements: context, meanings and understandings, knowledge, skills and competencies and materials and infrastructure, influencing the configuration of these practices as entities.

4.4 Managing material and financial resources

In this section I examine household practices involving the use of portable electronic devices that support the management of household materials and financial resources. Three practice areas are examined: managing effectively anywhere, anytime; adapting to income and resource shortages; and, shopping and consuming.

4.4.1 Managing effectively anytime, anywhere

Householders are constantly faced with the dilemma of managing competing day-to-day commitments if they are to live their daily lives successfully regardless of whether, relative to personal autonomy, those dilemmas arise over competing commitments between family and work or personal safety. Irrespective of the dilemma, electronic devices have become the quintessential household tool in this process. The issue of competing commitments also played out over day-to-day management of material and financial resources (Maher et al. 2008).

How then are electronic devices involved in household material and financial management practices? From a strategic perspective, electronic devices enable the conduct of household business practices and transactions twenty-four hours a day, seven days a week (24/7) and from a centralised point without the need to impinge on other activities such as sport and recreation, work and education commitments. The multi-functionality of a single, mobile platform, taking the form of one or more electronic devices e.g. smartphone, tablet, iPod, laptop and more recently e-watches, are essential for the performance of these practices. Table 4-3 demonstrates

these functional features enabling householders to centrally manage household material and financial resources, 24/7.

Table 4-3: Centralised and 24/7 household business management capacities

Device feature	Practice benefit	Householder comments
Internet access	• Do business on-line rather than in person • Saves time • Overcomes spatial differences	Jenna. *These days it is easy to find an app for some purpose. On-line shopping is an important activity for me because of its ease of access and delivery – greater variety. Another advantage of on-line shopping is that I can do comparative assessment of goods and pricing without having to travel between stores.*
Size and physicality	• Can go anywhere • Does not impact on person e.g. can be carried in a coat pocket	Jenna. *I take my phone everywhere with me and have a wallet that I brought specifically that enables me to store the phone, the rail card and some bank cards and this is all I now need when out and about so don't really need a handbag or something similar.*
On-line availability 24/7 and across devices	• Individual can determine when to initiate the practice	Holly. *Another thing that access 24/7 through mobile devices is contributing to is the condensing of time for decision-making with technology providing quite different definitions of time.*
Photo and voice recording functionality	• Support business and legal transactions e.g. car insurance claims	Eric. *The functions of the phone e.g. camera also enable another use or purpose for them. For example, the functions can be used to take photos of people taking things and if there are car accidents and emergencies. The phone camera enables you to take photos on the spot of the other party and material damage.*

Householders discussed a range of practices in which they used their electronic devices to help financially run their household in this way. Not all households engaged in these practices and there were variations across households as to the extent of that embrace. The most common management practices referred to were: on-line banking, paying invoices, managing investments, loan and credit re-payments, seeking on-line advice such as consumer rights as well as organising services and tradespeople schedules for home maintenance. Many householders stated that this mode of operating and managing their financial affairs will only increase in its intensity into the future, cementing further the importance of electronic devices in their household life. For example, in interviews several householders described how they had recently used their phones to book medical and other appointments on-line and for air-flight boarding passes, practices they see themselves performing more frequently in the future.

4.4.2 Adapting to income and resource shortages

Based on my observations most householders placed a high priority on running their households effectively and according to their needs and means. Their goal was to ensure that they had the

necessary materials and finances, and accordingly, carefully managed their resources. But not all households had the same income and resources to consume goods and services (see Chapters 2 and 3). That purchasing and financial status (economic capital) differed across households was not unexpected as it is supported by the demographic profiles presented in previous chapters. It was also an expected outcome given the criteria used to select the households for the study. Nonetheless, nearly all households endeavoured to acquire and use various types of electronic devices within their household budget limits to enable them to engage in everyday household practices.

On a practical level many households were involved in practices designed to adapt to their income and resource shortages, whether they were real or perceived. These measures took different forms and, in the case of one household with several younger children, the children were provided with a more recent iPod rather than a smartphone as a deliberate strategy by the parents to manage and contain household communication costs. In this instance, costs were lower because the children are unable to use the iPod for making costly phone calls. Further, the iPod model was deliberately chosen because it did not support expensive web-based functions involving data access, although it still allowed texting and emailing. As Simone explained:

> *Why I chose the iPod for the girls compared with the IPhone. It was costs. There is no running up of charges. (Simone)*

Another strategy employed by households to manage finances yet obtain materials goods, such as electronic devices, was handing-on and handing-down of currently in use devices. This practice varied across households as to the source of the handing-on or down. In some situations, devices were received from friends, others from family outside the household and others still being passed from one household member to another. In the later, hand-on devices generally passed from parents or older siblings to children or younger siblings.

Some households had purchased second hand devices, either on-line from overseas or within Australia or through a person to person transaction as a way of managing finances whilst gaining access to desired devices. Cody, a teenager, explained his reasons as follows:

> *The iPad was brought second hand off a friend for $50. It was obtained so I could compete with friends and get a better one and also wanted to be the same as my friends. (Cody)*

Interestingly, this strategy proved not to be all that cost-effective in the end as several householders mentioned they had found the goods to be unreliable, causing them to purchase a new pre-paid cheap smartphone in the end.

Retirement and recirculation of devices is discussed further in Chapter 7.

4.4.3 Shopping and consuming

In Chapter 2, I argued that Australian households are major consumption units in the Australian economy. But as Beck and Beck-Gernsheim (2002) argue, individuals too have become a basic unit of social and economic reproduction and, as a result, each individual household member is now an important consumer in the economy, including for the acquisition of electronic devices, that is transition point one on the material flow cycle. With the advent of portable electronic devices in the last 10-20 years and the associated greater access to the internet, the management of household materials and financial resources is increasingly conducted with electronic devices as tools to support both individual and household consumption practices, independently.

Consequently, many householders spoke about using their devices to conduct on-line shopping and market research. However, it was not a carte blanche approach to on-line shopping and or market research as some householders used their devices to do market research on line in the comfort of their home but then purchased a product physically at a store rather than on line. In other households the reverse process was adopted, conducting market research in a physical store and then purchasing the product on-line.

Clearly, not all householders participated in these practices. The intensity of the practices differed across households ranging from avid users to those who had never purchased anything on line, even though they had undertaken lots of market research. Desktops, laptops, tablets and smartphones were all used for both practices. Younger household members were more inclined to use smartphones for purchasing goods on-line than older members, whose preference was for use of either a laptop or desktop because of the greater control gained through these devices and less likelihood of making a mistake. In terms of gender, women of all age-groups seemed to embrace on-line shopping more than their male household counterparts, reflecting perhaps the same arrangements that women do more in-store shopping than men. Often, however, the deciding factor on whether to use electronic devices for on-line shopping purchases was relative cost and convenience compared with in-store purchasing.

Several householders raised another point regarding device-use for on-line shopping practices. These householders felt that on-line shopping provided a more individualised experience, such as through the chat facility with on-line stores. This compares to shopping in a store, amongst other people and waiting in queues which, whilst a more socially orientated experience, gave one householder justification for on-line grocery shopping. Such feelings and expressions could

be interpreted as supporting Beck and Beck-Gernsheim (2002) individualisation thesis. Electronic devices in combination with the internet are further reinforcing the market-based economy principle of individual needs and wants as the key consumption driver. The performance of internet researching practices for personal development goals are examined in Chapter 6.

To sum up this section, electronic devices are employed in practices that support the effective management of household materials and resources and maintain and or build economic capital conditions. Differences exist across households in the performance of these practices, with the elements of context, knowledge, skills and competencies and materials and infrastructure playing an important role in the configuration of practices. Meanings and understandings were also of influence, especially relating to the necessity to manage resources according to household finances and expectations. Building on Shove, Pantzar and Watson (2012), I argue that the differences between households are also linked to the impact of social inequalities and the ability and willingness of people to act as practice carriers and commit to practices overtime. These in turn are also linked directly to securing income and resources practices and have an important bearing on building social capital discussed in section 4.2 and cultural capital addressed in the next two chapters — the conversion process referred to by Bourdieu (1986) and briefly outlined in Chapter 3, Part Two.

4.5 Conclusion

My analysis in this chapter has demonstrated that portable electronic devices are used to support the building of household social and economic capital through practices that build social capacity, secure adequate income and resources and manage material and financial resources. Whilst all these practices were performed across households there were considerable differences between households (and householders) regarding how the practices were performed, including their performance frequency and how the practice elements were configured. These differences were due to variations in the types of devices available, used and what supporting infrastructure existed within households. All of which highlight the importance of the materials and infrastructure element of practices for shaping differences in how and why practices are performed across households and from day-to-day.

In addition, my findings demonstrate that other practice elements making up the practice entities are important for understanding household social and economic capital building practices. Taking the element of knowledge, skills and competencies first. The level and types of knowledge, skills and competencies embedded within a practice entity, and held by the householder when acting as a carrier whilst a practice is performed, play an important role in

what devices are used and how. So too, does the embedded knowledge and skills manufactured into the functionality of devices. The capacity of households to improve their skills and competencies when using devices was another critical factor in how and why a device is used. This applied too, to software applications supporting or expanding device functionality.

The second element contributing to both differences and similarities across households was the meanings and understandings participants held about their devices and the expectations associated with the importance of building social and economic capital. My analysis indicates that, at the most basic level, the meanings ascribed to practice entities and their performance were consistent across all households. All households described their desire to live a good life, support family members and have enough income and resources. But differences between the households did exist. Using IC System technologies and the meanings households attached to its role and importance in everyday living is one example. In some households, electronic technology was used as only one part of the everyday living equation and experiences and, as such, warranted conscious and considered use. By comparison in other households, electronic device technology was perceived as having no negative household or personal impacts, with devices being used unfettered throughout the twenty-four seven-time clocks, regardless of the age of the user.

Context also has an important role across all households in shaping the configuration of practices supporting social and economic capital. For example, the level of income influenced and informed the number and types of devices used within households. But a household's income and work status also informed the need for and type of portable electronic device in the first place, including households not participating in the paid workforce who were required to use devices for accessing government services such as income support. Household composition is another aspect of context that both shaped practices supporting the building of social and economic capital and the differences across households associated with these practices. This was demonstrated by incidences of households with young or school-aged children actively participating in practices of virtual social connectivity and safety as part of household daily routines compared with households with no children. Contextual factors such as participation in the paid workforce compared with working for oneself, also influenced how and why electronic devices are used in securing income and resources, along with household and family mobility status for building social capacity.

Permeating throughout the analysis is the theme of change, including transitional changes associated with evolving needs and aspirations during the different phases of life. Change was a

commonly occurring feature of social and economic capital building practices including both significant and minor changes over time. Further, change was evident with each of the four elements comprising the practices.

So, what are the implications of these findings for understanding electronic material flows through households? It is unquestionable that portable electronic devices now form a critical aspect of the materials and infrastructure element of practices contributing to the building of social and economic capital. The performance of these practices in everyday life is now difficult or impossible without such devices. Consequently, these circumstances will continue to drive the full spectrum of material flow from acquisition, use, retirement and divestment of electronic devices — all the transition points on the material cycle. Further, building on the planned obsolescence discussion in Chapter 2, the rate and volume of electronic material flows through households is likely to gain even greater momentum.

But as seen from the discussion in this chapter there will be differences in flows between households and even between individuals living within the same household. Further, the electronic device technology employed differs across households and householders. Rather than targeting householders to modify their behaviours, I argue a more beneficial approach would focus on the practices supporting social and economic capital development and how best to alter the configuration of the elements making up these practices within households.

In the next chapter I examine, leisure and entertainment, as an aspect of cultural capital and how and why electronic devices are used in the practices within this form of capital.

5. Cultural capital: Leisure and entertainment

> *For me the real driver for having and using devices is for entertainment — the top priority. (Cody)*
>
> *The phone – this is used mainly for entertainment and games, social media, texting and fun stuff as a procrastination strategy. (Jenna)*

5.1 Introduction

The previous chapter (4) demonstrated how portable electronic devices are used extensively in practices that contribute to social and economic capital outcomes. It further showed that the configuration of the elements comprising those practices frequently differed across households resulting in differences in practice-entities across households and in how and why devices are used. In this chapter, I remain at transition point two of the electronic material flow cycle (Figure 1-2) but move on to explore the leisure and entertainment household living domain identified in Chapter 3 and which aligns with Bourdieu's notion of cultural capital.

Leisure and entertainment activities are an important aspect of everyday Australian household life including watching television, playing sport, listening to music, playing electronic games, travelling and holidaying or reading. Their significance is reflected in the expenditure on these activities by Australian households. For example, in 2009-2010 the average weekly household expenditure on recreation (includes entertainment, leisure and fitness and holidays) was $161 per week, only $60 less than the average weekly expenditure for the same period on the combined costs of housing, water and energy (Australian Securities and Investment Commission (ASIC) 2018).

Broadly, practices falling within the domain of leisure and entertainment support the pursuit by householders of quality of life, well-being and social status objectives. The practices occur deeply within the personal world of householders and their day-to-day experiences of pleasure, satisfaction, enjoyment, enrichment, fun and challenges. Portable electronic devices, especially smartphones have become the quintessential tool in providing spiritual, emotional, social, health and physical states sought by individuals (Wilmer et al 2017).

With the emphasis on personal objectives a different analytical approach is taken in this chapter compared with the previous chapter by assuming that practices supporting leisure and entertainment outcomes are extensively personal in character so the focus shifts to individual householders (the micro-level) rather than the (meso-level) household (Reid et al. 2010; Lane and Gorman-Murray 2011). However, the performance of these practices frequently requires

the concurrence and or interaction of one or more household members as practice carriers and or the external world. One exception is the single person household where the practices reside with the one person and hence, the household and the householder constitute the same social unit. Single person households were involved in this research.

The purpose of this chapter is, therefore, threefold. Firstly, to identify the practices that involve the use of portable electronic devices, supporting the leisure and entertainment outcomes of: improving everyday quality of life and, maximising the enjoyment of travel. Secondly, to understand the configuration of elements constituting these practices and, thirdly, to explore the flow-on effects of unhindered and perpetual performance of one or more practices and the implications of this for electronic device material flows through households.

The chapter commences by examining the outcomes of leisure and entertainment activities in promoting everyday quality of life. Three groups of practices involving the use of portable electronic devices are examined: adapting to household physical environments; handling circumstantial difference; and easing work-life pressures. The configuration of each of these practices is discussed. The next section moves to the outcome area of maximising the enjoyment of travel. Here the practices of alleviating travel mobility constraints; navigating unfamiliar territory; and building capacity for an unfamiliar world are investigated, along with the configuration of each practice. In the last section I explore how householder engagement in these practices generate a ratcheting effect and intensification of practice-performances to a point of obsessiveness and addiction for some participants.

5.2 Improving everyday quality of life

Several householders described their day-to-day lives and personal environment as unmotivating, boring and mundane. They described feeling sometimes weary and impatient, unfocused and devoid of interests in what they were currently doing and or disengaged with their surrounds, including other people. These householders readily seek ways of changing their immediate environment to improve their quality of life, with devices providing the ideal tool for doing so. My data analysis identified householders who were and or had experienced such circumstances, especially feelings of boredom and disengagement. Consequently, these householders had participated in various leisure and entertainment practices on their devices such as watching movies, listening to music and playing games as part of their everyday life.

In this section I address three outcome areas and the practices supporting these outcomes: adapting to household physical environments; handling circumstantial difference; and, easing work-life pressures which support contribute to improving every day quality of life experiences. I

argue that each practice performance involves its own unique use of electronic devices. By participating in these practices, householders can and do create more positive environments in which they live their everyday life. The first of these practices deals specifically with the materials and infrastructure element as the significant factor driving the performance of the practices. The second and third groups of practices centre more on the contextual element as the factor driving practice performance. I begin by discussing adapting to household physical environments.

5.2.1 Adapting to household physical environments

Some, but not all householders, mentioned that the physical arrangements of their dwellings — the materials and infrastructure element — created feelings of boredom. Dwelling size was an important factor for some. This was of interest as I had initially used dwelling size as a household selection criterion (see Chapters 2 and 3) to determine whether dwelling size influenced device-divestment and accumulation practices. This finding, the linking of dwelling size to the boredom and the use of electronic devices by householders to alleviate their boredom was unexpected. Several householders provided examples of how devices were used to overcome the boredom generated by the physical environment of their home.

Take Shawn for example. He was an information technology professional, living with his wife and their two young daughters in a two-bedroom, second floor flat and located in Sydney's western suburbs, a less affluent but culturally diverse area of Sydney. Day-to-day, one bedroom in the flat was used for an office and religious purposes, leaving two areas for living and sleeping. Shawn discussed how his daughters always liked to be entertained, amused and learn new things as part of their daily life — build their cultural capital. The size of the flat, especially its living space, limited the capacity of the girls to play and entertain themselves across a range of practices, leading to the girls frequently becoming bored. In response, the girls downloaded and played games on Shawn's or their mother's smartphone and tablet. As Shawn described:

> *Daughters mainly use devices for games as they have no phones and use such things as drawing applications and games. Children download the games themselves and then use them. (Shawn)*

Shawn's experiences provided other insights into how dwelling size and household physical environments contribute to boredom for younger household members and the subsequent performance of entertainment practices to reduce that boredom. In the case of Shawn, his household's physical environment lacked open space such as a balcony as part of the flat, as well as open space in the immediate neighbourhood of the flat. Furthermore, he argued the neighbourhood was unsafe for the young girls to venture into. The girls, therefore spent most of

their daily lives living inside, except for the older daughter when away from home attending primary school.

In this environment of limited open space and the opportunity to participate in outdoor activities, the girls also engaged in entertainment practices involving drawing on paper. As Shawn indicated there are limits to how far drawing activities can prevent boredom. The small flat size limits many other alternative entertainment activities, thereby encouraging further use of small electronic devices for entertainment. In households with smaller internal spaces small and portable devices are modern and convenient modes of entertainment.

The situation of Shawn is also useful to demonstrate the influence of the meanings and understanding element in the performance of adapting to household physical environment practices. To illustrate, according to Shawn his childhood years were characterised by a strong social and family emphasis on outside play, leisure and entertainment practices in which he willingly participated. He indicated that his childhood physical world was more conducive to outside activities compared with that of his daughters because of perceptions around the lack of safety in the neighbourhood of the flat.

The significance of the meanings and understanding element also played out in the value placed on electronic games compared with self-directed play and recreation. Shawn's younger life was characterised by the popularity and use of electronic devices and software games. As for his daughters, these were commonly played in his family house. But, in contrast to the everyday lives of his two daughters and their immediate household environment, in Shawn's childhood world there was greater emphasis and value placed on a more diversified approach to entertainment and hence overcoming boredom. This involved playing computer games at the local games shop (the use of electronic devices) as well as playing outdoor involving more socially engaged activities such as cricket. This indicates that electronic devices and associated software and games have become not only substitutes for outside or more proactive play activities but that there has been a shift in the meanings attached to the two forms of entertainment; namely, a shift towards inside place-based entertainment activities and the use of electronic devices dominating over outdoor physical activities. A theme consistent with the argument that there is a link between increasing use of electronic devices and games and lack of fitness and poor health amongst the population.

Several other householders discussed how the importance and value of outside play had changed during their lifetime, as a way of keeping occupied and for reducing boredom, leading to the rise of playing electronic-based games. For these householders, young people (including

their own children and grandchildren) are now constantly keeping themselves entertained by playing on electronic devices — or more to the point playing games and using social media, 24/7. Smartphones, because of their size, portability, everyone having one, internet connectedness and multi-functionality, provide young people with the ideal tool for this purpose. I return to this issue later in the chapter when discussing addiction and obsessiveness.

The data did provide a case study that was in sharp contrast to Shawn (above). This is an Adelaide household and despite its physical environment, there was a potential for household members to become bored. In contrast to Shawn's flat, this house was five-bedroom, three-living room plus study, with an outside pool and a large garden with considerable playing space in a relatively affluent suburb. In the home each of the three children had a bedroom to themselves, different living areas were available for the children for either quiet spaces or for watching television. This created an environment with lots of entertainment options where the children were less likely to be constantly bored. Yet electronic devices such as smartphones, iPods, laptops and e-readers were used by the children in this household to keep them occupied. Their use was proactively managed by the parents, especially the mother, with rigid rules associated with when, where, for what and for how long the devices were to be used. In the context of this Adelaide household, there were agreed rules associated with prioritising different leisure and entertainment practices.

My personal observations indicate that this household's physical facilities, especially the garden and outdoor playing space and multiple living areas encouraged the children to have friends constantly around for playing to keep them entertained as well as be socially engaged. Specifically, the Adelaide house provided the children with the scope to access home-facilities that encouraged outdoor and non-electronic device activities such as being in the garden, swimming, basketball and doing craft activities (such as on the day I visited the daughter was tie-dying cloth and making pop-corn with friends) to keep themselves active and entertained. Against this backdrop, entertainment practices involving portable electronic devices were not the predominant approach to overcoming boredom and improving household members' quality of life. Rather, because of the greater value and meaning given to non-electronic device activities electronic device-use was not as great, as say Shawn's household.

The above comparison of Shawn's household with that of the Adelaide household demonstrates that the materials and infrastructure element in the form of household physical environments drives the need for householders to adapt to those environments to ensure they have ongoing quality of life experiences and limit the potential to become bored. Equally, the contextual

element of adapting to household physical environment practices — in the form of internal household rules and protocols — influence whether and to what extent portable electronic devices are used as the mechanism to overcome boredom. Further, as the comparison of both households demonstrates, the meanings element attached to practices involving the use of portable electronic devices and the importance of self-directed and physical activities do influence how boredom is alleviated. Thus, I argue that the configuration of leisure and entertainment practices does differ across householders and households and hence in how practices are performed and the entity to endure. Suggesting that practices contributing to leisure and entertainment (cultural capital) outcomes will directly shape the flow of electronic devices through households, especially the speed and volume at which devices transition into the different stages of the cycle.

To build on how such practices are configured. The above discussion has ignored the knowledge, skills and competencies element associated with the configuration of entertainment and amusement practices and the use of devices for overcoming boredom. A closer examination of these practices indicated that the knowledge, skills and competencies element does have a role in their performance. For example, the Adelaide household appeared to have a broad range of knowledge, skills and competencies across a range of leisure and entertainment activities, covering making popcorn, tie-dying to playing tennis and basketball as well as how to organise people and "things" for the performance of these practices. Additionally, the more expansive knowledge, skills and competencies sets of the Adelaide household enabled members to participate in leisure and entertainment practices in different and more flexible ways, including having the capacity to manage how and when they would participate in leisure and entertainment practices involving the use of electronic devices.

Dwelling aspect and ambience were also a dimension of household physical environments and their links to boredom. This issue is particularly interesting as it is a crossed-over between the materials and infrastructure element (house structure) and the contextual element (household intangible surrounds such as interior design and furnishing arrangements), thereby making it difficult to delineate whether aspect and ambience forms part of the infrastructure or context element.[18] This highlights the strength of social practice theory strength as an analytical tool

[18] In this context dwelling aspect relates to how the dwelling is situated for solar access into the different living-bedroom areas of the house. Ambience, on the other hand relates to the emotive and feelings a person gains from how the internal and immediate external environments are presented and enjoyed.

because of its flexibility in its application and in drawing out the complexities of understanding everyday life. Elements are interrelated rather than having a linear cause and effect.

Several examples were identified that demonstrated the influence of dwelling aspect and ambience in leisure and entertainment practices and their performance to reduce people's boredom. One example related to time of the year and where and when practices were performed within a household. Some householders stated that where and when they undertook leisure and entertainment practices (especially hobbies) was influenced by the ambience of the house which, in turn, was influenced by the seasons of the year. For these householders where their household or a room's ambience did not meet their expectations, they discontinued the practice completely and or shifted to another area in the house to participate in the practice.

Expanding on this point further, many householders explained that they played games, watched movies, engaged in social media, or did craft-based, hand-made hobby activities in various areas of their houses to keep themselves entertained or as leisure practices. Device-type used for the practices was dependent on a device's physical and technical features in combination with the physical infrastructure of the dwelling in its entirety. This influenced, for example, which room within the house a practice was performed.

Practice performance, however, was also closely related to aspect and ambient conditions of the dwelling at a point in time of use. Householders referring to this issue stressed that to fully enjoy their participation in these practices the immediate surrounds in which the practice was performed must also be enjoyable. Often this involved householders moving the site of activity to other areas of the house and or not participating in the practice for a period. In these situations, laptops, tablets and smartphones (and e-readers) because of their high degree of portability without the loss of functionality became a critical tool — householders could continue to enjoy participation in the practices but were able to alter where and when the practices were undertaken and to maximise their enjoyment. I present two examples (below), to illustrate changing activity arrangements relating to aspect and ambience.

> *The temperature of the house and each room influences what device is used and where. For example, because the desktop sits in the spare room we are less likely to use it in the colder months because there is no heating in the room. (Audrey)*

Barbara also referred to solar aspect as well as the benefits gained from the ambience of the garden:

> *When using the laptop and when it is sunny I use it on the dining room table where it is sunny, and I can look out onto the garden. (Barbara)*

Another household physical environment dimension linked to feelings of boredom was the physical isolation of a home, generating loneliness for some householders. The case of one householder stands out. Traci used the electronic devices she had available to be entertained and overcome the boredom she experienced. In her mid-20s, Traci lives with a partner and pre-school daughter and is often at home by herself during the day, without a car and was not involved in the paid workforce or community activities. Consequently, she frequently became bored and sought ways of being entertained. For Traci, using the laptop, with internet connection, was the most important tool that provided her with the scope to be entertain and alleviate her boredom. Watching television was another option but this, according to Traci, was not as effective because the television was unable to provide the diversity of programs to watch or games to play compared with the computer. She stated:

> *Got the computer to occupy me so that I can look up sports results and the weather and research things on the computer — the internet. (Traci)*

5.2.2 Handling circumstantial difference

Data from the household interviews indicated that some householders found themselves spending part of their everyday life in places and institutions away from their household base. Such circumstances related to householders having ongoing medical treatments and or were experiencing one off events, such as childbirth and emergency events and covered attendance or staying at an institution and place for an extended period and or regular periods. These observations support the claim that the physical structural arrangements of these institutions aligned with the materials and infrastructure element. However, at the same time, the existence of the conditions (state) of the householder implies a link to the contextual element, that is medical conditions are a contextual element in practices performed to alleviate boredom in these environments.

These different circumstances created an environment where householders were devoid of their usual home-based leisure and entertainment practices and subsequently found themselves at risk of being bored. For these householders, electronic devices, especially smartphones, tablets and laptops, became the essential tool through which they were able to prevent and or reduce the impact of boredom. It was the portability and multi-functionality of electronic devices that were critical features that enabled the performance of the preferred leisure and entertainment practices of householders whilst away from home.

Three householder case studies are illustrative of practices that supported householders to handle circumstantial difference. The first one addresses ongoing physical and medical conditions, the second explores maternity events and, the last, emergency events.

Ongoing medical and physical conditions. Two householders experienced these conditions. Brett was in his mid-30s and has a medical condition that requires regular and ongoing attendance at hospital. For Brett the hospital is a highly institutionalised place resulting in Brett being away from family and friends, the intimate and known surrounds of his home and his normal everyday living practices. Thus, as Brett explained, to maintain his motivation for further treatment he engages in different entertainment activities whilst at the hospital. The laptop and smartphone are the critical anchors and tools used for this purpose. As he explains:

> *It [the laptop] has proved to be invaluable for me with my medical condition. It provides a lot of support when having medical treatment. It helps overcome the boredom when being treated in hospital — which is often regular. It allows me to watch movies and play games.*
>
> *I use the phone for texting, calling which are the main uses and use texting a lot when I am having treatment as I can text people to occupy myself when having the treatment but those receiving it can access it when it suits them. (Brett)*

The other householder example is Rick who had limited mobility to engage in many physical day-to-day activities and consequently faced the potential for boredom. For Rick, having and using electronic devices enabled him to escape from his mobility limitations and obtain a reasonable quality of life. In addition, electronic device-use gave him the opportunity to give meaning to his life through being able to remain in contact with the outside world as he explains:

> *Because I spend a lot of time at home due to my limited mobility I tend not to move away from home all that much, I am relatively home bound. The introduction of the various electronic devices and computers and the smart television have meant I am able to keep my mind active and work on solving information technology type problems and staying in touch with the world. (Rick)*

For two other householders, boredom emerged in the context of maternity events. It arose because of the often-extended hours associated with the waiting game of labour. But it also arose because of the institutionalised and de-personalised environment of hospitals compared with a woman's normal household and day-to-day living arrangements. Olivia discussed this type of scenario. She was a single parent in her late 20s with a six-week-old baby at the time of the interview. As a single parent there was no partner to provide support to her in the birthing process, although it must be noted that her mother was present. For Olivia the smartphone proved to be an invaluable tool as a means of escaping the boredom of waiting to have the baby in a hospital environment and helped her to cope mentally with labour. As she comments:

> *When in labour I did use phone to play solitaire which helped me get through contractions. (Olivia)*

There were two other slightly different takes on this theme of child birth contributing to personal boredom and hence the need to engage in practices that supported entertainment outcomes. The first relates to feeding a baby. Christina, who was in her mid-30s, raised this issue. Several of her friends had recently had babies and with the arrival of the baby at home they found themselves bored whilst feeding their babies. They subsequently sought ways of keeping themselves entertained or occupied during this time. According to Christina the friends specifically went out and purchased an iPad as a way of handling the issue, with the tablet providing them with a choice of activity whilst feeding the baby. By comparison a hard copy book provided only reading as an entertainment option. With the advent of her baby's birth Christina too has purchased a tablet to keep herself entertained whilst she feeds her baby.

The second theme relates to escaping from boredom whilst at home on maternity leave, prior to having a baby. Here again Christina provides an example. At the time of the interview Christina was on maternity leave from work at home and six weeks away from having a baby. She described how she was frequently bored at home and, to escape this, she used her devices, mostly the smartphone with its associated device-software support systems to entertain herself, engage with others and to fill in time. She stated:

> *Do note that when I finished work there was a considerable increase in the use of Facebook and also instant use of Googling. Hence phone is used a lot more than previously. Use googling both at home and when out, especially when shopping. But I know it is really the applications that I am using rather than the phone per se. (Christina)*

Another type of event experienced by householders that generated boredom was emergencies, linked to specific places. One householder had experienced such an event immediately prior to her interview. In her case Kim, in her early 20s and a full-time tertiary student, there was a science laboratory mishap which caused a build-up of fumes forcing the evacuation of people, including herself from the building. Kim explained that because of the evacuation she had nothing to do, yet was required to stay near the laboratory to know when to return. The evacuation also meant she was isolated from the everyday systems that she would normally use to keep herself occupied. In these circumstances, Kim described how she filled in time (to prevent herself from becoming bored) by engaging with her friends via smartphone and through social media forums such as Facebook and SnapChat. The issue of emergency and risk management was also addressed in the previous chapter (4).

In the next section I explore how electronic devices improve the everyday quality of life experiences of householders by considering how devices contribute to easing work pressures and stresses.

5.2.3 Easing work-life pressures

Work-based stress has been, and continues to be, a major workplace management issue and a community health and welfare issue (Knapp et al. 2011; Levi 2006). From a householders' perspective, several householders referred to their experiences of work-related stress and how they use their portable electronic devices as techniques for coping and managing the issue. Many of these techniques linked to the software capabilities of devices that supported leisure and entertainment practices such as listening to music and following exercise and relaxation instructions. The goal for householders was to improve their everyday quality of life experiences.

Joan provides a useful case study of practices involved in easing work-life stresses and how these exist in terms of the configuration of practice elements. Joan is a professional person in her late 50s, employed in an industry sector that has gone, and continues to go, through significant structural change and uncertainty. In part as a flow on from this, Joan has commenced an involuntary transition to retirement process. In addition, on a day-to-day basis her workload had become very uncertain yet at the same time increased. These experiences and the transition to retirement process created considerable and ongoing stress. For Joan, it became increasingly important for her personal and emotional welfare to be able to cope and manage this stress. All of which is illustrative of the contextual element, but also meanings and understandings as Joan had ascribed negative values to the issue of having unmanaged personal stress levels. Joan found that portable devices, especially her iPod, became an essential tool to assist her live her day-to-day life. She explained thus:

> *I also use the iPod to stream podcasts so I can listen to them as I drive to and from work as a way of de-stressing. This activity has been a real-life saver for me because of the stress I have been under for work.*
>
> *I find that it [iPod] is like a security blanket for me. It is a sleep thing and a calming thing.*

Two other householders spoke about using portable devices to assist with managing workplace stresses. These cases differed slightly to Joan but also highlight the influence of the contextual element in the performance of leisure and entertainment practices. They involved householders listening to music on an iPod and or smartphone on the train or bus as they travelled to and from work — using the travelling opportunity and time to destress from workplace events and issues before entering the realm of the household and vice versa. In another two cases

householders spoke about the use of iPod or smartphones, with ear plugs in the workplace to listen to music to keep them calm and focused, rather than listening to peripheral talk and noises.

5.3 Maximising the enjoyment of travel

Travelling forms an important part of how Australian householders live their day-to-day lives, a circumstance that is grounded in the immigration and urban development objectives discussed in Chapter 2 and is also an important means to build personal and household cultural capital. That is, householders engage in travel to work, school, university, child-care and perform other essential day-to-day living activities such as shopping and attending medical appointments. Householders also engage in travel practices when visiting family and friends, regardless of whether they live close by, somewhere else in Australia and or living overseas in another country. Travelling is also a commonly performed leisure practice by Australian, with, for example, Australian households spending approximately $52 per week on holiday activities (ASIC 2018). Taken from this perspective travel for leisure purposes, clearly falls into practices that contribute to building cultural capital and illustrates the Bourdieu's view that economic capital can be converted into cultural capital through practices.

In the case of the householders involved in this research, all mentioned their enjoyment and keenness for leisure-holiday based travelling, implying that the meanings and understanding element played an important role in the performance of leisure travelling practices. Differences did exist across householders regarding frequency of travel, its purpose, mode, duration and destination. There were also differences across the participation by householders in travel practices based on age, suggesting age is an important contextual element in leisure-based travelling practices. For example, for many householders who were retired or in the age bracket mid-50s to 60s, air travel overseas was relatively common, both for leisure and visiting family and friends. Air travel was also commonly undertaken by householders 35 years and under, with leisure experiences the primary objective. Both instances suggest that disposal income and flexibility and freedom were informing householders' inclination to travel.

In this section I focus on practices that contribute to maximising the enjoyment of travel experiences outcomes rather than specific travel activities. These include alleviating travel mobility constraints; navigating unfamiliar territory; and, building capacity for coping with an unfamiliar environment.

5.3.1 Alleviating travel mobility constraints

As just discussed, householder travel was influenced by the needs of everyday activities. Travel variations also occur with respect to the form of travel used, that is, whether the travel was road-based (including car, bus and tram) train, air, bike and walking. All travel modes were discussed by householders in this research. An analysis of the comments by householders does, however, indicate that all householders felt, either directly or indirectly, that travel does involve entering environments that limit an individual's mobility. That is, travelling inevitably involves being restricted to a confined area with rigid or inflexible boundaries, preventing people from being completely mobile. When using public transport, for example, they are captured in a set space with little autonomy and or scope to alter their circumstances.

Householders do, however, have choices regarding the travel mode in which they wish to travel and hence the space in which they wish to situate themselves. For example, householders can choose to travel to Sydney from Melbourne by car, plane or even train — with the car providing greater personal autonomy and potentially greater space in which to travel compared with the other modes. Regardless of travel mode, most householders stated that travelling is boring and unrelenting, with little scope to change the physical circumstances of their travel. It is tolerated because of the perceived cultural capital benefits at the end of the journey. Clearly this discussion demonstrates how alleviating travel mobility constraints practices are closely linked to the meanings and understanding element — there is considerable emphasis and importance placed on travel for travel sake, the preferred mode of travel, as well as on the considerable value of minimising the potential for boredom.

A common practice amongst many of these householders to minimise boredom and make the journey go faster when travelling was the use of portable electronic devices to support entertainment practices. Further, the use of their personal electronic devices enabled householders to participate in their preferred forms of entertainment, they had greater choice. In fact, many householders stated that specific devices such as tablets and laptops had been purchased to support them in their travel experiences. Furthermore, they had downloaded software, applications and programs onto their devices to use whilst travelling, especially air travel involving long-haul flights for extended periods of time. These measures were designed to make an unpleasant experience relatively pleasant, with devices being used to limit the impact of the physical infrastructure constraints associated with modes of travel with the overall goal of making the trip worthwhile. The devices were the materials and infrastructure element contributing to alleviating travel mobility constraint-practices.

One interesting aspect of the finding that devices are used to assist householders overcome unpleasant aspects of travelling is the subtle role that the element of knowledge, skills and competencies plays in the configuration of the practice. This element is important on several fronts. Firstly, it involves knowing what is involved for the travel and or daily commute and what is involved for the practice to be performed. Secondly, an understanding of electronic device technology (its embedded knowledge and potential capabilities and functionality) is needed so the device can be applied to these circumstances. Thirdly, having the necessary skills and competencies to facilitate the performance of the practices.

Given these observations I therefore argue that alleviating travel mobility constraint practices, which support maximising the enjoyment of travel experiences, reflect a configuration of contextual, meanings and understandings, knowledge, skills and competencies and materials and infrastructure elements. Further the configuration varies across householders as well as across modes of travel. Table 5-1 provides a summary of examples from householders on how they used their devices when travelling across the different activity modes.

5.3.2 Navigating unfamiliar territory

Navigational devices and software, both inbuilt and portable, are used by many households to support their day-to-day driving and commuting practices, including householders finding their way around streets whilst walking. Several householders explicitly mentioned that they use their devices as tools for reducing and or managing the stresses they experienced when undertaking driving and commuting practices. This was especially the case when driving and commuting in unpredictable and unknown traffic and geographic areas. In these scenarios householders used these navigational devices to minimise driving and commuting times and, in the process, reduce personal safety risks. Three examples illustrate this use of devices.

The first example is Marcus. He was a mid-secondary school student, living with his brother and mother, a single parent. Marcus is an active and avid regular soccer player, who is reliant on his mother to drive him to his soccer matches across the Sydney metropolitan areas. Both Marcus and his mother stated that they find this driving, especially travelling to the unknown soccer fields from their home to be extremely stressful. For them, using the navigational features of the smartphone helped to reduce their stress and be more relaxed when they arrived at the soccer match or back at home.

Table 5-1: Entertainment, device types, travelling and activity modes

Travel mode	Householder quote: Using devices for entertainment and motivation	Device used	Activities
Feet and bike	*Got [it, the iPod] in the first place to listen to music and because of its mobility. It is especially useful when out riding as you need to ride in single file on country roads and so can't talk to fellow riders. (Brenda)* *The iPod is used a lot when out walking or bike riding. (Kathleen)* *iPod used for listening to music at the gym because it is small and light weight. Sometimes I use it when cycling for the same reasons. It sits in my pockets easily when active. (Marcus)*	iPod Smartphone e-watch Mobile phone	Road cycling for exercise Jogging for exercise Walking for exercise and pleasure
Road – car, bus and tram	*Kindles are great for travel, especially because you don't need books. (Leslie)* *Today, this [iPod] is mainly used on the bus when travelling to and from university or elsewhere. (Courtney)* *The phone is used for listening to music on the way to school and coming home from school on the bus. (Cody)*	iPod Smartphone e-reader Tablet Laptop Built-in video screens	Travelling and holiday Commuting to leisure activities School bus travelling
Train	*This [Kindle] is pretty much solely used for reading books on the train. It is slightly larger than the phone so easier to read. There are no other uses for the kindle. When travelling though [overseas or elsewhere] do take the kindle for reading and use the phone for other internet needs. (Holly)* *This [iPod] is and was used a lot for listening to music when travelling on the train and other public transport. The iPod is great for blocking out the noise of others. (Leon)*	Smartphone iPod e-reader Tablet Laptop e-watch	To and from work To and from education institution Day-to-day household Travelling Holidaying
Plane	*These devices [e-readers] are super when it comes to flying as you do not need internet connection and you can access a variety of genres at your fingertips depending on your mood at the time. (Leon)* *Each of our e-readers go with us everywhere. They are not bulky like hard copy books and provide a huge choice of books to read. This is especially valuable when travelling. (Leon)* *In the household — everyone now has a smartphone. Wasn't the case when I first moved into the house. Every member of the household now uses a tablet, especially for browsing the net and take it with them when travelling. (Trent)*	iPod e-reader Tablet Laptop Smartphone	Travelling and holidaying Visiting friends and family Work and education

What Marcus mentioned was how the physicality of the smartphone (its small, internet connectivity, portability and ease of use) made it an ideal tool for the non-driving person to use without impacting on the driver's ability to drive safely, again relieving the driver's stress. Especially, as there was no need to stop and check directions and re-enter the main traffic flow, a dangerous action, as would have been the case with a hard copy street directory.

The second example relates to the use of a function-specific navigational device, a Global Positioning Systems devices (GPS) rather than mobile phones to assist with reducing stress levels when obtaining geographical directions. Erica is in her early 20s and lives in regional Victoria. She is an avid bushwalker and horse rider and regularly undertakes daily walking and or jogging so was regularly in unfamiliar areas by herself.

In Erica's case because the GPS device was highly portable and did not impinge on her physical movements she had come to rely on it as a tool to reduce the possibility of getting lost. There was also another benefit. She was able to use the GPS to supplement her mobile phone's navigational capacities which, because of the regional location, was frequently not all that reliable due to mobile reception difficulties. Having the GPS, combined with the phone, helped Erica reduce her stress levels, whilst being able to continue to enjoy her outdoor activities, as she explains:

> *This [GPS device] is used or taken if bushwalking and will always take out when going bushwalking or horse riding because it supplements the reception of the mobile phone. So important for knowing where I am when out in the environment, especially when by myself. (Erica)*

Eric lives in Adelaide and provides the third example of the use of electronic devices, especially a mobile phone, as tools to reduce personal stress levels, again within a context of travel and navigating geographic uncertainties. Eric discussed his extensive reliance on his phone for his personal travel navigational needs, commuting around Adelaide. But he also explained his use of the phone when travelling to and from Adelaide to Melbourne to visit family, and how, once in Melbourne, he used it to navigate around the city of Melbourne rather than relying on a hard copy street directory (which he does not carry or own). For him having this device with its unlimited navigational capacities (regardless of locality) helped reduce the stress on being in unfamiliar street settings.

The same value was also important for Eric in his day-to-day professional work. But it was this value, combined with the phone's other functions of time management, people coordination and compass, that really stood out for Eric as a way of managing stresses of day-to-day living and

being constantly on the move. Eric describes his use of the phone and how it assists with working with clients and identifying a property's orientation:

> *Another use of the phone and which transgresses both personal and professional use is the use of maps and the compass. The compass is very useful because it provides me with information about the orientation of a home to potential buyers — this information is not contained in the house plans.*
>
> *The maps application on the phone is really critical for work as I go from property to property or locate a particular property that may come on the market. This includes using street view as well. The facility also provides me with a route to properties and the likely travel times for this. (Eric)*

5.3.3 Building capacity for an unfamiliar world

Above I explored the use of portable electronic devices as tools to improve quality of life and well-being outcomes for householders when participating in travelling and commuting practices. I continue with this theme but with a different focus by examining how devices assist in building capacity to navigate unfamiliar worlds such as travelling overseas or in unknown territories.

Many householders, regardless of age spoke about this issue and how it generated feelings of stress when travelling. This finding was unexpected as it was assumed that, if householders travel regularly, then stress would not be an issue — it was an acceptable and manageable part of the travel experience. Nonetheless householders did speak about using their electronic devices, especially smartphones and tablets, as tools for coping with this negative aspect of travelling. Strategies adopted included finding and then accessing free internet areas through smartphones and tablets and pre-loading maps and other applications, such as local train timetables, onto devices.

To illustrate. Jenna was her early 20s, a full-time student, living at home and a keen international traveller. She and her partner discussed their experiences when travelling and how using their smartphones and accessing free local internet services reduced their stress when participating in overseas day-to-day travelling activities. As she explained:

> *The devices and data access and options … are important when travelling, especially overseas. Being able to access free Wi-Fi overseas when travelling makes travel less and less stressful. (Jenna)*

A further illustration of this process but one which reflects the case of an older householder is Terrence who is in his early 70s and retired. He too found travel stressful but utilised his tablet's capacity to download maps of the areas in which he was visiting. As a result, he was able to study up on the area prior to visiting and, in combination with the maps, make the experience more predictable and less stressful.

> *I brought the tablet to go overseas so I could load maps. The purpose of this was for safety when travelling overseas and wanted to pre-load maps before going overseas so had them on hand. (Terrence)*

The above illustrates how householders used their devices to minimise stress when travelling and, in the process, achieve positive outcomes. However, one householder presented a contrary position. For Terry, in his early 60s and retired, the use of electronic devices by people when travelling and commuting contributes to another person's stress. To explain, Terry draws on his experiences of train travel prior to the existence of mobile phones. In this period direct social interaction occurred between commuters in a relaxed and friendly manner (Hughes and Mee 2018; Church undated; Bissell 2018 and 2016).

In comparison, today, Terry sees electronic devices, especially phones as enabling people to hold self-centred, personal conversations, which are often aggressive and loud within the realm of public transport. In this environment fellow commuters are unable to take the commute time and space for destressing and relaxing prior to arriving home (as discussed above). He explains as follows:

> *When I travelled on trains in Melbourne during the 1960s and 1970s the whole hour or so on the train was spent engaging with people and having conversations with strangers and social interaction — even if it was just observations. The time on the train was also a wind down time and time for relaxing after work and chill-out time before starting the household activities when I arrived home. So now you don't really have that wind down time before you arrive home because everyone is on their phones or devices, often having tense conversations on the phone or through their device. (Terry)*

This theme of devices contributing to stress for commuters was reinforced by other householders, including by Leon when he states:

> *I have concerns around how people use their mobile phones in public spaces and how you hear everything that is said about people's personal lives. (Leon)*

A final example of device-use for stress reduction linked to travelling is provided by Christina and her partner. They regularly commute by car to and from airports for travel and leisure purposes. By using hire car and or their car to travel they leave an electronic footprint and profile about their travel movements such as where they live, their preferred transport mode for travelling to and from the airport, and the commuting timeframes required to be on time.

Christina went on to explain that this type of footprint, gained through your mobile phone, is great because it has the potential to automatically organise your travel-commuting arrangements for you — it is easy to just go with having this process work for you. Consequently, it removes a lot of the stress associated with day-to-day airport commuting as she explains in

the quote below. On the flip side, Christina argued that this takes away a person's autonomy to tailor commuting arrangements that are most suitable and relevant for your circumstances such as the number of people travelling and the time of day of the travel.

> *Devices allow for decision making on the run and sometimes the trigger is not from your own initiative. For example, I can now get messages and prompts from the likes of Google and Apple when I am taking a fight and the messaging suggests you should be taking a taxi and that you should allow XX amount of time to get to the airport. All without any prompting from me. (Christina)*

To re-cap on the analysis in this section. It demonstrates that practices are performed to support the building of capacity to handle unfamiliar worlds and, at the same time, build cultural capital by maximising the enjoyment of travel experiences. Performance of these practices involve the configuration of the materials and infrastructure element dimensions of electronic devices as the physical structures of the mode of travel; the contextual element, the spatial and time arrangements associated with the mode of travel and age of householder; the meanings and understandings element including the desire to travel as well as limit its negative impacts; and, the knowledge, skills and competencies element such as ability to use devices and understand the requirements of travelling in different and unknown locations.

The above analysis also demonstrates that the relative influence of each practice elements in a practice configuration varies and that the configuration of the elements across each practice performance varies from performance to performance and across time and place. This finding is consistent across sections 5.2 and 5.3. Table 5-2 (following) summarises practices involved in leisure and entertainment outcomes at transition point two and the use phase of the material cycle.

Table 5-2: Leisure and entertainment household living domain, outcomes sought and associated practices

Household living domain: Leisure and entertainment	
Outcomes	**Practices**
Maximise everyday quality of life experiences for all household members	• Adapting to the household physical environment • Handling circumstantial difference • Easing work-life pressures
Maximise enjoyment of the travel experience	• Alleviating travel mobility constraints • Navigating unfamiliar territory • Building capacity for an unfamiliar world

5.4 Intensifying and ratcheting-up of practices

The management of boredom and stress through participation in leisure and entertainment described in the previous two sections can lead to unexpected side or flow-on-effects. There can be an increased ramping up and dependency on the practices or in Shoves' (2003) terms a ratcheting up of practices and the materials element included in the practices over time. For some householders this ultimately led to the performance of the practices in an obsessive and addictive manner and an increasing dependency on the use of portable electronic devices, software programs, applications and the internet. Activities pursued included playing games, using social media, especially Facebook, watching YouTube and searching the internet. All of which have implications for the rate and volume of device-flows through households.

Based on my analysis of the comments by householders and my personal observations, many householders appeared to be obsessed and addicted to leisure and entertainment practices involving the use of portable electronic devices, especially those enabled by smartphone technology. Clearly there were differences across householders around the performance of these practices, especially frequency and intensity, along with the types of devices used and the practices performed. Several case studies are illustrative here and reflect different household types, householder age groups, activity type and how the activities in question impacted on other household practices such as sleeping and eating meals and, socialising directly and in person with other household members.

I begin with the case study of Joan. Joan is a person in her mid-50s who described her addiction and obsession (in the quote below) with trawling the internet for gathering information as well as using social media for entertainment purposes.

> *I use this [smartphone compared with other devices] a lot for searching the web. For example, I love using www.stumbleupon searches and it brings up pages of interest. This becomes a bit additive, especially when using this website and I spend hours just cruising around.*
>
> *Found that before retiring I didn't really have any time for participating in social media activities. Now I have become a lot more obsessive and have heaps of connections. Even so, I have just deleted over 300 so called friends from my Facebook account. (Joan)*

The next case is provided by Cody, a person in his mid-teens, highlighting a significant age difference compared with Joan. Cody in his description states that he is a keen game player, and uses different devices, especially the gaming box and that, because of his obsession with playing games, it has impacted on how he lives his day-to-day life. As he explains here:

> *My sleep habits have changed a lot. Now spend a lot of time at night playing games on line so am not sleeping as much as I probably should. And at weekends I tend to*

> *play games well into the night and then sleep well into the morning. At this stage I think I tend to focus more on entertainment rather than school work, but I will need to learn how to juggle school work and my obsession with games. I have reduced the amount of uploading of movies …(Cody)*

Cody's obsession with his games and the impact of this on his and other members of the household day-to-day living is highlighted by Cody's mother, Darlene. She commented:

> *Cody only comes out of the bedroom for meals and at weekends we hardly see him.*

Joan's and Cody's examples clearly highlight some differences between the two. Joan is semi-retired and therefore has less of a structured work-day or week, providing her with more flexibility to surf the internet in an uninterrupted manner. Her obsessions resided with surfing the internet and social media and in the use of her smartphone. By comparison Cody's obsession plays out in an environment where he is virtually oblivious to the time of day and is heavily focused on games, entertainment and watching movies. Social media was a low priority for him.

Cody's obsession and addiction to games and entertainment had parallels with Erika's grandson. The grandson, aged around 20-25 years, lives in Melbourne and works full-time (but not in the IT sector). According to his grandmother, he dedicates nearly all his non-working hours to game playing. Like Cody his preference was for the use of a desktop or game box for game playing and both appeared to spend all their game playing time within their bedrooms. In both cases, the bedrooms were jammed packed with equipment and limited floor area for moving around — yet other areas of the house were uncluttered. This suggests that a consequence of an obsession and addiction to playing games is the emergence of another practice — bedroom cluttering as illustrated in Figure 5-1 below.

The discussion above of the obsession and addictive habits of Joan, Cody and Erika's grandson demonstrates four factors underlying the differences between Joan on the one hand and Cody and Erika's grandson on the other: age; gender; time availability and personal responsibilities; and, preferred leisure and entertainment activities. From a social practice perspective these factors are contextual differences, that is they fall within the practice element, context.

A further example of obsessiveness and addiction taps into the experiences of Lester, a retired person in his mid-80s. He discussed how he enjoys the relaxation and enjoyment from engaging in entertainment and leisure practices and the use of portable electronic devices for this purpose. But he also stated that he was very conscious about how these practices do take over his normal routines as he explains in the quote below.

I am very conscious of the additive nature of using the devices and the time factor and time wastage factor, so I don't want to become obsessive. There is always tensions between using the devices and doing other things. (Lester)

Lester's experiences are, to some extent, reminiscent of Joan's (discussed above) because both fall into the retirement demographic bracket. Accordingly, both have greater scope to subconsciously engage in entertainment practices in an unmanaged way.

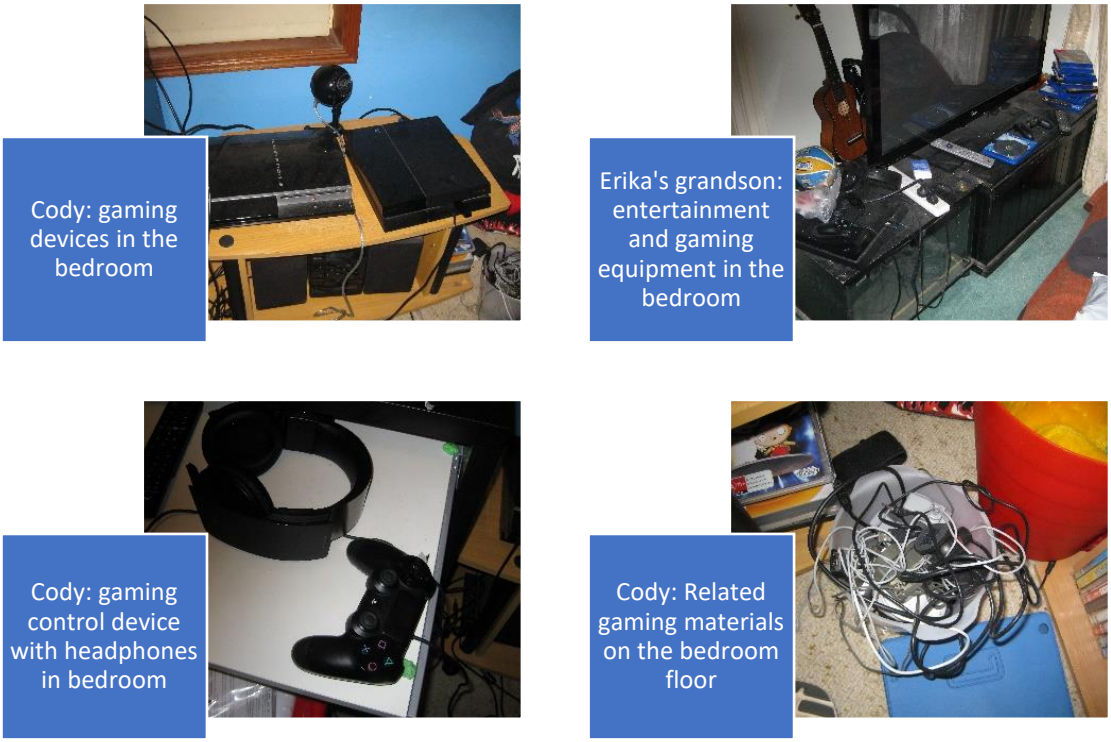


Figure 5-1: Cluttering of electronic game devices and equipment in bedrooms

The last example is based on the experiences of Michelle who is in her mid-40s, a single parent in the full-time work force with two sons in secondary school and lives in Sydney. In general, Michelle considered herself not a big user of electronic devices and certainly not in terms of engaging in entertainment and leisure practices, obsessively. Yet she did discuss that she, like many people, has become obsessed with playing games on mobile phones as she outlines in her description of the Candy Crush game below:

Phone is used for voice calls but have now become a bit addicted to playing games on the phone such as Candy Crush. (Michelle)

These scenarios and examples of obsessiveness and addiction were not all that surprising as practices involving electronic devices, such as smartphones, have been the centre of considerable research in the last five to ten years. Much of this literature is grounded in social marketing and or behavioural sciences and, as such, focuses on the behaviours of people rather

than the interaction between electronic devices and the addictive practices performed. Consequently, it provides limited insights into understanding the linkages between devices, practices and addiction and how these interact to increase the demand for and further drive the consumption of electronic devices and the material flows through households. In contrast I argue that obsession and addiction practices drive an ever-increasing need for newer and different devices to support leisure and entertainment software and applications. By implication there is an increasing rate of device retirement, thereby driving electronic material inflows and outflows in households (Figure 1-2) and which is inconsistent with the principles and concepts of industrial ecology and circular economy discussed in Chapter 1 and 3. I return to this issue in Chapter 7.

In an interesting twist and contrast to the above accounts of personal obsession and addiction to leisure and entertainment practices, is a household with three children, ranging in ages from 10 to 14 years. This household provides insights into how the meanings and understandings element influences the preparedness of householders to engage in leisure and entertainment practices involving devices in the first place, thereby leading to the potential for subsequent obsessive and addictive practices. In this household, the mother placed considerable meanings and value on promoting the children's health and well-being and their development as well-rounded people. For her, this involved discouraging the children from becoming obsessed with all things electronic as she explains:

> *The time for use of the devices is not at night and I am keen to limit electronic device time because it has the potential to limit time for other activities. It becomes like junk food for the brain. Electronics are like lollies to children. Electronics become all compelling — leaving little time for other activities and people and learning activities. With electronic binging the children never really learn how to engage their mind or work through the structure and or logic of things such as books. The devices provide instant gratification. (Leslie)*

A Melbourne family — involving four young people demonstrated similar meanings and values in that the use of devices for leisure and entertainment participation was managed by the parents to limit the performances of the practices, as well as where the practices were performed. As a consequence, it is suggested that electronic material flows through these two households, arising from leisure and entertainment practices and possible obsession and addiction practices, would be lower as the need for the latest and greatest capacity devices would be less.

A second issue to emerge from the findings in the above sections was the increasing need for, and reliance on, more advanced hard and soft information-communication infrastructure, thereby highlighting an increasing dominance of the materials and infrastructure element,

including how it changes over time. This played out in the form of an increasing reliance on the latest technology across devices, software systems, having the latest and trendiest applications and the scope to use converged and integrated technologies and an ever-increasing data and internet capacity (see Chapter 2 for a more detailed discussion of convergence and integrated electronic technologies).

Several householders spoke about this increasing reliance and dominance and how they in recent years are engaging in multi-media entertainment practices as part of their everyday life — in fact this method of entertainment was their preferred entertainment medium rather than free to air television. It enabled them to streamline their entertainment experiences within the home through a single device, including smartphones, and to have greater entertainment choices. However, these arrangements were dependent on having sufficient data allowances to live-stream programs and movies and or play same-time group games from anywhere, including outside of their house. According to Jenna and for other householders where all these technological factors align, there is the potential for obsessiveness and addiction to creep in. She explained so:

> *I feel that relative to Australia data allowances are so cheap in most countries. In these countries they don't really worry about the costs of phones so much but what is important is being able to get the data and the speed of access. In Australia data costs are expensive as is the device costs. This is changing slowly. For example, in my marketing class at university Optus gave a presentation and they explained how they are changing their plans because of the arrival of things such as Netflix so that people can binge on watching television programs. This requires a change in data limits and access which is what Optus is targeting. This wraps into how many people like to watch one television show consecutively and this requires more data allowances but at the end of the day the way I, like most people, prefer to watch a television series is a matter of personal choice. (Jenna)*

5.5 Conclusion

The analysis in this chapter has demonstrated how householders engage in different leisure and entertainment practices to improve their quality of life and well-being and build personal and household cultural capital. Portable electronic devices are the critical enabling tool for these practices. One set of practices enabled householders to overcome boredom and lack of motivation due to household physical environments; circumstantial difference; and work-life pressures. A different set of practices enabled householders to alleviate travel mobility constraints; navigating unfamiliar territory; and, build capacity to navigate unfamiliar worlds. Regardless of which practice set, the practices reflect a configuration of the four practice elements that is unique to each practice performance. Variations existed across a practice performance because of the relative influence of each of the practice elements.

Based on this analysis the performance of leisure and entertainment practices resulted in some householders developing a dependency on the practices and devices. This had the potential to generate flow-on practices of obsession and addiction in some circumstances amongst householders and, ultimately, a dependency on portable electronic devices. A number of questions are raised including what is the dependency required on a practice and or device before it becomes obsessive and addictive? How does this vary across householders? What are the implications of this for the movement of electronic devices from one transition point to another (or vice versa) in the material flow through households?

As signalled above practices within the domain of leisure and entertainment were performed across all households. But the analysis also demonstrated that there were considerable differences between householders regarding what practices were performed, why they were performed and how they were performed, including the frequency and intensity of the practice performance.

In part these differences were linked to the types of devices used such as a smartphones and tablets with their high degree of portability compared with desktop computers that are less portable but have larger screens. But other materials and infrastructure aspects help to explain differences across households. One of which is dwelling type of the householders including its physical size and scale. In other scenarios it was the physical mode of travel that shaped differences across householders. For example, not all householders used planes as their mode of travel for leisure activities, making the need for small devices less necessary. The materials and infrastructure element is, therefore, important for the configuration of leisure and entertainment practice entities, but it also helps to account for differences in the performance of the practices between householders.

Three other elements also constituted leisure and entertainment practices helping us understand householders' portable electronic device-use. Taking the knowledge, skills and competencies element first. The level and types of knowledge, skills and competencies embedded within a leisure or entertainment practice entity (through previous performances) and held by the householder as a carrier of a practice, influences what devices are used, where, when and how. For example, a tablet has aspects of smartphone and laptop technologies embedded within, giving it portability and functional/programmable strengths for householders. Nevertheless, the householders who used this device whilst travelling had a prior knowledge, skills and competencies set that enabled them to identify the benefits of the device to begin with and, hence the ability to use it for specific circumstances e.g. air travel or navigating

unknown streets. The analysis also indicated that the prior knowledge and skills sets of householders play a role in shaping and determining the leisure and entertainment practices that are performed initially.

Additionally, it was clear that householders' knowledge, skills and competencies sets are, in the main, dynamic and change over time — becoming more diverse and or sophisticated in device-use, device-applications as well as different practice-applications into the future. Where new derivatives of practices emerge, the knowledge, skills and competencies set of householders must adjust, which often requires re-starting from a lower skills base and building up to a higher skill set. This suggests that the dynamics of knowledge, skills and competencies associated with electronic device use over time is a contributor to the flow of electronic materials into and through households.

The second element contributing to both differences and similarities across householders was meanings and understandings. As I have argued most householders, either directly or indirectly, signalled their desire to improve their quality of life, well-being and social status (cultural capital stocks) and most were using portable electronic devices in some way to achieve this objective. But there were major differences between householders around the meanings and understandings linked to everyday leisure and entertainment practices involving the use of portable electronic devices. For instance, several householders actively discouraged the use of electronic devices for entertainment, especially by younger members of their household. In comparison other householders readily accepted the use of electronic device technologies in a carte-blanche way, leading to a situation for some householders to become obsessive and addictive users of the technologies.

Context also played an important role in shaping the configuration of practices supporting leisure and entertainment outcomes. For example, the level of householder income, age, gender and time availability influenced what practices were engaged with, when and how often. Further, it influenced where specific practices were performed. As I demonstrated, for example, householders in the age bracket 55 plus and around the mid-20s to early 30s were more likely to engage in overseas air and travel leisure practices compared with other demographic groups. But here again income and time availability play an important part in what practices are performed (and hence device-use) as some householders appeared to be less financially able to undertake regular overseas travel compared with others. Context played out too through the influence of medical and other events and the need for electronic device-use to inform the making of travel mode and associated spatial arrangements.

Given these findings, portable electronic devices are clearly central to the performance of practices within the domain of leisure and entertainment and building cultural capital. As such the interaction between electronic devices and these practices does drive the material flow of devices from acquisition, to use to retirement to divestment and the reverse process in households. This material flow will, however, differ between households and householders because of the differences in practices across households and householders, indicating that a one-size fits all approach to electronic device capture is unlikely to succeed from a sustainability perspective. Instead, I argue a more effective approach would be to explore mechanisms that would encourage the re-configuration of practices supporting leisure and entertainment outcomes that are driving the need for newer and different electronic devices.

6. Cultural capital: Education, learning and social awareness

> *I also use the laptop for YouTube watching. Mainly for education and learning purposes. For example, for languages, exercises and hobbies. Currently I am learning Italian and how to do water painting. (Joan)*
>
> *One of the things I find great about devices is how you can access multiple forms of information off the internet. (Dean)*

6.1 Introduction

The two previous chapters explored how and why portable electronic devices are used in practices that support the enhancement of social and economic capitals, and cultural capital, especially leisure and entertainment. This chapter explores device-use (transition point two in Figure 1-2) in practices involved in building cultural capital — specifically knowledge, identity and social status (Bourdieu 1986). I document how and why portable electronic devices are used and specifically focus on three cultural capital building areas institutional education; day-to-day learning; and, awareness and social status. I show that the meanings and understandings element is critical in the configuration of practices supporting the achievement of cultural capital outcomes.

The chapter commences by examining the area of institutional education as a way of building personal knowledge which as Bourdieu argues can be converted into economic capital in the future. Four practice sets are considered, namely, participation in formalised learning; balancing learning and everyday commitments; institutional locking-in of devices; and, post-study device use. Section two shifts from the formalised and structured educational learning practices to the area of day-to-day learning practices and how electronic devices are used. Two sets of day-to-day practices are examined: on-line researching and information gathering; and, working with hobbies.

In the last section my analysis moves to exploring how devices enable householders to become aware of their place in everyday life and in so doing build their awareness, social standing and status in society and amongst household members. Three practices areas are examined: improving self-awareness; resisting social pressures; and enhancing social status. The chapter predominantly focuses on Bourdieu's notion of cultural capital but acknowledges his argument that social and economic capital are readily converted into cultural capital and vice versa through practices such as those discussed in this chapter. What this conversion process frequently involves is the movement along the material flow cycle in households as new devices are acquired and existing ones retired.

6.2 Institutional education

In Australia there are four levels of government-funded institutional education: kindergarten and or pre-school; primary school; secondary/college school; and, higher education covering tertiary education and vocational training. Schooling at primary level and up to the age of 15 years is compulsory, with age open-ended in higher education. This section specifically examines how devices are used in institutional education learning practices, across institutional education levels. Four sets of practices are addressed: formalised learning participation; balancing learning and everyday commitments; institutional locking-in of devices; and, post-study device use.

6.2.1 Formalised learning participation

Participation in formalised learning practices was a common occurrence amongst many of the householders involved in this research, reflecting the considerable emphasis that households and householders place on these practices. That is, there was a drive to enhance cultural capital levels. This was apparent amongst many households with children. Parents in these households referred to the need for their children to complete formalised education, resulting in the obtainment of a university qualification and or trade certificate. Education was seen to provide a pathway for their children to secure a steady income in the future and achieve a successful career, thus providing a clear demonstration of the influence of the meanings and understandings element in the performance of these learning practices.

There were differences between the households regarding the number of members currently attending formalised learning institutions, levels of educational attainment across householders and those no longer directly involved in formal learning practices, such as those now in the workforce or retired. There were also considerable differences in the ages of householders participating in formalised learning, with several householders falling into the four to five-year old age bracket and attending pre-school.[19] At the other extreme was a householder in her late 50s undertaking a doctorate degree whilst working full-time. The largest age group by far was the 12 to 21 year-olds. Table 6-1 is a breakdown of householders participating in formalised education practices across levels.

Regardless of the demographic factors, portable electronic devices were, in the most part, a critical materials and infrastructure element in formalised learning practices. Here, too, differences existed across householders with respect to the use of devices, both in terms of device-type and level of participation. For example, Shawn's daughter in her first year of primary

[19] These householders were attending special education pre-schools.

school was not required to possess a device for school learning. Having one at home did, however, provide advantages, as Shawn explains:

> *The older daughter [at primary school] uses the iPad to log onto school to access the word programs but as yet the school has not demanded a computer at home. The library at school has computers for the students to use. (Shawn)*

Table 6-1: Numbers of householders participating in formalised education practices

Participation in formalised education across level	No. of householders
Pre-school	Nil
Primary school	10
Secondary school	10
Tertiary - university	7
Skills based training institution	Nil
Home school	1
Special school	2 (pre-school level)

Most children attending primary school did have mobile phones or iPod, which were provided by the parents to ensure personal safety (Chapter 4) and not as a requirement by the school. By far, the most common device-type used in formalised learning practices, regardless of level, were laptops and to a lesser extent tablets. This was especially the case for secondary and or tertiary-level participation in formalised learning — with tertiary students frequently using both a laptop and tablet and to a lesser extent desktops.

In some cases, ownership arrangements were due to the school having formal requirements that students have and supply their own devices. In other cases, where schools had a requirement that students have devices, some schools facilitated this by establishing a scheme for students to lease devices for the duration of their education, or until the device was replaced by the school as a means of reducing costs for students. In this scenario, devices remained the responsibility of the school. Software and internet access and use were monitored by schools in most cases. I pick-up on this theme again in section 6.2.3. Regardless of the acquisition method, formalised learning practices were a contributor to the flow of electronic materials coming into households, with outflow either directly a responsibility of the household or the educational institution in the case of school leasehold arrangements. The issue of device retirement and divestment is addressed fully in the next chapter.

Interestingly, it is difficult to determine whether these arrangements reflected the gradual adoption of electronic devices into the formal education system, starting at the higher levels and

then filtering down to the lower levels of formalised learning. If this is the case then, at some point, the flow of devices into households should, start to slow down. Rogers (2003) theory of technology adoption argues that the current movement of devices is an aberration that reflects the sharp rising adoption curve, before plateauing off.

However, I argue a plateauing effect is unlikely for three key reasons. Firstly, student populations move through the schooling system, resulting in each new wave of students requiring their own devices and which are in addition to the number of devices current students already own. Secondly, electronic device technology is designed to be constantly upgraded, both hard and soft technology. (See Chapter 2 for a discussion on built-in obsolescence and Chapter 7 for device-retirement implications.) Thirdly, formalised learning practices change over time. Taken together, these aspects indicate that formalised learning practices are likely to continue to contribute to the flow of devices into households and, ultimately, increase the need to divest the devices. In this context, I found that formalised learning involves the integration of electronic devices, as both learning and access tools, with access to the internet and enough data and speed capacity critical for this learning environment. The combined importance of these aspects is picked up in the comments by Jenna, a tertiary student:

> *Family also has Apple TV that connects to the main TV but is very slow because of internet connection – we are at the end of the ADSL the line! Because of this when I need to download material for university or other reasons I go around to Carlos [boyfriend's] place as even though just around the corner so to speak he has better and faster connection. (Jenna)*

Internet connection and data capacity were also important material factors for households with secondary students. Many of these students, like tertiary students, required out-of-school hours access to school systems for learning materials and assignment submissions.

6.2.2 Balancing learning and everyday commitments

Householders participating in formalised learning practices at the tertiary level described their need to manage their learning tasks, such as assessments with day-to-day living tasks and commitments. This balancing act frequently coincided with part-time work activities and managing all the responsibilities this entailed. In such scenarios, electronic devices became the essential tool for these householders to juggle such competing demands.

From a formalised learning perspective, the key features of portable electronic devices that supported the practices and provided householders with the capacity to manage conflicting needs were device multi-functionality, processing power relative to size, multiple software programs and applications, portability and wireless internet capabilities. Some of the thoughts of

higher education householders on the value of these device features are presented in Table 6-2 below.

Tertiary householders used devices extensively for completing assessment tasks, submitting assessments across 24/7 timeframes, conducting on-line library searching, accessing other support materials such as maps, communicating with student colleagues for assignment purposes and interacting remotely with lecturers and tutors. Portable electronic devices, including smartphones, tablets, laptops, desktops and more recently e-watches, enabled the performance of these practices in a streamlined manner relative to conducting in-person communication or document exchange. Jenna provides an example of this in the use of her laptop at university to deliver her assessment tasks and on time:

> *For me this [laptop not breaking down] is particularly important as I need to do assignments every week that go towards the final mark and if not submitted for whatever reason then I lose marks. (Jenna)*

Table 6-2: Value of electronic devices and their features for higher education

Device features	Higher education householder comment
• **Visual** • **Ergonomics** • **Processing capacity**	*Its [laptop] main purpose now is for intensive research and to do work/professional activities and for university work. Find that the laptop provides greater space and visual capacity along with power to do sufficient crunching needed. (Carlos)*
• **Portability** • **Flexibility and choice in use across time and locality** • **Software options**	*This [laptop] was acquired whilst studying, essentially because of its portability as it provided flexibility for when to use and where to use and could take to and from classes. I brought this myself and used the college's Wi-Fi and then also at home. It was a whole lot easier than relying on desktop access at university and then using desktop at home. It provided the opportunity to do homework on train and also was a great asset when needing to do slide shows for college studies. (Olivia)*
• **Portability** • **Simplicity of use**	*It [IPad] was especially great for university as it was very light in weight and highly portable and did pretty much all the functions of a laptop but was also very simple to use and not much fuss involved. (Joel)*
• **Design channels concentration**	*Use the desktop for doing work and work type things and for more serious things e.g. assignments for study and for work research activities and for research for studies. If I ever have to sit-down and concentrate, then the desktop is the best tool for me to do this. (Holly)*

Additionally, electronic devices provide higher education householders with a high degree of flexibility and autonomy to operate as self-contained units outside the influence of the household, regardless of whether they are on or off campus, the time of day or academic subject area. This further enhanced the ability of these householders to straddle educational, inter-academic disciplinary demands, personal and social needs, work and other activity pressures and priorities whilst still delivering the required assessment goods.

Based on interview data from both tertiary and secondary student householders, the need to juggle complex life-style and educational practices differed between the two levels. This suggests that the level of formalised learning activities may influence the flow of electronic materials within households. Table 6-3 provides a comparison of device-uses between secondary and higher education practices.

Table 6-3: Differences in device use across secondary and higher education levels

Device use factors	Secondary-level	Higher education level
Age range	12-18 years	18 years-late 50s
Devices	Principally laptops	Laptops Tablets Smartphones Cameras
Major uses — activities	Homework In class activities Communication	Course specific skills e.g. graphics Full gamut of activities
Where used	School Home	Campus — not solely in lecture room Home Anywhere and everywhere
Monitoring of device use — school, home and higher education organisation	Yes, parent and or guardian School	No
Rationale for attending	Compulsory	Choice
Working	No — not in case studies interviewed	Yes, all
Self-management of device financials and lifestyle	No	Yes

Several inferences are possible from the above table. Firstly, higher education householders (mostly university students) actively use multiple devices for a broader range of activities compared with secondary school householders. These students rely mostly on laptops.[20] The second, higher education householders operate more autonomously of household influences and conditions than secondary level householders with respect to how they use their devices.

[20] This situation applied to these students at the time of interviews conducted in 2015. The expectation is that they have probably altered in the last three years or so with smartphones and tablets playing a greater role.

For example, they are not subjected to household rules around the use of their electronic devices, such as where they are used and direct monitoring by parents and guardians as was the case for secondary school students. Nor are they monitored by the learning organisation. Marcus, a secondary school householder, explains:

> *This [laptop] was acquired as a requirement for school. It is school owned including all the software and is monitored by the school. (Marcus)*

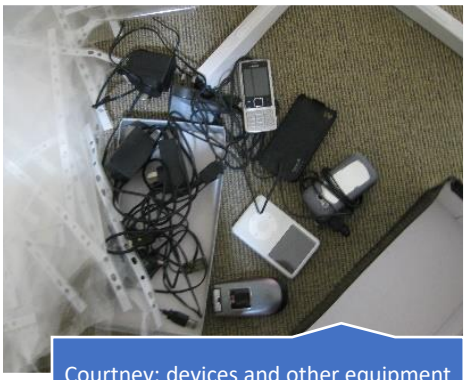
A third inference is that there are differences between secondary-level schooling householders and their higher education counterparts in terms of why they are participating in formalised learning and hence having a reliance on electronic devices. For secondary school householders, attendance at the educational institutions is compulsory. In contrast, higher education householders are attending by choice, albeit with parental influence in many cases.

The fourth inference is that higher education householders were participating in either full-time or part-time paid work whilst studying. In comparison secondary school householders were less active in the paid workforce. Finally, higher education householders have more responsibilities for the management of their educational learning activities and financial management of their lives and devices relative to secondary school householders.

What do these inferences imply for the use of portable electronic devices by householders in education practices and more specifically from a social practice perspective? Higher education students appear to lead more hectic and complicated day-to-day lives, living as independent adults (even if living at home still) and have responsibility for their own lives compared with their secondary school counterparts. Consequently, institutional learning levels do have implications for understanding the electronic material flows through households. Participation in formalised learning practices, in a formalised institution, demands individual use of portable electronic devices. This dependency on devices, including multiple devices, is expected to increase in the future. Participation in education builds the numbers of new devices within households, the retirement of other devices and the need to divest and dispose electronic devices. These consequences demonstrate a clear inter-relationship between contextual and the materials and infrastructure elements, both of which are underpinned by the value placed on institutional learning practices (meanings and understandings element) and the achievement of cultural capital outcomes.

A further question then arises, namely how are or how do households manage retired devices used by individuals, post their formalised learning? Based on my observations it was common to find retired devices of household members, who had or were participating in formalised learning

practices, stockpiled in areas of a household not frequently used by members as Figure 6-1 below illustrates. I address the issue of device retirement and divestment in greater detail in the next chapter (7).



Courtney: devices and other equipment once used for tertiary education and now stored in the attic

Courtney: other devices used for tertiary education, parked in a drawer

Trent: laptop and desktop once used by fellow housemate for tertiary studies but now sitting idle

Trent: laptop and printer, once key devices for tertiary studies and no longer the preferred equipment

Figure 6-1: Electronic devices and equipment retired from use during and or after completion of formalised education participation

6.2.3 Institutional locking-in of devices

The information presented above argued that higher education householders embraced portable electronic devices as tools to keep their day-to-day lives on track — that is, to navigate their day-to-day living commitments with the demands of participating in education activities. They, in effect, set the agenda for electronic device use in education, especially those householders participating in higher education, and or set the agenda for meshing educational and personal objectives through devices.

However, based on my analysis of the interview data a reverse scenario also applies with students having no choice about whether they used such devices. That is, entire educational systems, including learning delivery models and administrative arrangements, are all structured

and entrenched in a system and process where portable electronic devices are the operational centre piece. Householders participating in formal educational activities — especially secondary and higher education — are required to undertake all their educational activities using portable electronic devices and use the supporting information technology systems if they are to succeed. They have little, if any power, to influence these arrangements and processes and hence the underlying methodology of device use. This demonstrates the dominant influence of external organisation factors shaping learning and education practices. That is, the institutions are driving how householders engage in learning and educational practices to achieve their objectives, in much the same way as IC System industry players dictate to householders how they are to engage in information-communication practices (Chapter 2).

To illustrate how the "power" of organisations dictate to householders about how they use devices, many households with secondary level students discussed how the school made it compulsory for students to have laptops to access their lessons. This demanded students to use laptops and the internet as the platform through which learning activities were completed. As Carson, a secondary school householder describes:

> *I also have apps to do homework if need to on the phone. I use the pages app (a software like word) which enables me to save docs to Cloud storage and then to interact with it. This means I can use the phone to seek files from storage when I need them and from anywhere. Mobile phone is like a laptop and desktop. (Carson)*

For higher education householders the pressure to have and use portable electronic devices was subtle, less overt and not directly imposed by the educational organisation onto the student, as Kathleen explains, based on the experiences of her children currently attending university:

> *The older ones [members of the household] are not big users of Facebook but joined because it was a necessity for university, i.e. a lot of information is delivered via Facebook. They listen to lectures on-line. (Kathleen)*

In this context, educational organisations operate on the assumption that students will supply their own devices rather than relying on and using campus-based computers. As some householders explained, these computers were too unreliable and overcrowded, thereby compounding the pressure to use their own device.

One issue to emerge from the data regarding the use of portable electronic devices for educational purposes, and the interface of this with educational organisations, is the extent of the encroachment and embedding of information technology and third-party software and applications providers into mainstream educational organisations. By implication individual education organisations are losing their ability to influence the learning process for their

students. Again, this reinforces the notion that for students, their use of devices (and hence the switch to new devices and disposal of old ones) is largely determined by other players. Three householders discussed how external factors are now shaping the delivery of educational activities and, hence, how students need to use their electronic devices (aspects of this were discussed in Chapter 2, too). Their views on the impact of the external arrangement on students are presented in Table 6-4 below.

Table 6-4: Householders comments on how external factors are shaping education delivery

Impact on student	Description of external factor
• **Less paper** • **Virtual learning environment** • **Self-learning** • **Generic content with scope for individual tailoring to suit class and student needs** • **Loss of control in device use**	*My work [IT systems] takes me into Catholic schools – they use google drive and Cloud. They provide students with laptops. Why? Because the school and student learning are all based around lessons and classroom work being non-paper based.* *Based on what I see the teacher no longer stands up in front of the room. They present lessons then student goes to Cloud to do the follow up work and exercises — in this space it is all about self-learning. What is happening from my IT experience is that generic educational apps are being rolled out generally across all schools. This does provide some real benefits in that it can easily be tweaked/altered to tailor for more target audiences or purposes. Third parties not individual schools or teachers make these apps and are therefore quite different to book-based learning. (Shawn)*
• **IT technical assistance available** • **Entrenching of device use**	*In the last 6 years or so the school has employed IT specialists and now have 2 full time IT technicians and these staff have become critically important in the last 5-6 years. Previous technicians just fixed the computers in the computer room at the school. I feel there is not much difference between government and non-government schools in their approaches to the use of IT and devices, including accessing internet etc.* (Patrick)
• **Entrenching of device use**	*Today, schools mainly have own devices and the acquisition and use of the devices by the school has become like an industry and operates as a corporate or public organisation with its own IT system. (Kathleen)*

The involvement of third-party providers, enabled by portable electronic devices, suggests that the interaction between the educational learning system and individual householders is unproblematic and delivers successful educational outcomes for each householder and household using portable electronic devices. This is not the case as I have already discussed in Chapter 4. Where the educational learning system fails to meet the needs of some students, such as those with special needs or even accept a student into a school, some households are "forced" to look for alternative learning environments. Home-schooling is one such environment. Yet if householders pursue such an option they are still required to conform with government educational standards and regulations.

One household discussed their experiences in this context. They spoke about their heavy reliance on portable electronic devices, due to their broad-based functionality and access to the internet to underpin a home-schooling strategy. This strategy had to be acceptable to the educational regulators but, at the same time, provide the necessary learning experiences for their son as well as support for Tamara, the mother delivering the home-schooling activities. By way of illustration Tamara spoke about how she uses her iPad and the web to obtain information on developing teaching skills, as she comments it is like getting do-it-yourself (DIY) instructions for teaching. How electronic devices contribute in other ways to this household's home schooling is highlighted in the following quotes from Tamara:

> *Without all these devices it would be very difficult to do home schooling – we would have heaps of papers otherwise, too and which would be heavy. As I don't have a car this would be a problem.*
>
> *I use the tablet for Facebook chatting around learning ideas, research activities and for ideas on teaching techniques and it acts as a home library for my teaching activities. (Tamara)*

6.2.4 Post-study device use

The duration of most higher education certificates and degrees in Australia is from two to six years of full-time study, with householders owning many devices to support their learning activities during this time. But participation in formalised learning practices does come to an end and is usually accompanied by movement into the paid workforce. Clearly, this world is different to that of an educational environment for householders and, therefore re-defines how householders live their day-to-day life and the practices in which they engage as part of their everyday living.

Such changes have implication for the use of electronic devices, both existing devices and future devices, and current practices and the evolution of future practices. Four householders involved in this research had, within the last 12 months to three years, moved into the full-time paid workforce after completing their higher education and mentioned that their world and day-to-day practices had changed. Further, householders who had moved on from participation in higher education stated that their use of electronic devices had changed considerably, including a decline in the frequency of use. These changes occurred across commonly used devices, such as tablets, laptops and desktops but only to a limited extent with smartphones — use of these remained relatively the same. Annette draws out her changes in laptop use post-university in the following:

> *It [laptop] is also valuable in terms of the extra programs and applications that are available on it compared with the phone. These in a way really drive my use of it now*

> *because I no longer use it for university studies. That is originally the laptop was used almost totally for university work and assignments and university emails. (Annette)*

Joel provided similar comments around the intensity of device-use post higher education:

> *Nowadays I use the iPad a lot less than when at university. There are big differences in use when first used compared with now. At the beginning it was used solely for university work, especially taking to and from home to university and I also used it a lot for discussion boards associated with university work. (Joel)*

Decline in device-use as indicated above is not implying that device use per se has ceased. Rather as Trent explains his use sifted to another device-type, which invariably means the acquiring of other device-types and the potential to stockpile devices no longer needed:

> *This computer [all-in-one] was purchased quite recently in response to a number of changes in my personal lifestyle, especially the completion of university which has meant there is no longer the need for having a portable/mobile computer. (Trent)*

6.3 Day-to-day learning

In this section I examine two day-to-day learning practices that enabled householders to improve their cultural capital, outside of the formalised learning environment discussed above. They include on-line researching and information gathering; and, working with hobbies.

6.3.1 On-line researching and information gathering

Historically, people visited local libraries, visited shops, read newspapers and magazines and relied on word of mouth to learn about events, how to do things, what to buy and, make informed decisions about their everyday life. These practices are still performed today. But they are also performed using personal, portable electronic devices. These devices, with the arrival of the internet, have enabled these practices to be performed within households, by anyone, anywhere and at any time. This has created a practice world of on-line researching and information gathering that provides householders with the capacity to expand their cultural capital almost instantaneously.

According to my data analysis, on-line researching and information gathering was a common and highly valued set of practices undertaken in all households — the intensity to which these practices were performed did vary across households. Additionally, the reasons for the practices varied considerably across households and householders but a common theme for their performance was to make everyday activities simpler and easier, more predictable, time efficient, conducted in a more informed way and without the reliance on other people or mediums such as books. By drilling further into the data, six key reasons emerged as to why

householders performed these practices. These are presented in Table 6-5 below, along with generalised examples from householders' comments.

Table 6-5: Reasons for on-line researching, information gathering

Purpose for practice	Householder examples
Confirming or double checking	Where a restaurant is located Where a government services office is located e.g. Centrelink Determining time required for travel Confirmation of accommodation, event, airline tickets Receipt of job applications
Informed consumption decisions	Product and service comparisons between businesses and providers Impact of weather and road conditions on immediate and future activities
Being precise and right	Using dictionary and thesaurus for spelling and word appropriateness Using calculator for immediate numerical calculations Searching Google for "the facts"
Socialising and entertainment	Organise parties, having coffee and dinner etc. Identify upcoming events Identify things to see and do in other places Book event tickets Confirm meetings and social engagements
Save money	Search and scroll for cheap deals across various products and services, especially airline tickets Purchase products and services on-line at lower costs
DIY and improved competencies	Investigate various DIY tasks such as wall rendering, pruning trees, removing stains Build skills, especially through watching YouTube clips Health awareness Problem solving day-to-day issues e.g. I am in this situation what can I do — the what ifs

Next, I discuss examples of the engagement by householders in on-line researching and information gathering practices, beginning with sourcing cooking recipes. This practice occurred across a wide range of household age groups — commencing with householders in their early 20s through to one householder in her early 80s. It was mostly female members of the household who were involved in this practice, reflecting the general social arrangements where females are more likely to be the person cooking a meal. But several male householders also used on-line researching for recipes, albeit these householders were usually in mid-20s to early

30s. There was one exception, Dean, in his early 50s. Dean, in fact had embraced the use of electronic devices for on-line searching for recipes and noted:

> *Another great thing is how you can get recipes off the net. I now have a recipe book on-line or on the computer and have got rid of all my recipe books. (Dean)*

The above raises the question of why are, or have, householders switched to on-line researching for cooking recipes, especially when many have a collection of recipe books upon which they could draw. Based on my data analysis the answer lies in the meanings households placed on the importance of food and cooking in their daily lives for a variety of reasons including the need for sustenance, hobby activities (such as home brewing) and a platform for social interaction. It was clear that several of these reasons occurred amongst households.

But, there were other reasons driving householders to use electronic devices for sourcing cooking recipes. Firstly, accessing on-line recipes provides householders with the ability to be innovative in their cooking practices and shift away from their standard, perhaps more mundane cooking approaches. Some indicated this is especially important for household special occasion meals. But it also meant that, if they wanted something new and different, there was no need for them to go out and buy another cookbook for this purpose — a cost saving activity too.

Secondly, accessing on-line cooking recipes enables householders to broaden their knowledge and skills base, thereby supporting the above point of promoting greater innovation. A point alluded to by Gloria when she discusses how having access to a smartphone and the internet enabled her to be sufficiently confident to proceed with a recipe with an ingredient that she was unfamiliar with:

> *What the phone is really good for is instant solving of problems, regardless of where I am. This is really access to the internet. For example, when recently in the supermarket I needed a pomegranate for a recipe and had never used one before or brought one. I did not know when it is ripe or not. So, whilst in the supermarket I did a "How to on the phone for how to tell when it is ripe?" (Gloria)*

Another explanation relates to device functionality and how this supports access to and use of on-line recipes by households as they live their day-to-day lives. Aspects of functionality include the instantaneous accessing of other recipes via the internet, which is often quicker than going through a whole lot of different cook books; the ability to print recipes off the net; the scope via social media platforms to share recipes with others; and device mechanics. All of which I argue have and will continue to, increase the reliance of householders on portable electronic devices for performing the practice of cooking. Examples provided by householders of these functionality aspects are presented in Box 6-1 below.

Printing and hard copy functionality

*Also use the phone for accessing recipes on Google and screen shot these like a fixed recipe. (*Brenda)

*I use the laptop a lot for activities, including google searching for recipes as well as because I can print off the recipe and I need to have a print copy with me. (*Peggy)

Device mechanics

*I use it [IPad] mainly for accessing university and for cooking. I especially like the smooth screen and having no keyboard which is good when manipulating it for cooking and recipes. (*Courtney)

Sharing tool

*Use Facebook to share recipes and similar things. (*Jean)

Box 6-1: Enhancing cooking capacity through device use

Another example of householders engaging in on-line researching and information gathering practices is accessing technical information on information-communication technology and building skills and competencies in the use of that technology for day-to-day living. Through this access, householders were able to improve their electronic device expertise. To illustrate with two cases. The first, Cody. He is a teenager and a mad-keen gamer and has a great interest in computers. He explains how on-line researching enables him to build, through his own initiative and resources, the necessary technical knowledge he requires:

> *A lot of my knowledge around computers and electronic devices and gaming is gained through watching YouTube clips. I use the iPad for this purpose. School does not really help at all in terms of helping students build these skills, especially the technical stuff. I do it all myself. YouTube channel also gives a lot of inspiration as well as information. Another source of information is through bloggers on line. These are an important learning source and so I can find out things on-line and through the internet. These are great researching and learning tools for me. (Cody)*

Audrey is the second case. She is in her late 60s and engages in on-line researching practices to build her expertise in using information technology operating systems. Audrey's case provides some additional insights because she believes on-line researching does not necessarily deliver the desired outcomes, improved knowledge or problem solving. Instead, as she explains, successful results may also be dependent on direct person-to-person communication, even if that communication is via a phone call, reinforcing the interconnectivity between practices for each of their performances. As she explains:

> *A major driver for me to learn how to use devices is to connect to my children. This means also learning about the various applications and how to use them on each device as well as how to navigate the operating system.*
>
> *I basically start with the belief that I think something can be done but not sure how so I will persist until I achieve it. This may mean chasing up with service provider support*

staff such as Telstra but I won't allow myself to be beaten by them. I don't like being beaten. I will also do a lot of on-line research to find out about what other people say about software, apps and devices to help me work out what is going on or what I should do. (Audrey)

6.3.2 Working with hobbies

Pursuing hobbies and personal interests are an important mechanism through which individuals develop and expand their cultural capital across a wide range of activities, as well acting as an enabler for building self-identity. Many householders undertook hobbies and or personal interest practices and, in some circumstances, these involved the use of electronic devices directly e.g. a laptop for editing photographs or an iPod for listening to music whilst beading (Linda).

In addition, these practices created flow-on or subsequent effects for how and when householders engaged in other daily practices. For example, a householder with a hobby in short-story writing may spend periods of the day in an ad hoc way and, across the entire week, still drafting his or her story. Alternatively, a householder with an interest in horse racing and betting may confine his or her time spent on the activity immediately prior to, during and after a race is run. Electronic devices, because of their functionality, size and portability and internet connection, enable these activities to be performed anywhere and at any time — a great advantage for householders when juggling their interests with other day-to-day activities.

The scope and occurrence of the hobbies and interests amongst householders varied according to age, gender, household arrangements and cultural background and as a result influenced the reliance on electronic devices and device-type used. For example, music was a common hobby with many householders, regardless of generational profile, while younger household members were more incline to pursue fun things such as dancing and different types of electronic games (Simone).

A critical ingredient for householders to engage successfully with the performance of their preferred hobbies and personal interests was having the necessary body of knowledge, expertise and skills. Many householders gained this through on-line researching and information gathering practices discussed above. As in this discussion, electronic devices and internet access was fundamental for not only building this body of knowledge, expertise and skills but in maintaining it as well.

The combination of electronic devices and internet access provided householders with a broad range of information, from across a broad range of information platforms. This combination too, enabled householders to engage in a range of different information formats such as YouTube

and Blogs. The three information gathering conditions enabled different learning determinants such as age and learning needs and styles of householders to be easily accommodated. Further, they provide the technical capabilities to "replay and re-visit" learning mediums as often as necessary, again a positive attribute for learning.

Some householders indicated they learnt better through visualisation instructions, whilst others indicated a learning preference for a combination of visual and audio instructions. Overall, householders stated that the combination of on-line researching and information gathering and working with hobbies and personal interests expanded their knowledge, expertise and skills and contributed to their self-identity. But there were also more day-to-day mundane benefits gained as well, including:

- maintaining their motivation with their hobby and or interest, even when they encountered difficulties;
- saving money as they were less likely to make errors as would be the case if they relied solely on their own trial and error approach and were more informed on where to source their materials and or software and applications; and
- gaining personal satisfaction through success of the hobby or personal interest — it was all their work and effort so to speak and in the case of householders pursuing family history they gained a sense of achievement when they uncovered the "facts".

Based on the data, laptop computers were the most common device used to support hobby and personal interest practices and were used in a variety of positions within the house. Where some differences did exist these related to whether the device was used on the householder's lap-knees or on hard surfaces e.g. a table. The benefits of the laptop for hobby practices is referred to by Joan:[21]

> *I use the laptop a lot for searching the web. For example, I love using www.stumbleupon searches and it brings up pages of interest. I also use the laptop for YouTube watching. Mainly for education and learning purposes. For example, for languages, exercises and hobbies. Currently I am learning Italian and how to do water painting. (Joan)*

A snapshot of hobbies and personal interests undertaken by householders, age profile and the device used are presented in Table 6-6, along with the comments of householders on their hobbies and personal interests.

[21] This quote was also used in section 5.4 to highlight the benefits of the laptop for leisure and entertainment practices.

Table 6-6: Integrating device use into householder hobby and personal interest activities

Hobby or interest	Device	Age profile	Householder comment
Jewellery	iPod with internet access	Under 12 years	Paige. *I use it [iPod] a lot to access YouTube for researching and watching tutorials on my jewellery making hobby. I make jewellery – earrings and necklaces and enjoy doing this from old materials, such as old fencing wire.*
Betting and tipping	Smartphone	Early 50s	Dean. *I use my phone for a range of things other than just straight talking. I do on-line betting using my horse account.*
Multiple	Laptop and smartphone	25-30 years	Barbara. *I use the laptop for web browsing, scanning, researching and shopping for personal hobbies, such as short story-writing and making costumes for annual science fiction dress-up events.*
Household DIY	Computers, smartphones and tablets	Associated with householders with property of their own	This was discussed by a number of householders and covered things like making, mending and maintaining or for one householder how to remove stains rather than go to the drycleaners.
Genealogy	Desktop and laptop	45 years plus	Lloyd. *Use it [desktop] for a range of functions and activities such as doing family genealogy.*
Dancing	iPod	Under 12 years	Simone, talking about one of her daughters. *Device is a learning/educational tool for Paige as she pursues her interests in dancing.*

6.4 Awareness and social status

6.4.1 Improving self-awareness

One of the things many householders spoke about was the need to be constantly aware of what is going on around them, personally, nationally and globally, so they could understand this environment and how they sat personally within that environment, illustrating how the contextual element drives awareness practices. To do this, householders actively and constantly engaged in on-line searching and scanning of social media platforms, such as Facebook and Twitter or internet searching, to quickly gleam and know what is currently going on in the world. This includes things such as “physical events” such as political rallies; what is happening in people’s day-to-day lives; and, what people, community groups or institutions are saying about other people, groups and institutions. Electronic devices and internet access underpin these practices. They are also dependent on specific and readily available free or purchased software programs and apps. Combined they fall within the gamut of the materials and infrastructure element.

Many householders highlighted the importance of awareness practices in their day-to-day lives. They expressed a preference for scanning social media to know what their friends, colleagues and family are doing day-to-day, rather than communicating directly with them, which frequently involved spending considerable periods of time speaking, emailing or texting them directly. Additionally, householders used the practice of scanning social media as an important routine marker to give structure to their day. For example, several householders said they checked their social media site religiously for an extended period first thing in the morning, then at lunchtime and in the evenings, every day. Smartphones were the most commonly used device in this practice suggesting that checking social media structured daily life for some participants.

Based on my analysis of the data three reasons were identified that drive social media engagement. The first centres on wanting to know the latest results of sporting events, especially those events held in other international time zones. Scanning social media, especially first thing in the morning, enabled householders to bridge such time differentials across day and night. Two householders discussed the value of social media scanning for sporting purposes. Carlos' comments are illustrative:

> *My main social media is Twitter and I use this for accessing information around news, sport, especially European football as it is being played. I usually go to Twitter first thing in the morning and then to Instagram and Snap Chat. (Carlos)*

Trent provided similar comments about using social media scanning to know the results of international sporting events. His preference, however, was to take a multi-pronged approach for obtaining sporting results, sourcing results from clubs or news outlet websites as well as social media scanning. He stated:

> *If there has been a soccer match in Europe overnight I check the BBC sports application [on the phone] for results – this is often before I get out of bed. (Trent)*

Leon in his late 60s provides a different scenario. He is a keen American football observer and a frequent traveller, raising the prospect of him losing touch with the status of the competition. To avoid this prospect Leon travels with his laptop and more recently his tablet as he describes below:

> *This [laptop] is also taken sometimes when travelling overseas – but more in the initial days prior to purchasing the tablet. Because I love American football I wanted to be able to watch this whilst away so I use it to access this whilst away but also when at home I use the laptop to stream back through the TV. (Leon)*

Another reason for householders to participate in social media scanning practices is to be socially and politically aware. Often the sub-text for performing these practices is to obtain current information and knowledge and, in the process, improve their quality of life, including

such things as work performance and the pursuit of social justice issues. Electronic devices are central for this process and for building personal social, economic and political awareness objectives. The devices enabled householders to override time, and other issues they encountered in the process, allowing them to operate in the same time capsule with other people and not be disadvantaged.

This ability was important to householders who have either lived or worked overseas or have family and friends currently living overseas. Several householders discussed the need to be socially aware of the circumstances in which their family, friends and peers were living. Examples of how such householders use devices for social and political awareness are presented in Box 6-2 below. Also included is the use of devices for awareness of religious activities.

News media awareness:

> *I use the phone to read the news such as* The Guardian *and keen on this because it allows me to know what is going on overseas. (*Ruth)

> *I browse news at breakfast on the phone rather than the physical paper because it is more up to date with articles. I usually source The Age newspaper through work's electronic subscription to keep up to date personally and to have conversations at work. (*Trent)

Religion:

> *I use the phone a lot for religious activities and uses.* (Shawn)

Box 6-2: Comments by householders on device-use for being socially aware

Jean provides an expansion of this socially aware theme by explaining that improved capacity through the assistance of electronic devices and internet access has broaden her horizons, well beyond just being socially aware:

> *I think the devices and technology have some real positives in that they have enabled me to know what's happening in world affairs and opened horizons that I have not previously been exposed to. (Jean)*

In another take on this theme, Carlos explained how he uses electronic devices and social media platforms as a way of exercising his civil society rights. For him, social media and the way people can scan it, with the assistance of electronic devices to know what is going on and to review public comments made about organisations and decision makers, is the ideal tool to make the people and organisations accountable. And ultimately for Carlos, achieve better customer service outcomes for himself and others in the future.[22] As he explains here:

[22] This type of social media use-strategy has gained greater prominence and impact since the commencement of this research. The MeToo 2017 hashtag campaign is probably the most high-profile example.

> *My experience is that Twitter is also a good platform for pushing companies and organisations to deliver better customer services. For example, I called out Telstra on their poor service performance through Twitter. I feel this is a good technique for "exposure of companies" and placing them in the public domain. In this way you usually get resolution to your problem. To me it feels a bit like the passive aggressive approach to effect change. (Carlos)*

6.4.2 Resisting social pressures

Much of the analysis in this and the two previous chapters has assumed that households and householders readily succumb to electronic-device technologies and engage in the associated practices, such as staying connected as part of their day-to-day living. That is, they willingly become carriers of practices involving electronic devices. I consider now that this is the case and argue that it is likely to increase further into the future.

However, within the collection of households interviewed, there were householders who rejected this unquestionable adoption of technology and resisted social pressures for its adoption and the subsequent practices involved. Consequently, these householders did not embrace or willingly become carriers of the practices involving the use of electronic device technology. This illustrates that the meanings and understandings attached to the unquestionable use of electronic devices, and the practices supported by those devices, differs across householders with some householders more positive towards use and participation in various practices whilst others ascribed lesser value.

For example, Lloyd outlined his conscious decision and choice to reject any acquisition of new devices for the sake of having a new device and did not personally own a mobile phone. This case was interesting because Lloyd was highly knowledgeable about information technology and its devices, its applications in day-to-day life and business operations, and about the general benefits this technology can provide; that is, he was a prime candidate for using electronic device technology. [23] Instead, he continued to rely on landline for his verbal communication with his family and the use of desktop computers for emailing rather than purchase additional personal devices such as a smartphone, laptop or tablet. For him, such devices were excess to his needs and represented consumption for consumption sake, which was a theme addressed in Chapters 1 and 2 and, as discussed, perpetuated by the economic system and the information communication corporate world.

Two further examples of resisting pressure and going against the "tide" to acquire more devices is provided by two households that had rationalised the number of devices. Their intention was

[23] This householder (Lloyd) was responsible for his workplace's information and data system, a responsibility requiring a high level of knowledge and expertise in this area.

to limit and or reduce their future device acquisition patterns and openly stated that their approach was at odds with the pressure applied by their peers to continually acquire different devices and or upgrade their existing ones.

This trend was also prevalent in households that included younger members such as financially independent children or members of group housing arrangements or, in one situation, a young couple-only household. Young adults, such as Joel, indicated they were content to rely solely on smartphones, and or a combination of smartphone and laptops, to perform their household management responsibilities:

> *Would I get another iPad? Probably not as I could easily go without it and get a new phone and laptop, especially as phones are so much more like computers these days …… (Joel)*

Resisting social pressures to acquire and use electronic devices also played out in other ways, but, interestingly, the associated practices involved householders proactively adopting electronic devices. I found many householders used their devices to connect with others (as discussed in Chapter 4) but also to resist person-to-person communication and or manage when and how this communication occurs. In effect, by resisting person-to-person communication householders were no longer willing to act as carriers of direct person-to-person communication practices. Instead, they had re-set the configuration of communication practices by changing the meanings and understandings embedded into these practices. For these householders, less value was placed on direct person-to-person communication.

Many householders discussed the use of device functionality for this purpose and it involved consciously disengaging with family, friends and other people. This avoidance occurred throughout the day for most householders except for one household where the daughter with children silenced incoming calls at the children's bedtimes. Device functionality was the critical enabler in these practices which included using software to block mobile phone calls, not picking up incoming calls, using text-based communication formats such as phone texting and emails, turning the phone silent, closing-down personal social media pages, and refusing to engage in an active entertainment or communication exchange.

Table 6-7 provides examples of why households were avoiding direct communication. The examples provide insights into how householders use devices to "do the talking" for them, and or manage other peoples' expectations and demands, including response times whilst ensuring that priority was given to meeting their individual needs.

Table 6-7: Devices enabling management of expectations

Householder examples	Why avoid interaction	Device and format
My major preference is for texting as this is simpler and less complicated. On the other hand, if I want to ask for something and want appropriate tone to be portrayed then will call. This provides scope to portray emotions more or control them if I wish. Texting on the other hand is more clinical and abstract and perhaps more decisive and objective. (Carlos)	• Avoid detail • Seek quick and instant interaction • Delay time and response • Avoid physical contact – electronic only • Keep things simple	Phone texting (implied) Phone voice calling Phone – social media platforms
..daughter puts phone on silent when children go to bed (Elaine)	• Delay time and response • Avoid physical contact – electronic only • Avoid household disruption	Phone
One of the functions I do use on the phone is how you can ignore incoming phone calls or other communication if you so desire. (Ruth)	• Avoid detail • Avoid disruption • Delay time and response • Avoid physical contact – electronic only	Phone
Today I use phone extensively for using Facebook. This is especially important for family and friends who are not directly around where I live. This gives me the chance to communicate more often and more easily but without strings attached as would be the case if you physically visited or made voice contact. (Annette)	• Avoid detail • Avoid disruption • Delay time and response • Avoid physical contact – electronic only • Avoid emotional connection	Phone Social media platforms
Prefer to use ways of making the communication or action quicker and don't really want to know about much level of detail so very much after behaviour or technique that will speed things up. Not into small talk. Will only use voice calling when want to have an in-depth conversation with someone and would like a response at the time. (Jenna)	• Avoid detail, which takes up time • Seek quick and instant interaction • Delay time and response • Avoid physical contact – electronic only	Phone texting (implied)
I feel that if you constantly ring them [adult children] you drive the kids nuts. Even to the point that if you are contacting them constantly then they think there is some sort of subterranean plot going on. Now I find it easier to email and text without being nosy. Flick off messages [to the family] without any strings attached. (Margaret)	• Avoid detail • Avoid disruption • Avoid physical contact – electronic only • Avoid emotional connection	Phone Laptop

This table demonstrates why householders cease to act as carriers of direct communication and social connection practices. It shows that most householders interviewed actively sought to avoid communication detail and disruption to their own worlds, suggesting that these practices are relatively common-place, performed regardless of age with the mobile phone being the main

enabling tool for the practices. This is particularly so with respect to obtaining a quick response through the texting function of mobile phones.

6.4.3 Enhancing social status

People have their own individual needs and wants to function as an individual and as part of society (Maslow 1970; Coleman 1990; Berker et al. 2006; Couldry 2012). Having social status and standing within households and within the broader community and society is an important aspect of meeting these needs and wants. Individuals, therefore, strive to understand and build their social status amongst social peers, networks and family. I found that portable electronic devices are an important enabling tool for householders to establish and reinforce their social status and self-identity in everyday life.

The gaining and cementing of social status by individuals, links to the performance of different practices involving the use of portable electronic devices. One such practice is the demonstration of device-technology savviness, which involves using specific types of electronic devices that require high-levels of proficiency in their use. This scenario was evident amongst several householders, with Holly providing valuable insights into this practice in Box 6-3.

Researcher:

How did you go about purchasing your phone?

Holly:

This was a difficult process for me. I quite like Apple products, especially as they are easy to use and very user friendly. What I wanted was to have more diversity, so I decided to try the android so that I could be more technically savvy about what goes on in using my phone. Apple phones lead you rather than you driving the phone.

Basically, I selected the phone I have because the on-line reviews that were largely positive and cheaper and the feedback suggested that they were reliable. Friends who were knowledgeable also provided advice. (Holly)

Box 6-3: Social status and positioning through device type use

Terry, an older householder, also explains this practice based on his experiences of family members exerting pressure on him to become more "with it" in his device choices and their use:

> *I have a son who is an IT specialist and he sees parents as in the "dark ages" and so need to update their devices and that the computers especially are out of date and don't support the latest software.*
>
> *Another reason too was that adult children all had smartphones and so I had to update and keep up with the times or so we were informed. (Terry)*

Clearly, there were pressures on householders to have and use specific types of technology and devices if they wished to be included in a group and have standing within that group. However, for some householders, this practice undermined their feelings and meanings attached to their

self-worth. Specifically, these householders spoke about a loss of status and standing as they had lost autonomy to make their own choices about what to acquire and use —"*things were being imposed onto them"* (Terry). Nevertheless, they did acquire new devices, and, from a materials flow perspective, this acquisition was contributing to the expansion of electronic material stocks, regardless of a householder's satisfaction with their existing devices.

Another practice that enabled householders to improve their social position amongst their peers was having devices, or more specifically certain types of devices, that had high social status standing — that is, the material element of the practice becomes the social status symbol. The inter-relationship between social status and devices, and the influence that this has on individual worlds of householders, was discussed on numerous occasions by householders. Younger householders were actively engaged in this practice based on their reasoning for transitioning from one device to another and from one brand to another. Courtney is a case in point. She was in her early 20s and explained that the pressure to have "cool" devices was the major reason she was enticed into acquiring specific types of devices:

> *Obtained my first mobile phone about 11 years ago and went against my parents' wishes at the time. Because of this I got the phone myself, paid for it and paid the operating costs which was through credit – pre-paid. I then got a flip phone because it was perceived as being really cool by school friends and other friends. It was the fashion at the time. After the flip phone I got a slide phone — again because it was the cool thing to do at the time. These were all in the times prior to the arrival of smartphones. (Courtney)*

Expanding on this further. It was not sufficient for householders to have an electronic device or multiple devices. Rather they must have the latest device and or latest model, latest operating system, software and applications available, and purpose specific devices. But by far the most common status symbol aspect of devices was around brand type and operating systems —as Holly alluded to above. In this respect, several householders stated that they acquired and are using new devices purely to meet social expectations associated with branding. Acquisition of Apple products provides the best illustration of this phenomena. For example, some households made comments such as "*this is an Apple-only household"*. As some interviewees crudely put it if you don't have an Apple product your social standing amongst your friendship peers is considerably lower, especially in the worlds of design or photography. This sentiment is supported by Alan, who has two teenage children, in the first quote below and Trent, a young adult in his late 20s, in the second:

> *Purchasing of phones is influenced by the "shininess of the device plus its attractiveness and appearance". This ties in with brand preferences and Apple users are more often keen on status than other device brand owners. (Alan)*

> *As a designer I have a strong philosophical connection to the design elements of Apple products in terms of visual design but also because of materiality e.g. mostly metals and glass and not plastics – these are really important to me. (Trent)*

Being socially accepted in terms of device-technology savvy also related to device operating system currency. In several instances householders spoke about the pressure placed on them to upgrade their devices as a way of having the latest operating systems and data processing capabilities to access and use the latest software and applications. For some younger household members being "*cool"* or owning a device having "*coolness"*, was directly associated with using popular games such as Candy Crush and Zombies — playing such games was itself a status activity (linked to a competitive ethos) and relied on having adequate operating system capabilities. Courtney illustrates the significance of this through her comment:

> *For me sometimes the images of what is going on and the preference for products, especially computers is like the girl in Legally Blonde where you just want the device to help you manage things and for it to be like having an electronic book that you just open up. I have the same scenario in my own experience with people in the Law School at university. (Courtney)*

6.5 Conclusion

In this chapter I explored how and why portable electronic devices are used in the household living domain of cultural capital. In doing so, I demonstrated that portable electronic devices and associated soft and hard materials and infrastructure are central to the performance of all practices supporting cultural capital outcomes. The meanings and understandings element is critical in the configuration of all practices supporting knowledge, identity and social status outcomes. Amongst most householders learning and education outcomes were ascribed considerable value and significance to ensure a successful and rewarding life.

Specifically, I demonstrated that portable electronic devices are entrenched within all institutional education practices, a situation compounded by institutional lock-in of devices as learning platforms. This highlights the impact of external contextual factors (element) on learning practices alongside meanings and understandings attached to formalised learning activities.

Devices are the main enabling tool for giving householders the capacity to gain an education whilst juggling other competing needs such as participation in the paid workforce. Device functionality and portability are central to this process with laptops and, to a lesser extent tablets, the preferred electronic device at the higher education level indicating that the materials and infrastructure element has an important role in the configuration of these

practices. It was also demonstrated that when institutional education is completed there are changes in device use.

Informal learning practices were also ways through which cultural capital was developed and gained. Two sets of informal learning practices that build householders knowledge, skills and competencies were identified: on-line researching and information gathering; and, working with hobbies. Like institutional education practices, these informal learning practices are reliant on portable electronic devices, combined with their supporting infrastructure, as the learning platforms. Engagement in, and the configuration of these practices, is informed by household contextual factors, such as life-stage, gender, and parental monitoring. Meanings and understandings also shape the performance of informal learning practices as does the prior knowledge, skills and competencies of householders (especially with respect to use of electronic devices), the embedded knowledge and competencies within devices software and practices themselves.

In comparison to institutional education practices, informal learning practices shape virtually all aspects of the everyday life of householders. This reinforces that electronic devices, in some form, will remain critical tools in the future for the performance of these practices, regardless of how they are configured. From this perspective, informal learning practices will continue to influence the electronic material flows through households, the volume of which is only likely to increase in the future.

Four key findings emerge from this synopsis of the practices that contribute to developing household cultural capital outcomes. Firstly, not all householders are willing to act or continue to act as carriers of past and current practices and, as such, these householders provide useful insights into how and why different practices gain traction and or fade and hence electronic devices move through the material flow cycle in households.

Secondly, household living is firmly encased in a world where there is inter-dependency across the levels in which practices are performed. That is, at the macro-level of analysis, there is inter-dependency across household living domains which in the context of this thesis are: social and economic capacity; leisure and entertainment; and, cultural capital. As a result, each practice influences and is influenced by the configuration of other practices and some performances depend on the performance of several practices. For example, institutional education learning practices interact with day-to-day learning practices for individuals such as on-line researching, information gathering, and working with hobbies. These are all interlinked and build the capacity

of each other's performance. A phenomenon not that dissimilar to Bourdieu's argument that each capital form has the potential to convert to another form of capital (Bourdieu 1986).

Thirdly, differences in practices will always exist across households and householders, with differences being determined by what practices are performed and how; frequency of performance; what devices are incorporated; when practices are performed and who acts as the carrier of the practice. Configuration of practices is therefore, highly fluid over time and circumstances. As a result, electronic material flows through households will also vary according to household and householder.

7. Progressing to material outflow

> *For the old phones I have always chased up where and how to get rid of them. I have recycled phones through formal arrangements e.g. envelope and dropping off to businesses. When we were downsizing we were able to recycle virtually everything. It took a lot of time and constant phones calls and searching but got there in the end. (Lester)*

> *We also have numerous phones — as shown by the drawers and up in the attic, which should have been thrown out. One of the reasons for this is that I am paranoid about personal data and what happens to it when the devices are thrown out. It would be good if there was more information available about how individual consumers could wipe and strip off everything on their devices because most of us don't know how. (Joan)*

7.1 Introduction

This final analysis chapter is informed by the themes that emerged in my review of Australia's IC System and Australia's economic and urban development since British colonisation (Chapter 2) and the role portable electronic devices have within households as part of these systems and processes. I established that Australian households have high levels of electronic technology adoption, resulting in unsustainable electronic device material flows through households and a subsequent loss of electronic material resources from the electronic resource system presented in Figures 1-1 and 1-2, Chapter 1. In addition, it draws on the theme-based data analysis in Chapter 3 which identified device-waste management practices being performed in households (see Figure 3-6: Themes consolidated and redefined).

In Chapters 4, 5, and 6, I demonstrated how and why portable electronic devices are used in practices that support outcomes associated with social and economic capital; leisure and entertainment; and, cultural capital. All chapters demonstrated that electronic device-use influences device acquisition, but none explored, in detail, how and why electronic devices are retired, accumulated and or divested by households, that is, what happens to the electronic materials flow process within households, post-use. Evans (2018, 2012 and 2011); Gregson et al. (2007); and, Hawkins (2009) provide useful insights for framing the discussion in this chapter. They argue that much consumption research is too simplistic and linear and tied to conventional individual choice-based theories, and is therefore, limited in its ability to fully explain how and why households manage waste. Instead, all argue initiatives to reduce household and society's ecological footprint must involve changes in existing social, political, economic, cultural and technical arrangements. Such arrangements, it could be argued are high-level and institutional and therefore operate outside the realm of household practices and the everyday, and as a result, are not relevant for my discussion here. This however, is not the case, as in Chapters 2

and 3 I argued for such arrangements to be incorporated into my theoretical analysis by including them as a practice element, context. Making their research relevant for this chapter that examines how and why households handle electronic devices post-use.

The work of Evans (2018, 2012, 2011) and Gregson et al. (2007) provides additional insights for my analysis in this chapter.[24] Both argue for the concept of consumption as a continuum process that covers actions including, consumption, appropriation, ridding, accommodation, divestment and disposal. In keeping with this, both argue that any analysis of waste must involve investigating the conduits through which materials and objects are divested. That is, they argue for a multi-flow process through which all household waste is managed. Based on my data integration, it was clear that differences across households, within households and across devices existed in how post-use devices are managed, making the concept of conduits or multi-flow processes (Evans 2018, 2012, 2011, Gregson et al. 2007) directly relevant. As such, the following analysis adopts the term pathways to denote this multi-flow process, specifically the pathways of: retirement and replacement; handling processes post retirement; and, disengagement and divestment (see section 1.6.4 for an explanation of the term handling pathways).

Against this background the purpose of this chapter is to understand how and why electronic devices are retired from use within households; determine what factors influence the accumulation of electronic devices within households; and, understand in greater depth how and why electronic devices are divested by households into the external materials stream.

Analytically, the chapter centres on the premise that all household practices, discussed in Chapters 4, 5, and 6, lead to device retirement and replacement at some point in time. Accordingly, section one of the chapter focuses on device retirement and replacement (transition point three) as a practice entity by examining it through the lens of the four practice elements and their dimensions. The second section examines the accumulation phase of electronic device material flows within households (transition point four), with section three addressing the divestment phase of electronic device materials into the external materials stream (transition point five). All three sections re-engage with industrial ecology and circular economy principles and concepts relating to electronic material flows and the phases of device

[24] Hawkins (2009) deviates from this approach by arguing that whilst it is reasonable to assume consumption and waste are part of an ongoing process, she takes a more ethical approach to waste management. Arguing that as a society, individuals and society need to take responsibility for, and live with, the waste they generate and not take the easy step of "flushing it away" as a short-term fix. Whilst this thinking is logical for achieving the ideal closed-loop material flow cycle it is limited for my purposes of investigating how and why households handle their post-use devices.

flows in households discussed in Chapters 1 and 3. Figure 7-1 re-introduces the industrial ecology and circular economy principles and concepts and their association with the phases of material flow in households, discussed in earlier chapters.

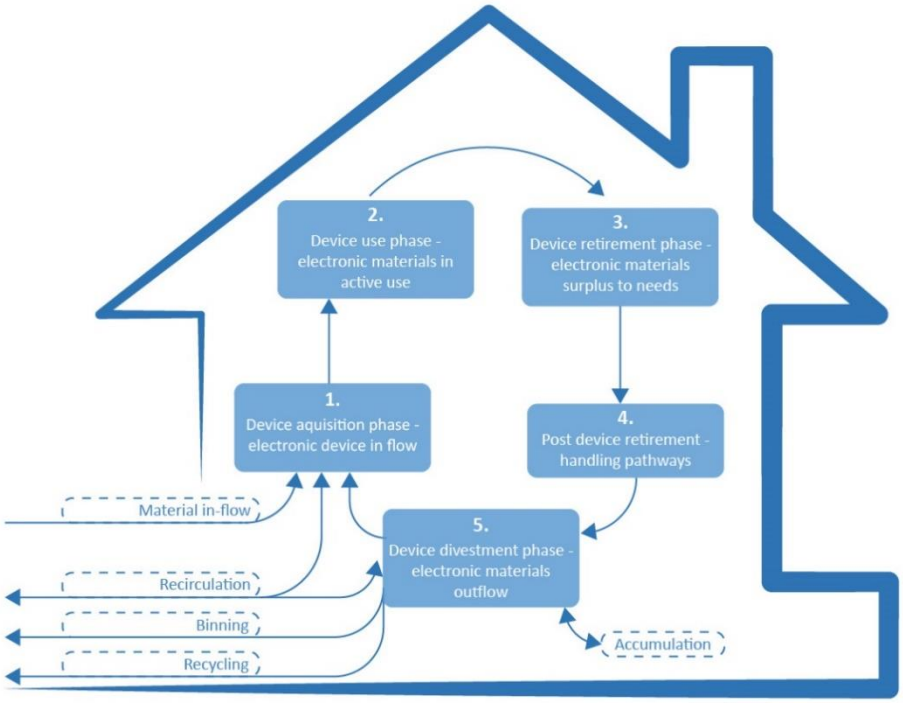


Figure 7-1: Industrial ecology and circular economy principles and concepts paralleled with household electronic material flows

7.2 Retirement and replacement

The interview data indicated that all householders had retired at least one if not multiple electronic devices, since commencing their use of electronic devices as part of their everyday life and which for many was over 30 years. The data also confirms that device retirement largely involved devices that still functioned as designed, suggesting two underlying reasons for the retirement of devices. Firstly, replacement occurred because a device's functionality had completely collapsed with no scope for ongoing use. Household examples here included the smashing of a mobile phone by a vehicle driving over it and a laptop just dying that could not be re-activated. Secondly, device replacement occurred on emotional, yet conscious grounds, to discontinue the use of a still functioning device. The second reason was the more common rationale given by householders for retiring devices. Examples of conscious decision-making for discontinuing use were the retirement of a basic mobile phone and its replacement with a smartphone and the retirement of a smartphone for a later model or different brand.

There were, however, considerable variations across households regarding device retirement with respect to, for example, device-types retired, frequency of device-type retirement, duration of use, who within the household retired their devices and what replacement devices and or new devices were introduced. These retirement variations across households can be accounted for by the contributions that each of the four practice elements, and their respective dimensions make towards the performance of the retirement practice. Thus, in this section, I will seek to demonstrate how materials and infrastructure; meanings and understandings; knowledge, skills and competencies; and, context as individual elements and as a configuration, inform, the device retirement process and the first phase of the materials cycle post-use.

7.2.1 Changing device and associated technologies

The interview data clearly demonstrated that technology change in both the hard and soft dimensions of the materials and infrastructure element is a critical factor driving electronic device retirement. The analysis also revealed the speed in which this technology change was (and continues to be) transferred into household and householder day-to-day living has (and continues to have) a profound impact on device retirement.

Aspects of this theme have been canvased in previous chapters, all of which highlighted the increasing presence of change and of the interlinkages between different practices that subsequently initiate further changes in existing practices or the formation of new practices. Here I focus only on the nexus between change and device retirement. To illustrate, at the commencement of this research project in 2014, the incidence and use of smartphones and Wi-Fi within Australian households was relatively low. By comparison in 2017, most householders from the age of seven years plus now use a smartphone, suggesting the likelihood that many "non-smart" mobile phones had been retired within households. Retirement of the older-style mobile phones was not due solely to the device per se. Rather it reflected a system wide technology change process, the most notable of which was the domestic roll-out of the internet and, more recently, the NBN roll-out referred to in Chapter 2. Access to the internet had become increasing available, with each householder having the infrastructure capabilities to access all things internet and from anywhere and at any time. Householders embraced this technology and its benefits (whether by choice or through external requirements — see Chapters 2 and 4) and hence, the circumstances for ongoing device retirement practices were established. This resulted in the retirement of the less technically advanced phones and their replacement with smartphones or other devices such as iPod and tablets.

Changing materials and infrastructure as a driver for device retirement also played out with respect to device physicality, design and structure. Many householders referred to the ever-increasing compactness, yet at the same time increased power of electronic devices, for their decision to retire existing devices and replace them with smaller size, lighter weight and more ergonomically friendly devices. Further, the physical dimension of devices gave householders greater mobility, flexibility and the ability to operate instantaneously in their day-to-day lives. Where these day-to-day objectives were compromised, householders retired their existing devices. This finding is consistent with those in Chapters 2 and 5 on device technology and innovation and increasing physical portability of devices.

The combination of ever-increasing compactness, smallness and powerfulness as a driver for retirement was not, however, consistent across all electronic devices. Certainly, the nexus between upgrading smartphones and retirement was a common and ongoing practice, with considerable frequency. Yet, this did not necessarily hold for all other device-types. Technological changes varied across devices over time, hence the need to retire different types of devices, purely on technical grounds varied as well. For example, householders retired their larger devices e.g. desktop computers and smart televisions less frequently than their smaller devices like smartphones. An exception to this was the low retirement levels for tablets and iPod, both of which are relatively small devices. Even so, I would argue that smaller devices have faster material flows through households compared with larger devices (Golev et al. 2016).

In an extension of this issue, many householders saw device innovation as a device self-perpetuating prophecy. By way of example several householders mentioned they were captured by the concept of the tablet because of its portability, in combination with its design element of a keyboard being ergonomically more aligned to a laptop keyboard with which they were accustomed. These physical dimensions were considered by several householders as positive features for travelling (see Chapter 5). It was these materials and infrastructure dimensions that were used to justify the retirement of similar devices and the purchase of different or newer devices. Once acquired, the tablet, became embedded in the everyday practices of the households at the expense of devices such as laptops and or desktops, triggering flow-on processes amongst other devices and their retirement.

The materials and infrastructure element, especially device technical specifications and changes to these, encouraged the retirement of currently in-use devices, which in turn, acted as a precursor to the practice of device switching and substitution. This issue links closely to the point made above and occurs where device performance levels stagnate and decline, making the

devices dysfunctional or an existing device is shown to be inadequate for current circumstances and for specific tasks, hence the pressure to retire even though technically it is still operative. An example of this switching and substitution is illustrated in Figure 7-2. It highlights the switching process over time from earlier devices to newer ones and later versions, a process that is replicated across devices other than the music-listening devices shown. This practice was common amongst many households, but particularly pronounced amongst younger household members involved in tertiary education (as discussed in Chapter 6).

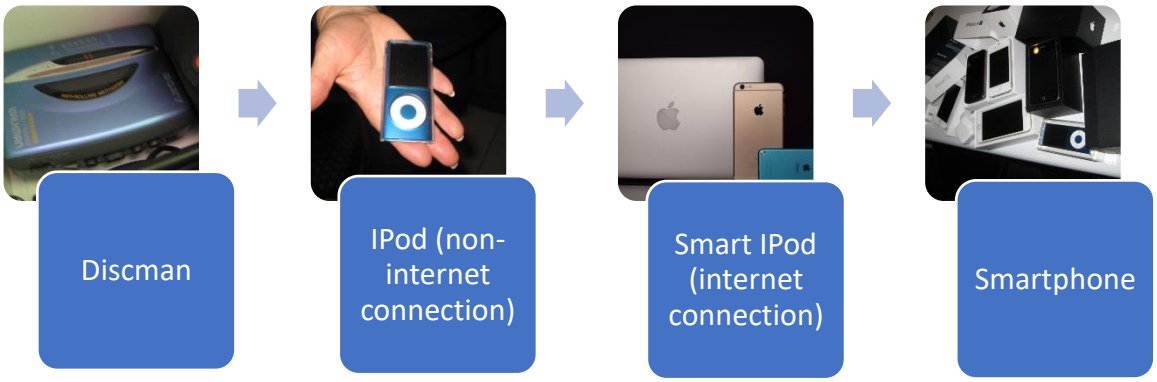


Figure 7-2: Switching and substitution of devices over time performing similar functions

Table 7-1 (below) presents further examples of this switching-substitution process by householders for other types of electronic devices. The comments by householders summarising the rationale for switching and substituting to alternative or substitute devices, hence retiring, are included.

A dominant theme across all three previous chapters was the perception that new devices were essential for successful day-to-day life. Having a reliable and well-functioning electronic device was viewed as critically important. Where device functionality falls short, such as device operating systems freezing and or batteries collapsing, householders readily retired and sought to replace these devices. Even allowing for automatic upgrades to the operating systems for their devices to maintain reliability, many households mentioned that ultimately, they did or would retire their devices. In fact, Mr Jupiter, a device repairer suggested that smaller devices all have programmed within them set time frames for when an operating system will collapse and

no longer function adequately.[25] Further, the business of programming operating systems of devices is undertaken by third parties, who have an incentive to ensure that operating systems regularly fail (Mr Jupiter). A comment that is consistent with Reller et al.'s (2009) arguments discussed in Chapters 1 and 2.

Table 7-1: Device switching-substitution case studies

Original device	New alternative	Rationale for switch
Discman	iPod	Portability Ascetics and appearance Data capacity Single device and no support materials e.g. compact disc
iPod	IPhone	Centralised multi-functionality within a single device, providing greater scope and range Data storage large enough to cope with vast amounts of music Capacity to do same time streaming
Digital camera	Phones and tablets	Data storage greater and data transfer across devices more streamlined Can be accessed anywhere and anytime and linked to cloud facility
Desktop	Laptop (sometimes tablet)	Data capacity and processing just as good as with desktop Portability, (weight and size) especially between home, work, education and between household rooms Can be "made" like a desktop with the addition of a keyboard and or mouse
Laptop	Smartphones	Smartphones have data capacity and functionality almost equivalent to laptop, e.g. can access records and data through the cloud Physical size and portability a real bonus for lifestyle, work and education factors

The materials and infrastructure element also played out as a driver for retirement through device battery lifespan. In recent years portable electronic devices have been fitted with batteries that are effectively non-replaceable. Many householders stated that they believed batteries have a life span of two to five years before they breakdown. These timeframes are relatively short compared with ten to 15 years ago when battery lifespan extended for five years

[25] As mentioned in Chapter 3, Part Two, I interviewed Mr Jupiter, an electronic device repairer to gain insights into the potential for electronic device-repairing to become a mainstream household activity as a strategy for minimising electronic material flows through households. Another reason for interviewing Mr Jupiter was to understand why individuals do not readily engage in device-repair activities to extend the life of their devices.

or more. There are however, several inter-related and converging factors making battery decline a driver for device retirement. Firstly, individuals once replaced batteries in their devices themselves and or had a service centre do the replacement, thereby reducing the need to retire a device. Two, the working life span of batteries are now claimed to be longer, which may well reflect the change from nickel to lithium-based batteries and the lack of understanding on how to maintain lithium-based batteries (Mr Jupiter and Shawn). Thirdly, batteries were historically removable parts whereas today they are manufactured permanently into the device, making it impossible to replace a battery and hence the need to retire a device completely unless a householder has the necessary skills and equipment (Mr Jupiter and Shawn).

7.2.2 Knowledge, skills and competencies renewal

Throughout this thesis the importance of the knowledge, skills and competencies element in a practice configuration, along with the knowledge, skills and competencies of the householder as a carrier has constantly been highlighted. It is also a factor that shapes device retirement. Retirement presents as an outcome of the abilities of householders to use devices and their associated infrastructure network. The data indicated that the longer householders had and used devices the more competent they became at using the device. This finding is not unsurprising and is consistent with the expected outcome of all competencies-based education practices.

However, what proved to be an interesting departure from this well-accepted perspective on the development of skills and competencies for using and retiring electronic devices were comments made by several householders that they retired their devices because they felt their device-operating competencies and skills had plateaued. That is, they felt insufficiently motivated by the familiarity of the "workings" of a device to continue with its use. They were now bored and were seeking greater technical use-challenges. Where this occurred, devices were retired purely to pursue the technical challenges associated with having a newer or different device. Some householders stated that this lack of technical challenge provided an excuse, a justification, to purchase a new device, an example of the new tool syndrome and the feelings of well-being gained through retail therapy. This issue was discussed in Chapter 2 with respect to the obsession of Australian households with consumption for consumption sake but illustrates the interconnection of different practices for the performance of each practice individually.

The role of the knowledge, skills and competencies element in enabling the repair and maintenance of electronic devices and supporting infrastructure was instrumental in influencing

device retirement practices (as flagged above). Clearly householders who had adequate and appropriate repair and maintenance skills were important for extending the operating life of devices — seeking to extend the life of other household goods and appliances, such as washing machines, is common practice and was discussed in Chapter 2. But, as nearly all householders considered that they did not possess the necessary knowledge, skills and competencies to repair and maintain their electronic devices, leaving them with the only option of retiring their existing devices and replacing them with new or better working devices. It is also feasible to argue that the embedding of knowledge, skills and competencies within devices, that are essential to enable the repair and maintenance of devices, has been a deliberate manufacturing strategy consistent with the phenomena of built-in obsolescence referred to in Chapter 2.

There were, however, a couple of exceptions to inadequate repair and maintenance skills and competencies. These occurred where householders worked either directly or indirectly with IT systems in their everyday lives and work activities. Often such householders were able to rectify many of their device performance problems, or if necessary, change hardware components of their devices to improve their performance and or run diagnostic tests on device software and operating systems. But even in these cases, there becomes a point where device retirement and replacement are evitable outcomes.

An interesting extension to this theme was the relatively unexpected finding that some householders employed professional, IT technicians, both mobile and in-shop front, to maintain their electronic devices and home information systems. These householders saw the associated expense as worth the cost relative to purchasing new devices. All acknowledged, however, that there is an inevitable point where a trade-off occurs cost wise between repair and maintenance costs and the price of a new device, especially when a new device may provide added functional and aesthetic extras compared with the current device.

7.2.3 Value and end of device usefulness

The meanings and understandings element attached to devices and incorporated into different practices is an important influence on the retirement of electronic devices within households. Four dimensions to this element were identified from the data. One dimension is the meanings and values householders placed on the need to minimise consumption (especially consumption for consumption sake) and waste generation; that is, they had an overall philosophical commitment to avoid and or reduce the consumption of all-things material in all aspects of their day-to-day living, not just portable electronic devices. For several of these householders, efforts

were made to extend the life of their electronic devices as much as possible prior to retiring and replacing their devices or, for that matter, any other good.

Another dimension of the meanings and understandings associated with device retirement was the value householders placed on electronic devices. This tied into the views expressed by some householders that devices are readily replaceable at a relatively low cost and once used, are valueless. This implies handling devices in a way that ensures their longevity — looking after them — is not a major concern or practice for these householders. Whilst this thinking was not commonplace across households it was one factor influencing device retirement and ultimately the electronic materials flow from households. One area or way this played out was through device misuse, resulting in the complete or partial functional breakdown of devices and, ultimately, their retirement. Interviews indicated that misuse happened in various ways, one of which was through negligence or lack of care when handling devices either in the workplace or with personal activities. The result was broken devices and enforced retirement.

Two examples are illustrative of this process. One is provided by Darren, a farmer who had broken his phones on numerous occasions by physically placing his phones on the tractor where they would slide-off and be driven over by the tractor. The second example is device breakage of an intentional nature as outlined by Kathleen. She described her experiences of young people she knew who had deliberately smashed their devices (mainly smartphones) to force one or the other parent to buy a new phone for them. Mr Jupiter, a repairer of electronic devices, reinforced the role of device mis-handling as a trigger for retiring devices:

> *The assumption is that once it doesn't work people will go out and buy a new one. So, I believe that over the years there has been a practice of not caring for your phone. For example, most people are not prepared to attach a hand-wrist strap to their phone to prevent dropping their phone …… and to avoid smashing the glass fronts on the phone or damaging the mechanics. (Mr Jupiter)*

Two other issues emerged during the discussion with households about the costs of new devices compared with repair costs. The first relates to the lack of incentives to look after current devices as Lloyd, a householder based in Swan Hill, explains:

> *Compared with me most of the people in my workplace would have a later model phone. I consciously look after my phone and hence have not really physically needed to replace it like other staff members and hence do not have the latest model phone. (Lloyd)*

Another dimension to the element of meanings and understandings is social status — cultural capital. This has already been discussed at length in previous chapters as an important driver for device acquisition and use. Considering this I restrict my discussion of social status and cultural

capital as factors influencing device retirement to one case. Suffice to say, social status and cultural capital are major factors contributing to device retirement and replacement.

Meanings and understandings attached to aesthetic considerations also act as drivers of device retirement. Here devices are retired, largely due to product-brand differentiation and the differences in appearances and the meanings householders place on the ambience and aesthetics of their devices and dwellings. One example is a household where a working personal computer desktop (PC^2) was retired to make way for an Apple product equivalent (IMAC), largely because of the Apple products aesthetics, ergonomics, simpler operating systems and streamlined inter-connectivity between devices. Figure 7-3 illustrates the aesthetic comparison of the exposed wiring and infrastructure of the two types of device brands.

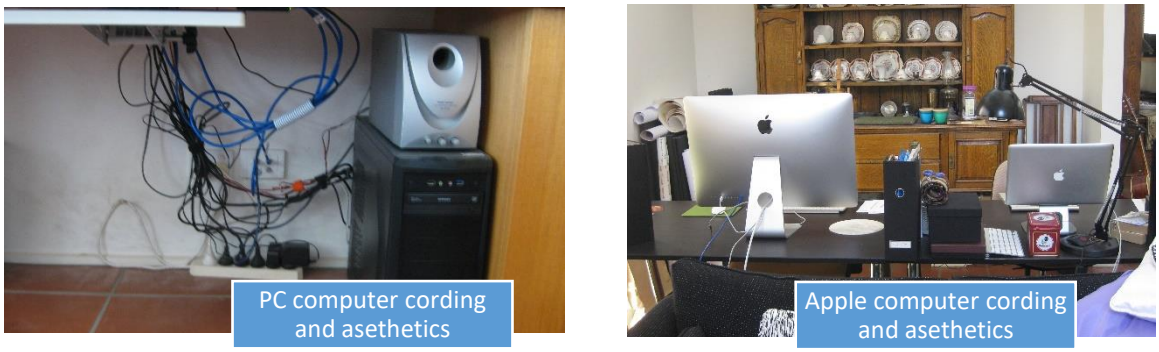


Figure 7-3: Brand aesthetics and ambience comparisons as device retirement triggers

7.2.4 Context as a retirement influencer

As I have argued in previous chapters, the context faced by an individual household member be that the external environment of a household or the internal environment of a household, plays an important part in the configuration and performance of everyday household practices. According to interview data the practice element of context and its various dimensions is a factor influencing retirement of electronic devices. For my analysis here, I focus predominantly on three dimensions: market conditions and consumer lock-in; poorly aligned resource costings; and, stage of life transitions.

Industry marketing campaigns are part and parcel of everyday life and straddle all areas of household consumption. Individuals and households are constantly pushed and respond to the pressure to consume. These conditions play out directly in the electronic device and information-communication sector, encouraging the consumption of additional products and services and or upgrade to new models (as indicated in Chapter 2). But the flip side is that the

sector places pressure on householders to retire their existing electronic devices to make way for the newer or different device. In both cases it establishes an economic and social environment whereby the material flow of devices through households is ramped up, surplus to needs (Gregson et al. 2007; Evans 2011, 2012 and 2018). These circumstances were described by nearly all households as factors in constantly retiring their existing devices for newer or different devices and increasing data usage. Some householders mentioned they had resisted marketing campaigns to retire their existing devices as discussed in Chapter 6 but this required awareness.

One of the most common contextual dimensions discussed by householders that drove retirement of devices was packaging and or bundling of one or more devices, a device blended with data usage or multiple data services, or multiple data services with different devices. For example, many households explained how the cost of their phone was built into the overall cost of the data service. As a result, the true cost of the phone was hidden from them. Further when such plans expired, most householders explained that they felt trapped in that the retirement of their existing device became inevitable as re-negotiating the contact involved upgrading to a new phone and or re-negotiating their data conditions. Michelle from Sydney illustrates this situation:

> *The purchase of phones and data allowances are closely interrelated. In 2013 I wanted to upgrade the internet allowance and to do this I was required to take on board a phone as part of the package. Previously phones were not tied to any data plan at all. It was the package that needed to be purchased not the discrete product. (Michelle)*

Another dimension, but relatively less common, is the obligation imposed by electronic device retailers on householders to retire their devices through promos and bonuses, even though their existing devices worked perfectly well and or there was no real need for other types of devices in their day-to-day living. As Michelle and Olivia, two householders living in Sydney explain in their respective comments:

> *The iPod was acquired for free as it was part of a package deal and promo when new models came out. (Michelle)*

> *For the tablet I didn't deliberately go out and buy it. It came with a package. At the time it was very opportune because I was setting up my own business …. (Olivia)*

Extending the theme of device costs. According to the data one key reason for retiring and replacing existing devices was because the cost of new devices is less than the cost of having existing devices repaired. Smaller portable electronic devices such as phones, iPods and tablets were the most common devices falling into this circumstance. Terrence and Kathleen provide insights into the process of retirement relative to repairing because of the costs involved. Their respective comments were:

> *They (computers and phones) are no longer functional for what we need them for, too slow and won't cope or support the graphics needed with the result there is a decline in definition. When it comes to this point and need more functionality find it is cheaper to get a new device rather than attempt to fix it. The other thing here is that the relative costs of new devices compared with purchase price of previous devices is always cheaper. (Terrence)*
>
> *The eldest son's laptop died by just sitting. He spent around $400 repairing it but it still didn't work. (Kathleen)*

Whilst these quotes highlight why householders choose to retire and replace devices because of device repair costs, it raises the issue of why new devices are less expensive than repairing an existing device that already has resource costs embedded within it. This issue was raised in Chapters 1 and 2 and is essentially due to how resources, and the production and supply of electronic products, are arranged through competitive market forces in response to profit-making objectives. Thus, as Reller et al. (2009) outlined, the cost of all things electronics, especially resource inputs do not reflect the full cost of resource creation and their processing, nor environmental consequences such as global warming.

The second issue, again raised by Mr Jupiter the electronic device repairer, is that because devices, especially phones and tablets, are now so entrenched in our personal and work activities it is virtually impossible to operate without them. In fact, from a work perspective there are costs associated with not having a device and to be without a device whilst it is repaired, is not a viable option — hence a mentality of "*if it doesn't work, replace it"* (Mr Jupiter). This theme is touched on above under meanings and understandings and is equally as relevant and applicable to supporting household social, economic and cultural capital outcomes.

Stage-of-life is another contextual factor driving device retirement in that the stage of life demographics of householders influences the retirement of devices because their existing devices no longer meet the needs associated with the changing circumstances of the householder. Six life-stage circumstances were identified from the data that shaped the retirement of devices by householders. These stages, along with a description of each stage, are presented in Table 7-2.

Changes in life-stage, circumstances varied considerably between households and was closely linked to when and why devices are retired. For example, transitioning from secondary school to tertiary education was a common device-retirement point. So too was the life-stage point of transitioning from tertiary education to the workforce and establishing an independent household.

Table 7-2: Characteristics of life stage transition points as drivers of device-retirement

Life stage	Key features	Number of households
Arrival of a baby	• Single or couple household with a newly arrived baby, especially a first child • Approximate age range: 25 – 37 years	2
Moving from primary to secondary schooling	• Stage roughly coincides with children becoming less reliant on parents for support to undertake daily activities • Approximate age range: 10 – 13 years	16
Transitioning from secondary school to tertiary education	• Usually involved student householder retiring an existing device • Primary objective of a device – portability and multifunctionality, with internet access • High levels of device and IC knowledge, skills and competencies • Increasing independence, both financially and socially • Approximate age range: 17 – 22 years	10
Transitioning to workforce participation and independent household	• In full time or part time employment • Not living at home and solely responsible for personal financial affairs and living arrangements • Setting up recently rented or purchased dwelling • Shift in priorities compared with studying e.g. social interaction, entertainment, work commitments and travel • Approximate age range: mid 20s to late 30s	3
Workforce retirement	• Had transitioned out of full or part time paid work • Have grandchildren • Involved in voluntary or similar activities • Frequently travel, especially overseas • As a household may include one member retired whilst the other member is continuing to work • Approximate age range: 55 – 75 years	9
Downsizing	• Downsizing the scale of the household dwelling such as transitioning from a standalone house to an apartment or flat • Frequently involves reducing material goods • Is not solely the domain of older households and includes households who downsize when children leave home • Approximate age range: 50 and ongoing	2

The demographic phenomena associated with stage-of-life transitions make further contributions to understanding household electronic materials flows other than acting as a driver for device retirement as discussed above. A re-examination of my discussions in, and findings from, Chapters 4, 5 and 6 in their totality demonstrates that stage-of-life is a common phenomenon occurring across each of the domains in which devices are used: social and economic capacity; leisure and entertainment; and cultural capital. As contextual factors therefore, the phenomena shape how and why devices are used in each of these domains. In

doing so, they demonstrate that differences in device-use occurs according to stage-of-life and between households due to households being at different points on the life-stage transition spectrum.

One further finding relates to the influence of stage-of-life on the complete cycle of electronic material flows in households, which is critical for understanding electronic material flows through households. Stage-of-life dimensions are a major driver of the movement of electronic devices covering acquisition, use and retirement and ultimately divestment. This is because, with every acquisition as part of a life-stage transition, comes retirement of at least one device, compounding an ever-expanding volume of retired devices in households. Thus, reinforcing the interconnection and feedback loops between device acquisition, use, retirement and ultimately divestment of retired devices from a household dwelling.

7.2.5 Device retirement practice: Summary

The analysis in this section has demonstrated that each practice element and its associated dimensions shape the retirement by householders of devices and that there are strong overlaps between each of the elements that lead to how retirement practices are configured as represented in Figure 7-4. However, it was also clear that retirement is closely linked to the performance of practices supporting the outcomes of social and economic capacity; leisure and entertainment; and, cultural capital.

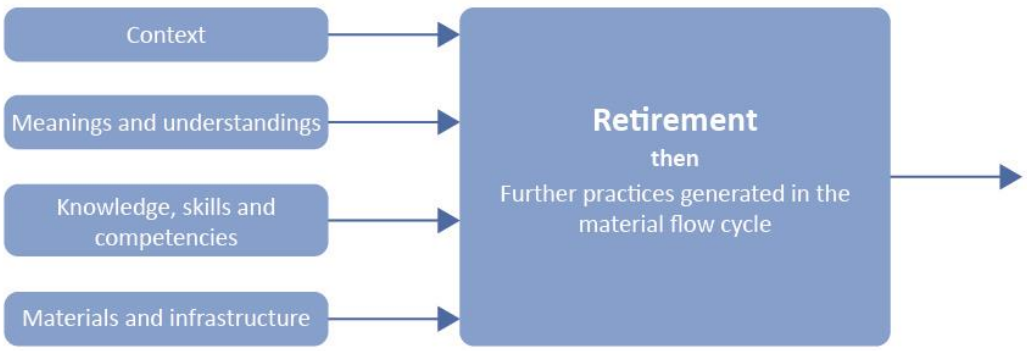


Figure 7-4: Retirement practice and its configuration of elements

7.3 Handling processes post retirement

This thesis thus far has argued that households and individual householders use portable electronic devices in practices that enable them to pursue the objectives associated with the household domains of social and economic capacity, leisure and entertainment, and cultural capital. These objectives are largely individualistic in action and are consistent with, and reflect

the discussion in Chapters 1 and 2, whereby households and householders exist in a system centred on a capitalist-profit making ethos and individuals and on households taking greater responsibilities for meeting their day-to-day living needs.

As discussed in Chapter 2, the economic and political system shapes many aspects of the arrangements in the IC System and other social and economic arrangements in society. In doing so, it sets up an environment where households respond to those arrangements through the practices in which they engage day-to-day. This same argument applies to the above section on retirement. Here the practice of retirement reflects a rationale that is individualistic and household outcome focused. Thus, I argue that the engagement by householders in the different practices of day-to-day life is the central driving force to the flow of portable electronic devices from point of entry into households and their uptake by householders, up to and including retirement.

In contrast, with respect to practices linked to transition points four and five (Figure 7-1) of the household electronic material flow, I argue that these are orientated towards resource sustainability and society objectives rather than being individualistically orientated. This results in a disconnection in the material flow process within households between transition points one, two and three and transition points four and five, which causes a lack of effective device post-retirement handling practices. This leads ultimately to ineffective device divestment and capturing practices for electronic materials re-processing. This issue is now considered in more detail.

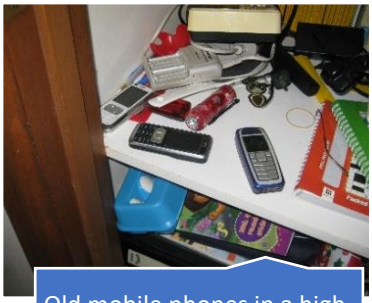
Currently, many different waste management practices are performed in society, many of which involve households and householders as the carriers of the practices, including re-use of, for example plastic bags and green waste, the recycling of different materials (such as paper and aluminium) and to a lesser extent waste reduction. My interview data, along with the e-waste literature and industry surveys, indicate that only limited post retirement device handling practices are performed within households. This allows considerable amounts of e-waste, a valuable resource, to go uncaptured and the overall electronic material flows within households to be minimised (Chapter 3 and Figure 7-1 above). This raises the question of what post retirement device handling practices are being performed in households and how? A second and corollary question is what factors contribute to households limited engagement in post-retirement practices? These questions are addressed in the remainder of this section and section 7.4.

7.3.1 In-situ accumulation

All households had accumulated retired portable electronic devices within the house and, by implication, had stagnated the electronic material flow in households. Huge variations existed across households as to the extent of this accumulation, with one or two households accumulating only a few devices, others had retired many devices without accumulating them, whilst other households had considerable stocks of retired electronic devices. Differences existed too, across households around how long devices had been accumulating, what devices were accumulated and what devices were dispensed with.

Differences in accumulation across households reflected the historical embedding of devices within household practices and the period of that embedding. For example, one or two householders were at a point where only a couple of devices had been used (that is, the inflow of devices into households was low), with the associated device accumulation occurring over more recent times and limited to a small number of devices. In other households, the use of electronic devices had been occurring for 30 years and, when combined with the number of devices used and retired, had led to significant device stocks in the accumulation phase of the materials cycle of electronics. Accordingly, it is extremely difficult to understand the accumulation process across all Australian households, including across the households involved in this research, a situation which is compounded by the difficulty of needing to rely on the memory recall of householders. Any program therefore aimed at changing existing household accumulation practices will need to be cognisant of this issue.

So what devices were households accumulating? The most prolific device accumulated is the mobile phone, especially pre-smartphones, although there was evidence that many smartphones were being accumulated as well. Examples of phone accumulations are shown in Figure 7-5. IPods, laptops, desktops and gaming machines were also accumulated. However, there was no evidence of the accumulation of e-readers and tablets. Additionally, and based on personal observations, the accumulation of electronic devices extended well beyond portable electronic communication devices. It included a huge range of goods used for all-things household and personal and covered hair dryers, digital measuring equipment, shavers, electronic toothbrushes, kettles and electronic power tools. As a couple of householders suggested, everything today has electronic componentry and hence all contain valuable resources and so all should be treated the same. This is consistent with an argument put forward in its proposed e-waste management strategy for Victoria by the Victorian Government (DELWP 2017)



Old mobile phones in a high-use cupboard

Collection of retired phones in bedroom wardrope

Early mobile phones

Figure 7-5: Examples of phone accumulations

By far the most all invasive presence of accumulation were peripherals, the supporting materials associated with the various devices. Many households explained that often these materials accumulated, often unused because they replicated supporting materials in previous devices and hence were readily transferable across to the new device. Compounding the situation was that these materials became disassociated with the primary device that they supported, making awareness of where they were stored a challenge. Such materials include battery charging cords, device charging beds, connecting cords, modems, printers and gaming machines. A sample of the accumulation of these supporting materials and devices found within households are shown in Figure 7-6.

One Melbourne household case study provides a unique insight into how some households engage in the accumulation practice. This household had developed a structured process for handling their household retired devices in-situ and which is accompanied by — at least with the intention of — undertaking a staged device-exiting process. In this household retired devices initially go into the spare room, lying anywhere and on anything. Then, depending on size they are boxed into containers (smaller devices) and stored on shelves in the laundry where they could sit indefinitely. Larger devices were boxed up (such as the printer) and are eventually stored in the garage. Alternatively, they have been dismantled for parts to be used in home-made electronic devices. The remaining dismantled materials go into the domestic waste bin.

Larger devices are less in number and are also taken to the local government waste transfer station.

Figure 7-6: A sample of accumulated electronic materials and devices

A popular belief and one promoted by industry groups, such as MobileMuster, is that devices are stashed in common and favourite places, such as drawers within households and that these are consistent across households (Golev et al. 2016; AMTA 2016; Deloitte 2017). Thus, as part of my research I was keen to understand if this was the case. Based on the interviews and my observations this did not transpire. Rather there was considerable variation of in-situ accumulation sites across households, with any place and any spot having the potential to become an accumulation site.

There was, however, one common feature that was largely consistent across households. Devices were accumulated and stored within the house, rather than in an outside space. Accumulation sites were wide ranging and included, the laundry, occupied bedrooms and bedside drawers, unoccupied bedrooms and wardrobes, hallways and living area cupboards, office desks and generally anywhere where there was a flat surface. In one household many retired devices and peripherals were in an attic. Surprisingly I found retired devices and support materials accumulation occurred on household floors — there were at least 10 households where this occurred. Examples of in-situ accumulated devices are illustrated in Figure 7-7 below.

Figure 7-7: Examples of in-situ accumulation of electronic devices and materials

There were exceptions to this common practice of retired devices accumulating within houses. For example, one householder was accumulating and storing all the household mobile phones in the garage as a collection. In another, older mobile phones were stored in a detached shed, shown in Figure 7-8 below. In this case the storage was acting as a staging post in readiness for the retired devices (along with other household goods) to be sold at a garage sale or a stall at a nearby trash and treasure. In a further instance, retired mobile phones had been packed into boxes and stored in a commercial storage facility whilst the householder's small, inner city apartment was being renovated. Overall, my observations were that desktops were accumulated in garages, largely due to the size, with laptops and phones accumulated within the main house.

Another issue I sought to gain a greater understanding of was the length of time electronic devices were accumulated within households before being dispensed with back into the active materials cycle. Based on my analysis there was considerable variation across households over how long retired devices had been accumulating. For some householders the accumulation of retired phones had been for one to two years. In these instances, the devices had been retained as an insurance policy in case the current phone was lost. For other householders and based on the age of phone models observed, accumulation had been going on for five to ten years,

perhaps more. Laptops, desktops and gaming boxes were also accumulated by households for periods that were often much greater than a year.

Garden shed used for household goods storage, including old phones

Figure 7-8: Storage of old mobile phones in detached shed, prior to Trash and Treasure market selling

7.3.2 Recirculation

Recirculation was another handling pathway practice many households engaged with through a variety of ways, effectively maintaining an active electronic material flow. One method of recirculation was either handing-on or handing-down. Families commonly used this, with parents handing devices onto their children, partners handing devices to partners (a less common practice) and adult children handing on their devices to one or both parents. Table 7-3 gives examples of comments made by householders of their experiences with this method.

An important outcome of adopting this method of divestment and acquisition for householders were the flow-on benefits. Specifically, the handing on of devices often enabled older parents to acquire their first mobile phone and or smartphone or, enabled a child to introduce a parent to a specific brand or device such as a tablet. In effect it was a knowledge, skills and competencies building exercise for the recipient, prior to acquiring a new device. But in other circumstances

handing-on and handing-down was clearly related to affordability, a contextual factor discussed earlier in Chapter 4. In some cases, it related to philosophical positioning around the need to minimise consumption of goods, a dimension of the meanings and understandings element also discussed earlier with respect to retirement of devices.

Table 7-3: Householders experiences of handing on and down of devices

Hand-ons and hand-downs		
What becomes part of how we use devices within the household. We do alot of hand-downs or hand-ons, particularly from me to the children. (Leslie)	*Within this household and family the main practice is re-gifting of phones. usually the re-gifting is among family members. As I am part of a large extended family there is always someone to hand a phone onto. Young people will take anything if it is free. (Erika)*	*Most of the phones I have had over the years have been hand-downs - hand-downs from the children and Gloria. So whilst I don't get brand new phones I do get new phones quite regularly. They are just not brand new ones. (Randell)*

A second recirculation practice was householders on-selling their retired devices. This was a relatively uncommon practice amongst the householders interviewed. It involved some form of monetary exchange and occurred through personal-social networks, cash-based markets such as trash and treasure markets, and more formalised markets such as Mozilla and the Apple buy-back business. Jenna describes this type of market and activity in the following:

> *… the North Beaches Buy and Sell Markets — have explored these as a way of buying and selling devices and are keen on using this option wherever it is possible but would like some payment for the goods. (Jenna)*

Annette provides a slightly different take on this theme of goods exchange. Annette lives in South Australia which has container deposit legislation. Her example links issues of affordability and income with contextual issues, such as government and industry recycling strategies which are factors external to Annette's household. In Annette's case she holds onto her retired devices until she has a reasonable quantity and then barter-exchanges these with a family member for his aluminium cans. She then collects the return deposit on the cans. Meanwhile the family member sources his own cash payments for the electronic devices and or other electronic waste.

A third recirculation method is dismantling and reconfiguring devices. Like on-selling this method was relatively uncommon across households, although it was prevalent for laptops and

desktops and involved either the partial or full dismantling of the devices. This enabled the devices to be reconfigured or re-built according to householder needs. In some situations, this involved the building of alternative purpose devices from the parts (see Figure 7-9 below). Where this activity was completed it was frequently undertaken by male household members, who had an interest in electronic device technology. As Randell, a retired person from Melbourne explains:

> *My old laptop. I am reconfiguring this to support my train set hobby and I will use it to operate the signal system for the train system. (Randell)*

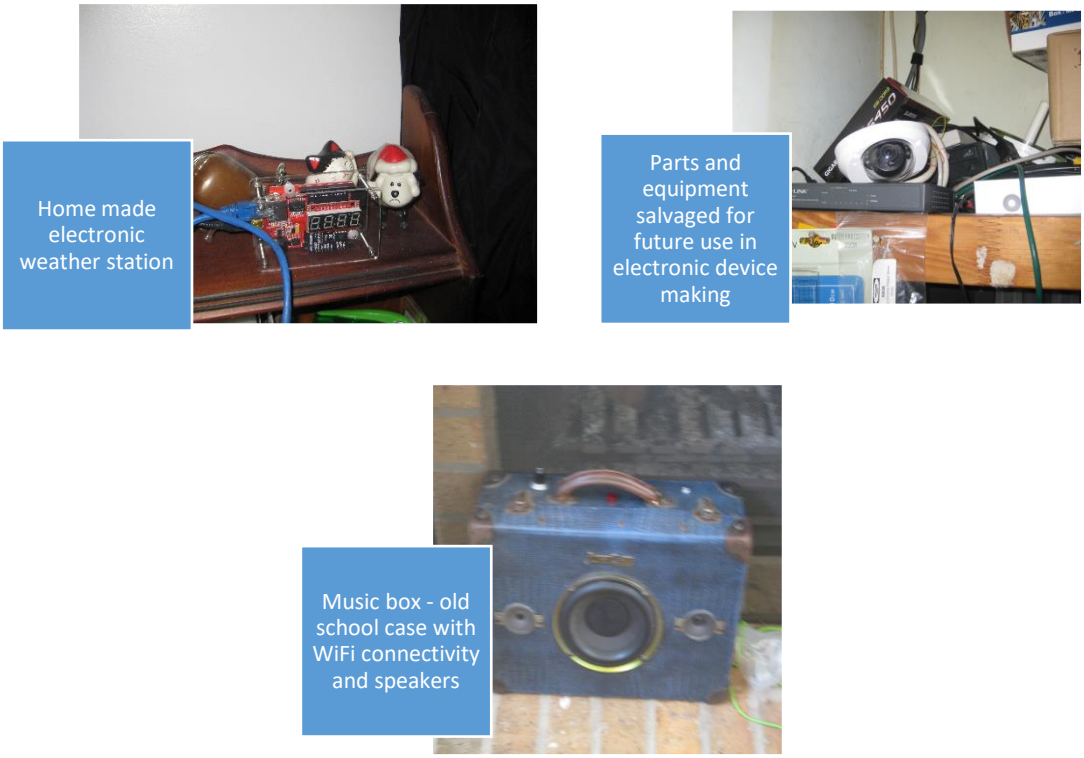


Figure 7-9: Electronic materials salvaged and examples of reconstructed devices from electronic parts and materials

The last recirculation method to manage the retirement of devices was gifting such as to community groups, like Men's Sheds. This practice was commonly linked to laptops and desktops and frequently involved the devices being re-conditioned by the receiver prior to the devices being used again. As Erika explains here:

> *For the old desktops. These have gone to the local Men's Shed. Or twice a year Council offers a service to hand in your desktop, which are then re-conditioned and provided to community groups. (Erika)*

Gifting of good working but superfluous devices was also a practice undertaken by families for special purposes. This involved giving a family member, on a special occasion, a device as a present. As Jean explains:

> *The laptop was a birthday present from my son. Now I really value the portability and mobility of the laptop. (Jean)*

7.3.3 Recycling pathway

Recycling is another pathway practice householders engaged with as a way of handling their retired devices. It involved householders voluntarily dropping-off and or sending in their devices to external third-party electronic waste recycling facilitators. Success of the practice is dependent on householders having knowledge that this option exists and about where to go to access the service. Based on my data many households engaged in the practice. But only seven householders indicated that they engaged in this practice (seven out of 36 households), suggesting the contribution of the knowledge, skills and competencies element was limited.[26] This is consistent with surveys from industry groups such as MobileMuster and other research (AMTA 2016; ACMA 2017; Golev et al. 2016). Yet, it is this practice that is likely to provide the best avenue for recovering household electronic material stocks and returning these to the broader electronic material system.

For householders engaging in recycling practices various approaches were adopted. One involved industry sponsored recycling drop-off facilities and was commonly used for mobile phones. Facilities included those provided by organisations such as Officeworks, Australia Post and Telstra. According to some householders Officeworks also provided facilities for dropping-off devices such as printers, faxes and laptops for recycling. Such facilities acted as an incentive for these householders to drop-off many of their electronic devices for recycling.

One variant of this recycling practice was the use by two households of small business shopfronts as drop-off points. These were information technology service based-businesses, including reconditioning and repairing electronic devices (mainly laptops and desktops) and or the on-selling of devices. These businesses, according to the householders, already had a process for dispensing with the electronic waste materials they generated and acquired. It was

[26] The incidence of recycling of all electronic devices across all households was extremely low. Of the seven households who mentioned they had recycled devices four were Adelaide households, two Melbourne, one Sydney and none in Swan Hill. This suggests that Adelaide households may have a greater awareness of the importance of recycling compared with households in the other regions and which may reflect the influence of South Australia's container deposit legislation and its impact on the preparedness of households to recycle.

this capacity that the householders were tapping into, without seeking payment from the business or imposing any disposal cost onto the business. As Leon explains:

> *When it comes time to get rid of the laptop we will recycle it to our friend who runs a business repairing devices and IT systems for householders. This means that they can also have all their data and information transferred by professionals. (Leon)*

Mail services were also used by several householders as a way of placing their retired devices into the electronic recycling stream, hence materials flow cycle. This was principally used for mobile phones, with MobileMuster envelopes used in some instances. Interesting, the uptake of this technique by householders interviewed was not all that extensive. In addition to the MobileMuster supplied envelopes, some householders used mailing services as a way of sending in their retired devices to commercial organisations for payment. The proviso here was that the devices needed to be well-looked after and still operating effectively, suggesting that this practice was more aligned to device re-use after the re-conditioning of devices. Mozilla was one such example.

A couple of householders expanded on this theme of mailing and on-line transactions as a recycling practice. These householders explained how they had purchased electronic devices through on-line facilities but, in the process, had missed out on the option of handing in their retired devices physically. The on-line stores did not offer the option of accepting retired devices. Consequently, the householders were left with the issue of how best to handle their retired devices. The result was that these households either had to physically store their old devices and or dispense with them through their own initiatives. This indicates that on-line purchasing makes the recycling process less streamlined and less convenient from a householder's perspective.

A final practice available to householders for the divesting of their devices into the recycling stream was "handing in at the time of acquisition". Many householders discussed that they had used in-store drop off facilities to dispense with their retired device when acquiring a new device. However, many householders also expressed hesitation at the prospect of using these facilities. As to why this hesitancy? Two potential explanations were discussed. The first, relates to the concerns of householders over personal data security and privacy. The second is that householders chose to hold onto the device for future hand-on, re-sell or back-up purposes.

7.3.4 Intentional binning

The final post retired device pathway used by households was intentional binning into the mainstream domestic waste collection system, resulting in electronic materials being lost from

the materials flow cycle (Figure 1-1, Chapter 1). Many householders opening stated that they engaged in this practice.[27] A range of devices from phones — both pre and post smartphone — old digital cameras through to desktops, gaming consoles, device componentry parts and batteries (following the dismantling of a device), were all dumped into household rubbish bins. This situation is reinforced by Jenna's comment:

> *.. my sister is always breaking her phones and so is always acquiring replacement ones and always chucks the broken ones into the mainstream household waste bin because they could not be on-sold. (Jenna)*

7.4 Disengagement and divestment

The discussion above demonstrated that capturing retired electronic devices from households to provide future electronic resource stocks is less than successful. Given this, along with the social imperative to maximise the capturing of these resource stocks and hence minimise the outflow of materials, this section investigates what factors discourage the engagement of householders in electronic device divestment practices. Four themes were identified from the data to explain the limited engagement by households and householders in divestment practices. These closely align to the four practice elements and, as such, the following analysis is grouped around each of these elements. I commence with contextual factors as an explanation.

7.4.1 Contextual arrangements as discouragement

Based on the interview data there are various contextual based factors that discouraged divestment practices. One is risk management. This played out in a variety of ways, external to households, including the lack of transparency in how divestment and recycling practices are conducted. Several householders expressed concerns with the overall ethical, moral and social justice dimensions of electronic device divestment and recycling. Consequently, they did not participate in any recycling scheme that could compromise the achievement of these social aspirations. This was particularly so where there was insufficient information available to householders as to how these practices were conducted and whether they accorded with the prevailing ethical, moral and social justice principles.

Specifically, some householders raised concerns that devices, once handed in for re-use or recycling through channels such as MobileMuster or Officeworks could end up in third world countries. These concerns then extended to once there, the devices would be sorted, and the precious metals extracted, by exploited and low-paid workers. Additionally, householders

[27] But I also felt that many householders had used the mainstream domestic rubbish collection for their devices. But at the time of the interview chose not to engage on this topic. Most likely, I believe it was not discussed because of feelings of guilt on the part of householders.

expressed concerns that precious metal extraction techniques were primitive, leading to workers inhaling toxic fumes, with the ultimate consequence of serious long-term ill-health issues or worst still death for these workers.

Because of this lack of transparency some householders chose to hold onto their devices, albeit that they added to their household stocks of electronic devices. In the case of these householders they were only prepared to participate in the recycling process if it were more transparent and respectful of the treatment of workers. If these aspects were met, they would then readily dispense with their retired devices. On top of these concerns some householders believed that sorting and extraction operations for recycling portable electronic devices should be completed within Australia. This was because of the more rigorous environmental regulations and workplace occupational health and safety conditions that are in place in Australia. Further, they argued having the recycling activities located on-shore would generate employment opportunities for Australians.

Risk of harm also played out around the lack of guarantee by organisations on the protection of personal data security and privacy embedded within electronic devices. This was a constant issue raised by most householders. However, this lack of guarantee on data security and privacy presents as an interesting contradiction for householders. Some householders flagged that our society is based on the premise of privacy and protection of individual rights — hence their reluctance to dispense with devices. Yet most of these householders (as with most members of society I would argue) have set up internet and data accounts and constantly access and use the internet, especially social media platforms. By their participation in such activities, householders have willingly giving up personal and household private information to organisations and unknown third parties.[28]

Using privacy and data security reasons to justify not dispensing with electronic devices raises other issues too. For instance, hacking and scam activities targeting householders are now common. Further corporations, governments and government agencies can access personal data, albeit through third-party providers and the growing commercial data markets. Recent events regarding the sharing and selling of people's information by Facebook to Cambridge Analytica (2018), who then on-sold the data to other business and nations, such as Russia and the United States Republican Party, all without people's prior knowledge, demonstrates the

[28] There is legislation in Australia limiting the exchange of personal data, especially to third parties. Protection wise this requires ongoing monitoring and policing by the relevant regulatory authority for it to be effective.

uncertainty around the protection afforded to personal details and data. Yet people willingly participate in and share their information on social media platforms such as Facebook, suggesting there are other, more profound reasons why householders are not dispensing with their electronic devices rather than data security concerns. I pick up again on this point shortly in the context of skills and competencies.

Another dimension to risk management is the lack of clarity around e-waste governance arrangements and who is responsible for electronic waste management across the different levels of Australia's jurisdictions and how these levels interact with each other. Except for Annette who participated in cash for recyclables in South Australia all households raised the issue of "who is responsible" for the management of electronic waste in their immediate household area. More specifically, householders wanted greater and more readily available information on who is responsible, what electronic devices and materials go where and, importantly, where the drop off points are located. All householders indicated that this type of information is inadequate — even after they had spent time doing web searches on the topic. As householders suggested, the information that is available is usually not targeted adequately for specific devices and associated peripherals. This differs significantly from the level of information available for other recyclable materials such as paper, metals and plastics where the amount of information is extensive and easily accessible.[29]

Householders making these comments went on to explain that, historically, local government has been a major provider of capacity building activities for residents as well as being the operational agent for local recycling services. These arrangements do not apply to household electronics, leaving many householders interviewed with feelings of confusion. They were unable to identify the right course of action for their electronic device divestment and recycling practices. Confusion, and therefore, lack of clarity on responsibility, is one factor limiting household participation in electronic device recycling. Householders also relayed that specific recycling programs such as MobileMuster and the Officeworks drop-off points do not have a sufficiently high public profile to influence participation in device divestment practices.

Another dimension to the contextual factors influencing the engagement of householders in divestment and recycling are those that play out within households themselves. One such factor is household mobility. This factor was alluded to in Chapter 2 as a reason why or why not

[29] Information on recycling plastics is an interesting case as from late 2017 China has imposed bans on poorly sorted, unclean and contaminated plastics imports from countries such as Australia. How waste plastics would be managed in the future is uncertain, thus the information available to guide households will likely need to be changed, too.

households participate in accumulation, recycling and divestment practices. To illustrate some households had moved premises in recent years and used the opportunity to divest retired electronic devices that had accumulated within their existing house. For these householders it was only by having to sort through stuff for packing and moving that they gained a full appreciation of the number of devices that they had accumulated.

This same theme surfaced in the case of one household involved in downsizing into a retirement unit and in other cases that had moved internationally. In these cases, householders stated that in sorting and packing they realised it was impossible to take everything with you — especially the stuff no longer being used such as electronic devices. Further, Australian standards for electronic devices are not necessarily compatible with the standards of overseas country to which you are moving (and vice versa), leaving the only option to divest devices. The question then becomes, how? Several of these households indicated that, for convenience, electronic devices were dispensed with through the mainstream domestic waste stream, destined for landfill.

Another household-level factor influencing household engagement in divestment practices is household dwelling size. I began this research with an assumption that larger household dwellings would encourage the accumulation of devices rather than encourage divestment practices. Based on my data the accumulation of electronic devices, and subsequent limited divestment of devices, is more common within freestanding dwellings with at least three bedrooms and attached garages. Some accumulation and lack of divestment was also apparent in larger apartment-unit dwellings. Little evidence of accumulation was found in households living in flats. Thus, I argue that dwelling size is a factor influencing accumulation of retired devices and the incidence of device divestment.

As mentioned earlier in this thesis nearly all household members now have at least one portable electronic device. This implies that each member takes on the ownership arrangements for their individual devices and, in theory, are responsible for device retirement and replacement as well as accumulation (or not) and divestment. This contrasts with ownership arrangements for other household devices and appliances such as televisions and desktop computers where ownership is joint and shared and the domain of the household's primary decision maker/s. Accordingly, it is more difficult to manage divestment of all electronic devices within a household, resulting in ad hoc and most likely (based on personal observations of many households) limited joint-participation in device divestment practices.

In these circumstances there is arguably a lack of clarity around divestment and recycling responsibilities (discussed above) being played out at the household level. The data also demonstrated that this situation is compounded by the influence of stage-of-life transition, such as the transition from late secondary school to higher education, or the completion of higher education, where household members are taking on greater responsibilities for their individual day-to-day life yet are still residing in the same household.

7.4.2 Time, household clutter and ascribed meanings

In each of the earlier analysis chapters it was demonstrated that managing time effectively is an important objective of households and householders. Portable electronic devices provide the quintessential tool for this purpose. As time is a scarce commodity for households and householders (Maher et al. 2008), many householders explained that putting aside time to handle devices that are not included in mainstream household kerbside waste collection was not a high priority for them. I propose, therefore, that these householders placed greater value and meaning on meeting their everyday life needs rather than orchestrating device divestment and recycling practices — that is their preparedness to act as a carrier of divestment and recycling practices. This scenario is consistent with the thesis of Beck and Beck-Gernsheim (2002) that in recent decades individual priorities are the centre of day-to-day living rather than common interests — the phenomena of individualisation.

The interview information indicated that the participation of householders in divestment and recycling practices was limited by the time lag with acquisition. This existed where there is a time lag of approximately two years or more from the period of device acquisition to the point of device retirement and the subsequent need to dispense with devices; that is, there is a time separation between the practices on the transition points on the material flow cycle. This differs markedly from other household material waste management such as metals, paper and plastics where the time between the consumption-use point and placing a device into the recycling stream occurs within short periods of time, certainly not years.

Based on my observations there are variations across households regarding electronic materials and other forms of household clutter. Some households presented as clean, uncluttered and highly functional environments. In others, the opposite conditions applied — there was considerable mess, clutter and less of a clinical environment. Figure 7-10 provides an illustration of these differences across households. It should be noted that it is not my intention here to make judgements on which arrangements are more appropriate.

Figure 7-10: Comparison of households' mess, clutter and functionality

Clearly there were differences between the meanings households attached to their material ways of living and maintaining a household environment. For me the point of interest was whether the tolerance of householders of material mess and clutter influenced divestment practices. Overall, my observations indicated that households with more mess and clutter and, hence, more tolerance towards this type of environment participated less in retired device divestment and recycling practices. Furthermore, and a somewhat unexpected finding, was that, because electronic devices were perceived as clean materials, there was no real urgency to dispense with them, compared with other household waste materials such as pet food tins or milk containers.

7.4.3 Materiality differences and size

I will now build on the issue of perceptions (meanings) associated with "clean" compared with "dirty" waste and how this impacts on the immediacy for dispensing with electronic devices as part of day-to-day living. Clearly, households believed that there was no imperative to dispose of devices for hygiene reasons, compared with say pet food tins. Thus, the cleanliness of devices, acts to detract from the pressure to divest devices, with many householders perceiving electronic devices as different from mainstream waste. Other differences between the two types of waste stream systems were also noted.

To explain further the five main materials disposed of through household recycling systems are glass, metals, paper and cardboard, plastics and aluminium. All of which are consolidated into

the one material at the start of their manufacturing process — that is, at the beginning of their recycling process they are not de-constructed into their constituent parts, making the recycling process relatively simple. For portable electronic devices the scenario is different. Electronic devices are composed of multiple elements, metals and components, as a result sit outside this main household materials recycling system. Consequently householders, as recycling agents, are required to undertake a separate process for these devices — a process that imposes costs on individual households in the form of having to undertake deliberate recycling practices for external practitioners. Rather than incur such costs, several householders discussed that they were prepared to hold onto their devices until an opportunity arose for them to dispense with the devices without incurring time or monetary costs.

Materially electronic devices, especially phones, iPod, e-readers and tablets, are one of the smallest electronic devices/appliances found within households. Because of this they can go anywhere, be used anywhere, be dumped anywhere, leading to them being found in all areas of a home. Compounding this further is their size, which makes them almost invisible amid all other household stuff, ending up in unnoticeable and out of the way niches of a home as demonstrated by the various images in Figures 7-7 and 7-10 above. In these circumstances the presence of portable electronic devices is forgotten — that is, out of sight and out of mind. Further, even with multiple devices, size is so insignificant that the devices do not directly impact on the quality of the day-to-day living experiences of householders and other household practices. Device size is, therefore, not a major fact in driving households to engage with divestment and recycling practices.

7.4.4 Skills and competencies shortfalls

In the above I have demonstrated that households have limited engagement in electronic device divestment and recycling practices. Throughout the discussion it has been assumed that households and householders have the necessary skills and competencies to act as carriers of divestment and recycling practices. More importantly, that current e-waste management systems for households operate on the basis that householders do in fact, have the necessary skills and competencies required. Drawing on the data I argue that this is not the case for both divestment and recycling. Certainly, as I have indicated above householders are keen to gain more information on how to divest and recycle electronic devices. But this has not translated to householders having the necessary skills and competencies to initiate divestment and recycling practices for their electronic devices, as demonstrated by the large numbers of devices accumulating in households.

For example, many householders did not fully understand the distinction between device memory cards and SIM cards. Further still they lacked the necessary skills to personally cleanse data off the memory card of the devices as well as how to manage SIM cards. For example, several householders explained that all they thought was necessary to clear data from a personal electronic device was to remove the SIM card from their phone. What many did not know was the need to access the factory settings of their devices and, from there, delete their data. The important message here, from a device capture perspective, is that the skills and competencies of householders in this area are inadequate and, if enhanced, householders would then be able to cleanse their personal data from their devices and hand them in for recycling. This would help overcome the personal data and privacy concerns of householders discussed above as a rationale for not divesting their devices.

7.5 Conclusion

This chapter focused on transition points three, four and five, of the electronic material flows in households (Figure 7-1). It had three objectives, namely to understand how and why electronic devices are retired from day-to-day use; what handling processes of retired devices occur within households; and what factors influence divestment practices within households. In doing so, the chapter diverged analytically from the previous chapters. It adopted a practice entity analysis, based specifically on the four practice elements and their associated dimensions. In addition, it built on the assumption that practices involved in transition points one to two, and to three, are all centred on the achievement of individual household and personal outcomes. By comparison, the practices in transition points four and five are more societally orientated, with limited benefits (meanings) for households and householders to act as carriers of these practices.

To recap. Retirement practices are performed in all households. The scope of those practices varied across households and householders, time, devices and rationale. Phones were the most common device retired. Each of the practice elements, materials and infrastructure, context, meanings and understandings and knowledge, skills and competencies all contributed to device retirement practices.

Once retired, devices within households followed one of four pathways — with cross-over between each — in how households handle them. In-situ accumulation of devices is the most common practice across households, informed by the contextual factors of household mobility, dwelling size, device type and size and stage-of-life. Generally, households and householders are not engaged in divestment practices, resulting in considerable amounts of devices and peripherals accumulating in the households involved in this research. Households and

householders are largely disengaged as carriers of divestment practices, hence accumulation. Accumulation and divestment practices did vary across households, but the extent of those differences was relatively minor. The limited participation of households and householders in divestment practices is linked to the combined effects of the configuration of the four practice elements that discourage householders to act as carriers of the practices — no single element is a stand-alone factor. Furthermore, retirement and divestment practices have embedded within them the effects of use-practices, which again restrict the performance of post-use practices.

In addition to this broad finding, four specific findings were made. The first is that each of the elements in a practice, including their associated dimensions, influence the configuration and hence performance of practices, with performance varying considerably across households and householders and over time. This suggests any program to encourage greater capturing of retired electronic devices would need to take a flexible approach to reconfiguring current household practices, especially divestment practices. Furthermore, the approach would need to accommodate time and place dimensions to enable continuous feedback and interaction processes between practice elements and between different practices.

Secondly technological change, both soft and hardware changes, are an important driver of device retirement, including device substitution, switching and upgrading practices. These, in many circumstances, are locked in by information communication business practices as well as the need of households and householders to have reliable and functional devices to participate in society. Additionally, it was demonstrated that technological change had a close interrelationship with a need to enhance the, knowledge, skills and competencies element.

Thirdly, there are clearly contextual factors, external to households that drive device retirement, how these devices are handled and the inclinations of householders to participate in divestment practices, especially recycling. Monetary value attached to retired devices and the limited availability of shop-fronts for depositing retired devices are two such factors.

Finally, the extent of device accumulation in households involved in this research is extensive. Such accumulation, I would argue is likely to become even more pronounced with the ever-increasing arrival of new and different household electronic devices, along with all their peripheral equipment. The inability to capture electronic devices, in all their forms, is a lost opportunity to build electronic material stocks for future re-processing and, hence contribute to more sustainable resource use.

8. Conclusion

This conclusion chapter begins with a reflection on the research journey and then articulates the key findings from this research. It is followed by a discussion of the implications arising from these findings, including suggestions for future research. Finally, it sets out the key contributions of this thesis to its field of study.

8.1 Overview

The fundamental research problem addressed by this research is that current electronic material flows are unsustainable. From a materials, energy and resources perspective the extent and rate of consumption of electronic devices, along with their accumulation after retirement, makes them particularly unsustainable (Chapters 1, 3 and 7 and Figures 1-1, 1-2 and 3-1). This situation is compounded by the loss of household electronic device stocks for future re-processing. The research also addressed the corollary problem: how to reduce electronic material flows towards more sustainable levels?

As I demonstrated throughout the thesis, portable electronic devices are now firmly embedded in all aspects of the lives of people. They are therefore, essential tools for everyday life, propelling the production and consumption of electronic devices and driving ever-increasing electronic material flows. The thesis built on the premise that households are the primary place for electronic device use in everyday life and the primary place where electronic material flows occur. The thesis used 36 diverse households as the site of qualitative analysis for investigating how and why Australian households acquire, use, retire and divest portable electronic devices in their everyday lives and why.

Using a social practice theoretical framework, households are viewed in the analysis as carriers of practices. This approach allowed me to gain a greater understanding of the interaction between households and portable electronic devices through investigating the nuances and dynamics of everyday life, especially household activities involving portable electronic devices from acquisition through to divestment. Social practice theory was then incorporated into the principles and concepts of industrial ecology and circular economy (Chapter 3) to link the theory with material flows in households and include sustainability.

Throughout the thesis, a practice, as the unit of analysis, reflected a configuration of four elements: context; meanings and understandings; materials and infrastructure; and, knowledge, skills and competencies. These configurations were applied to three domains or forms of capital, namely, social and economic; leisure and entertainment (cultural capital); and, cultural capital.

Through these domains and their practices, I demonstrate that portable electronic devices are critical tools for households and householders in their day-to-day life. Configurations of practices were complex and varied across households, yet there were also similarities. A key finding is that the use phase does influence the acquisition and retirement phases of the material flow cycle and to a lesser extent accumulation (transition points four and five, Figure 1-2 and Figure 7-1).

Chapter 7 explored the end-result of household practices, discussed in Chapters 4, 5 and 6, on device retirement and replacement. Using the four practice elements (context; meanings and understandings; materials and infrastructure; and, knowledge, skills and competencies), I identified that changes in each element altered the influence and importance of each element in the configuration of use practices, thereby triggering device retirement. The chapter also argued that there is a disconnect in the material flow process within households between transition points one, two and three and transition points four and five. This is triggered by households and householders giving greater priority (meanings and understandings) to the more individually-based acquisition, use and retirement of device-practices compared with post device retirement handling and divestment practices which are largely orientated towards sustainability and societal outcomes.

Four handling pathways were identified — in-situ accumulation; recirculation; recycling; and, intentional binning — with accumulation by far the most prevalent practice. The last section of Chapter 7 showed how current household practices limit the engagement of households and householders in device divestment. However, there were clear differences as to how these practices were configured and performed. I argue that reducing electronic material outflow, and or the capturing of retired devices from within households, requires a re-configuration of various elements involved in divestment practices. I suggest that practices in the context of diverse households must be the central focus of change, rather than individuals, if more sustainable electronic device consumption and flows are to be achieved.

8.2 Key findings

Based on my analysis of how and why Australian households acquire, use, retire and divest portable electronic devices, six key findings were identified.

8.2.1 Household living domains

Finding one. Three key household living domains, involving the use of portable electronic devices, were identified across all households: social and economic capital; leisure and entertainment; and, cultural capital. All involved portable electronic devices as the material and

infrastructure element of the practices and, in most circumstances, all were dependent on access to the internet and data for their performance.

The practices, supporting the different household living domains, all influenced the acquisition, use and retirement of electronic devices within households. The resulting materials flow from inflow to outflow was shaped by the dimensions of each element and the configuration of elements when a practice was performed. The willingness of households and householders to act as carriers of the practices was influenced by household income, stage of life, employment arrangements (context), the meanings households/householders ascribed to portable electronic devices, associated practices and outcomes desired (meanings and understandings). Additionally, the performance of the practices was dependent on knowledge, skills and competencies embedded within technology and practices as well as the knowledge, skills and competencies of households and householders as carriers.

Practices within the household living domains provided an understanding of the flow of electronic devices into and within households, including retirement of devices. However, they provided only limited explanations as to why households did or did not divest their devices into the external electronic materials stocks. This supported the adoption of practice elements as the analytical tool for studying device handling processes post retirement and divestment (Figures 3.1 and 3.3).

I found that household living domains were interdependent as were their sets of practices. Devices in combination with households and householders as carriers of practices are the glue or tool through which this interdependency is achieved. Alternatively, where competition between individual practices, across domains and between devices, is too great households and householders as carriers will disengage with a practice in its current configuration.

8.2.2 Devices as a mediating and negotiating tool

Finding two. Portable electronic devices are multi-faceted tools (not solely mobile phones) supporting households and householders to successfully live their everyday lives, across each of the domains discussed above, including mediating and negotiating various competing demands and interests during everyday life. Competing demands and interests presented as conflicts, tensions and risks between household members and between householders and the outside world over time, place, physical and emotional needs, and aspirations. People used their devices to enhance their capabilities and capacities (knowledge, skills and competencies) to limit and or navigate such conflicts, tensions and risks and enhance their quality of life. As such electronic device reliability is paramount, a factor contributing to the ongoing retirement, divestment and

renewal of electronic devices within households and their unsustainable flows through households.

8.2.3 Domestication and the ratcheting effect

Finding three. Household practices involving the use of portable electronic devices have become enmeshed in processes over the last decade known as domestication and the ratcheting-up of practices. As demonstrated electronic devices are now fully domesticated (embedded) into a whole range of daily household and householder practices and routines. Compared with other technologies such as cars and television in previous decades and centuries, electronic device domestication has been profound, rapid and all-encompassing regardless of social, economic and geographic position.

It has resulted in a perpetual need for at least one device (the smartphone being the principle device) but, in most cases, multiple electronic devices to support everyday household life. The proliferation of devices compounded the practice of constant upgrading to ensure device reliability and to maximise device functionality to support household living. Importantly device upgrading was also driven by economic and corporate practices of built-in obsolescence (Chapters 1 and 2).

Household dependency on devices for everyday life is a key explanation for the movement of electronic device materials into and within households and the accumulation of devices within households over time. I found that the device domestication process contributed to the accumulation of electronic materials in households, a practice that is relatively removed from device divestment practices — that is, there is a disjunct between device domestication use and device divestment.

Closely related to this finding on domestication is that of the ratcheting effect of household practices on the use of electronic within households and by individual householders. In this process, once practices are performed, the intensity and frequency of that performance increases driving a carrier's (householder's) ongoing commitment to the use of electronic devices to support that practice. This led ultimately to, the frequent retirement of devices and the need for newer or different types of devices to support the obsession of many householders with playing games and using social media. This contributed to the compounding of the ever-increasing accumulation of devices within households.

8.2.4 It's not just phones and communication

Finding four is the need to reframe and broaden the understanding of what constitutes portable electronic devices. Today, all things electronic permeate the world of households and householders ranging from devices such as FitBits, toothbrushes and power tools, supporting peripherals and larger appliances such as heating, cooking and monitoring energy consumption. All contribute to electronic material accumulation within households and the need for adequate divestment processes. Focusing solely on mobile phones as "the device" and "use only" in the flow cycle is short sighted and restrictive. It was because of these shortcomings that I broadened my interpretation of what constitutes electronic devices and device-materials from specifically mobile phones to a more all-encompassing grouping that included devices such as tablets, digital cameras, e-readers, iPod, gaming consoles, laptops and GPS.

8.2.5 Contrasting priorities

Finding five. This finding emerged from the analysis in Chapter 7 and relates to the differences in meanings and understandings and priority ascribed to household practices linked to acquisition, use and retirement (transition points one, two and three) compared with those involved in device handling post retirement and divestment (transition points four and five). In transition points one, two and three households and householders ascribed a high priority to practices contributing to individually-based goals and objectives such as completion of secondary and tertiary education and participation in the workforce to build economic capital (Chapters 4 and 6). In comparison, households/householders gave less significance to post retirement device handling and divestment practices because of their lesser significance for achieving everyday life outcomes (Chapter 7).

Furthermore, as practices in transition points four and five contribute directly to resource sustainability objectives, such as e-waste management rather than individual household objectives, there is less enticement for households and householders to engage in divestment practices. This in turn, creates a disjunct within households between practices involved in transition points one to three and transition points four and five, leading eventually to a loss of electronic materials from the material cycle. Thus, from both a materials flow and social practice perspective, there is insufficient enticement for households and householders to act as carriers of post-retirement device handling and divestment practices, including the capturing of devices for external re-processing.

8.2.6 Change: An ongoing phenomenon

Finding six. Change is an inevitable feature of everyday household living including macro-level changes, such as technological, political and economic changes, in the realms of digital data and communication provision, governance arrangements associated with communication and waste management or the role of government in the economy and provision of community services. Changes within households were also common including life-stage transitioning, geographic mobility and employment status.

Change, therefore, regardless of whether it occurs external or internal to households or in the composition of a practice element itself, does influence what practices are performed in everyday household living, the portable electronic devices used and the movement of electronic material through households over time. Electronic material flows through households will therefore be characterised by uncertainty, unpredictability and consequently household divestment practices may well conflict or compete with other everyday life objectives of households, leading to a disengagement with device capturing programs and the minimal recycling of devices for re-processing. Activities initiated to achieve social change must therefore accommodate these dynamic conditions of everyday life.

8.3 Implications and future research

These findings raise several issues regarding the sustainability of portable electronic device flows through Australian households into the future, all of which have direct policy implications. The challenge is to locate where, in the material flow cycle (Figures 1-2 and 7-1), is it most appropriate to initiate change to re-configure the practices associated with portable electronic devices. From a sustainability perspective, the ideal point to initiate change is prior to the consumption or introduction of devices into households or by householders. Exploring how best to reduce consumption at the front-end was certainly an objective of this research. That is, to develop an understanding of how to reduce household consumption of portable electronic devices at the front-end of the flow process (transition point one).

However, as my findings demonstrate, reducing the consumption of devices by householders is extremely unlikely. Firstly, electronic devices are now totally embedded in a whole raft of household practices — if they fail a new or alternative device is immediately obtained. Secondly, the whole field of household electronic devices and IC System technology is constantly changing at an ever-increasing rate. Staying up to date with this technology is now essential for householders to effectively participate in society driving householders to constantly purchase newer and alternative devices. Thirdly, the needs and aspirations of householders are dynamic

rather than static throughout the course of their lifetime. That is, how one householder at the age of 18 years of age participates in the practice domains (social and economic capacity; leisure and entertainment; and, cultural capital), differs significantly from a householder aged in his or her 70s. Consequently, throughout a person's lifetime there will always be a need to purchase devices that better suit the evolving needs of an individual at a point in time as well as over time.

This suggests that a longitudinal study of a larger pool of households than this research from a social practice perspective would be fruitful. It would be useful to identify how life transitions shape the entire electronic device material flows through households and the influence of emerging technologies and their domestication (embedding) on household practices over time.

A key finding of this research was that many householders were not prepared to repair and maintain their devices to extend their lifespan and reduce the number of devices coming into households. More research would be useful on the promotion of acceptable transitions from device retirement to device divestment as the key point for re-configuring household practices. The goal would be to maximise the capture of all electronic materials within households (not just portable devices) for return to the mainstream materials stocks, rather than stockpiling or binning devices as is currently the case.

Finally, the links between social equality and device use and divestment is worthy of more investigation. My research has demonstrated that the cohort of households with the greatest uptake and movement of all things electronic, and the adoption of new, are those with higher income, stand-alone dwellings and larger dwelling size. These households are involved in accumulating and acquiring devices more frequently and a greater range of devices and have material flow practices that are less sustainable compared with lower income, smaller-sized dwellings and apartments. Thus, in developing any policy strategy to re-configure practices, it will be important to ensure that those having the greatest resource impact can be held to account more fully. Furthermore, emphasis should be placed on building the practice element of knowledge, skills and competencies associated with electronic materials handling throughout the flow cycle for all households, to encourage greater equity of participation and outcomes.

8.4 Contribution to knowledge

This research built on previous research (Chapters 1 and 3) that employs social practice theory and everyday practices as analytical tools for understanding social phenomena and change. In doing so, the thesis reinforces the value of everyday practices as a conceptual approach. Contributions to knowledge fall into two themes: conceptual and theoretical; and social applications.

8.4.1 Conceptual and theoretical

From a conceptual and theoretical perspective this research makes two valuable contributions. Firstly, it clearly demonstrates the importance of a multi-disciplinary placed-based analysis to fully understand complex social, technological and resource scarcity issues faced by society. Through this analytical approach, which included a focus on where, what, how and why of electronic device material flows within households, the research has contributed to the consumption and material geographies literatures. The notions of retirement (a relatively unused concept when discussing material flows) and multi-flow pathways for devices post-use are specific contributions that offer valuable insights into how best to achieve more sustainable material flows in households.

The second conceptual and theoretical contribution made by this research to knowledge is its extension of a social practice theoretical approach into the realm of electronic devices life-cycle processes set within the domain of households and the use of material flow transition points to describe the movement of electronic devices through households. This area, at the time the research commenced, was largely unexplored. Specifically, the research provided a unique conceptual and theoretical approach that linked the dynamics of everyday life (what goes on within households and why) with resource sustainability analysis techniques, through the incorporation of industrial ecology and circular economy principles and concepts, to form a coherent and logical approach (Figures 1-2 and 7-1). This allowed me to demonstrate how and why electronic devices move through households in either sustainable or unsustainable flow patterns. This is an original tailored approach for studying electronic material flows in households.

The research also increases the body of knowledge by expanding on what constitutes the bundle of elements constituting a practice. Drawing on the analysis in Chapter 2, I argue that the contextual arrangements of households and householders are key for understanding everyday life, and are important factors influencing device acquisition, use, retirement and divestment. I argued therefore in Chapter 3 that context should be included as an additional element in the bundle of elements, making four elements in total: context, meanings and understandings; knowledge, skills and competencies; and, materials and infrastructure. Most social practice research has largely been built on a bundle of three key elements and all have effectively minimised or left contextual elements out of analysis of everyday household practices.

Incorporating context into an analytical approach enables the drawing out of influences and the role of contextual factors in shaping practices and on the willingness of householders to act as

carriers of those practices. For example, it enabled me to explore more fully practices relating to the overlap of device use for work purposes and household needs, including the need to interact with income support agencies and educational institutions, thereby driving acquisition, use and retirement. Furthermore, it demonstrated that households and householders are not autonomous carriers, always able to choose if they wish to act as carriers of practices.

This approach allowed me to capture the complexity of everyday life and performance of practices in households and the dynamic configurations of all four practices elements. This is a situation I would argue more closely reflects the reality of everyday life, with its dynamics, unpredictability and competition between practices, everyday life domains, elements and householders as they act out their willingness to act as carriers.

Frequently, researchers argue for a system-based approach without detailing the theoretical structure for conducting such an analysis. My tailored theoretical framework and the expansion of social practice theory to incorporate contextual arrangements is an original contribution to the field. It presents a viable and working analytical and system-based alternative to other frequently used analytical approaches centred on linear, cause and effect logic, with a single-issue focus.

8.4.2 Social change application

The research makes a further valuable contribution in applying research outcomes to social problems and prospects for social change. There is an urgent need to improve resource sustainability within households particularly with electronic materials. Importantly, I demonstrated a need to shift away from the largely unsuccessful conventional behavioural change approaches focusing on the individual behaviours of people as the underlying problem for the lack of improved environmental outcomes. Instead, this research provides insights into the alternative change approaches, ones that incorporate the dynamics of practices and their respective elements and how they are configured during performances and their emergence as practice entities. Greater emphasis should therefore be placed on manipulating the input of practice elements, and or the configuration of practice elements in their totality, to implement successful social change. These social change programs would be blame-neutral and cognisant of the wider context that households are embedded within whilst acknowledging that household practices do not exist in a vacuum.

8.5 Concluding comments

I began this thesis with three objectives, namely to 1) understand social practices associated with portable electronic devices; 2) canvas options to inform policy development to encourage

more sustainable use of electronic device materials; and, 3) contribute to the bodies of literature associated with social practice theory and sustainable resource use. I believe this thesis delivers on each of these objectives. Some concluding remarks are therefore worthy at this point.

The flow of portable electronic devices through Australian households is shaped by a complex performance process between different household practice domains, their practices and associated elements, and the interactions between each of these. Households and householders are only players in this process through their preparedness to act (or not) as a carrier of the practices involving the use of portable electronic devices.

To date, these practices involving devices as the materials and infrastructure element of the practices have indeed become extremely attractive to householders. It is unlikely that this attractiveness will decline in the immediate future, thus perpetuating and compounding current unsustainable household patterns of acquisition, use, retirement and divestment of electronic devices.

My research suggests that disrupting and or breaking these unsustainable patterns will require a shift away from current ad-hoc and behaviourist capture programs, to interventions that place household practices as the central driver of electronic device flows through households. This will require strategies at the household and policy levels to re-configure the dynamics between each of the practice elements (materials and infrastructure; context; meanings and social understandings; and, knowledge, skills and competencies), as well as between practices and practice domains. It will also involve strategies that focus on practices within the realm of individual householders, households and society and the cross-over between each of these realms.

Given that electronic devices, especially mobile phones have been embedded within most households for well over 20 years, but without any real progress made in capturing these materials, there is now a growing need for some form of real and effective action to be implemented at the household level. Furthermore, it is imperative that any such action does not disadvantage those households with less capabilities and capacities to participate and be engaged.

References

Agar, J 2003, *Constant touch: A global history of the mobile phone*, Icon Books, Cambridge.

Ajzen, I 1991, 'The theory of planned behaviour', *Organisational Behaviour and Human Decision Processes*, vol. 50, no. 2, pp. 179-211.

Alaszewski, A 2006, *Using diaries for social research*, Sage Publications, London.

Alizadeh, T and Farid, R 2017, 'Political economy of telecommunication infrastructure: An investigation of the National Broadband Network early rollout and pork barrel politics in Australia', *Telecommunications Policy*, vol. 41, pp. 242-252.

Allon, F 2011, '"Home economics": The management of the household as an enterprise', *Journal of Australian Political Economy* (JAPE), no. 68, Special issue on contesting markets.

Allwood, J, Ashby, M, Gutowski, T and Worrell, E 2011, 'Material efficiency: A white paper', *Resources, Conservation and Recycling*, vol. 55, pp. 362-381.

Andrews, K 2017, 'What is our love affair with smartphones doing to us?', *ABC Science Australian Broadcasting Corporation (ABC)*, viewed 11 August 2017, http://www.abc.net.au/news/science/2017-08-11/what-is-our-love-affair-with-smartphones-doing-to-us/8790870.

Australian and New Zealand Recycling Platform (ANZRP), 2015, 'Global e-waste systems. Insights for Australia from other developed countries', *A report for ANZRP*, The Economist Intelligence Unit Limited.

Australian and New Zealand Recycling Platform (ANZRP), 2015, *Australian and New Zealand Recycling Platform Limited Annual Report 2015-2016*, Melbourne, viewed 8 March 2018, http://www.environment.gov.au/system/files/resources/485889d5-5fc1-45a2-83f0-436a0ad74f3f/files/anzrp-annual-report-2015-16.pdf.

Australian Bureau of Statistics (ABS), 2013, 4602.0.55.005 *Waste account, Australia, experimental estimates*, viewed 30 April 2014, http://www.abs.gov.au/ausstats/abs@.nsf/Products/4602.0.55.005~2013~Main+Features~Electronic+and+Electrical+Waste?OpenDocument.

Australian Bureau of Statistics (ABS), 2017, *2016 Census QuickStats,* viewed 18 February 2018, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/036.

Australian Bureau of Statistics 2006, *Australian social trends 2006-2007*, Cat. No. 4442.0, viewed 22 September 2014, http://www.abs.gov.au/AUSSTATS/abs@.nsf/7d12b0f6763c78caca257061001cc588/165F54034241B1A6CA2571B000103250?opendocument.

Australian Bureau of Statistics 2010, *Measures of Australia's progress*, Cat. No. 1370.0, Canberra, viewed 22 September 2014, http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1370.0~2010~Main%20Features~Home%20page%20(1).

Australian Bureau of Statistics 2012, 'Feature article 1: Population by age and sex, Australia, states and territories', *Australian demographic statistics*, Cat. No. 3101.0, Canberra, viewed 22 September 2014,

http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1370.0~2010~Main%20Features~Home%20page%20(1).

Australian Bureau of Statistics 2012, *Australian social trends, Data cube – population*, Cat. No. 4102.0, Canberra, viewed 22 September 2014, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4102.0Sep%202012.

Australian Bureau of Statistics 2012, *Labour force, Australia: Labour force status and other characteristics of Families*, Cat. No. 6224.0.55.001, Canberra, viewed 22 September 2014, http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/6224.0.55.001?OpenDocument.

Australian Bureau of Statistics 2012, *Reflecting a nation: Stories from the 2011 census, 2012-2013*, 100 years of Australian lives – Population, Cat. No. 2071.0, Canberra, viewed 22 September 2014, http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2071.0main+features952012-2013.

Australian Bureau of Statistics 2013, *Australian social trends – Same-sex couples*, Cat. No. 4102.0, viewed 22 September 2014, http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features10July+2013 .

Australian Communications Media Authority (ACMA), 2013, *Communications report 2012-2013: fast facts*, Australian Communications Media Authority, Commonwealth of Australia, viewed 8 March 2018, https://www.acma.gov.au/theACMA/Library/Corporate-library/Corporate-publications/communications-report-fast-facts.

Australian Communications Media Authority (ACMA), 2014, 'Tablets take off: take-up and use of tablet computers in Australia', *Research Snapshots*, Australian Communications Media Authority, Australian Government, viewed 23 January 2018, https://www.acma.gov.au/theACMA/engage-blogs/engage-blogs/Research-snapshots/Tablets-take-off-take-up-and-use-of-tablet-computers-in-Australia.

Australian Communications Media Authority (ACMA), 2016, *Communications report 2015–16*, Australian Communications Media Authority, Commonwealth of Australia, viewed 23 January 2018, https://www.acma.gov.au/~/media/Research%20and%20Analysis/Report/pdf/ACMA%20Communications%20report%202015-16%20pdf.pdf.

Australian Communications Media Authority (ACMA), 2017, *Communications report 2016–17: fast facts*, Australian Communications Media Authority, Commonwealth of Australia, Commonwealth of Australia, viewed 20 February 2018, https://www.acma.gov.au/theACMA/communications-report-2016-17-fast-fact.

Australian Communications Media Authority (ACMA), 2017, *Communications report 2016-2017*, Australian Communications Media Authority, Commonwealth of Australia, viewed 20 February 2018, https://www.acma.gov.au/theACMA/communications-report.

Australian Institute of Family Studies, *A snapshot of how Australian families spend their time*, Commonwealth of Australia, Melbourne, viewed 22 September 2014, http://www.aifs.gov.au/institute/pubs/factssheets/familytime.html.

Australian Institute of Family Studies, *Family facts and figures: Australian families*, Commonwealth of Australia, Melbourne, viewed 22 September 2014, http://www.aifs.gov.au/institute/info/charts/familystructure/index.html.

Australian Institute of Family Studies, *Family facts and figures: Australian households*, Commonwealth of Australia, Melbourne, viewed 22 September 2014, http://www.aifs.gov.au/institute/info/charts/households/index.html.

Australian Mobile Telecommunications Association (AMTA), 2013, *Mobile Australia: A report into how we use and recycle our mobiles*, viewed 13 May 2014, http://www.mobilemuster.com.au/decluttering-old-mobile-phones/.

Australian Mobile Telecommunications Association (AMTA), 2016, *Annual Report 2016*, Canberra.

Australian Securities Investments Commission (ASIC), 2018, *Australian spending habits*, Australian Government, viewed 8 March 2018, https://www.moneysmart.gov.au/managing-your-money/budgeting/spending/australian-spending-habits.

Balbi, G 2009, 'Studying the social history of telecommunications', *Media History*, vol. 15, no. 1, pp. 85-101.

Balbi, G 2013, 'Telecommunications', in Simonson, P, Peck, J, Craig, R and Jackson, J (eds), *The handbook of communication history*, Taylor and Francis, New York.

Baldé, C, Forti, V, Gray, V, Kuehr, R and Stegmann, P 2017, The global e-waste monitor – 2017, United Nations University (UNU), International Telecommunication Union (ITU) and International Solid Waste Association (ISWA), Bonn/Geneva/Vienna.

Baldé, C, Wang, F, Kuehr, R and Huisman, J, 2015, *The global e-waste monitor – 2014*, United Nations University (UNU), IAS – SCYCLE, Bonn, Germany.

Barbon, N 1690, *A discourse of trade*, Lord Baltimore Press, viewed 8 March 2018, https://ia802205.us.archive.org/26/items/nicholasbarbonon00barb/nicholasbarbonon00barb.pdf.

Bartiaux, F 2012, 'Researching on energy-consumption practices: Adding social interactions and geographical characteristics to the social theories of practice', paper presented to *MILEN International Conference – Advancing the research and policy agendas on sustainable energy and the environment*, University of Oslo, 22 – 23 November 2012.

Baxter, P and Jack, S 2008, 'Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers', *The Qualitative Report*, vol. 13, no. 4, pp. 544-559.

Beck, U and Beck-Gernsheim, E 2002, *Individualisation: Institutionalised individualism and its social and political consequences*, Sage Publications.

Beer, A 2012, 'The economic geography of Australia and its analysis: From industrial to post-industrial regions', *Geographical Research*, vol. 50, no. 3, pp. 269-281.

Berg, B 2004, *Qualitative research methods for social sciences*, 5th edn., Pearson, London.

Berker, T, Hartmann, M, Punie, Y and Ward, K 2006, *Domestication of Media and Technology*, Open University Press, Berkshire.

Bijker, W and Law, J 1997, *Shaping Technology/Building Society: Studies in Sociotechnical Change*, The MIT Press.

Bijker, W, Hughes, T and Pinch, T 1987, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, The MIT Press.

Boehm, E 1993, *Twentieth Century Economic Development in Australia*, 3rd edn., Longman Cheshire, Melbourne.

Bourdieu, P 1986, 'The forms of capital', in Richardson, J (ed.), *Handbook of Theory and Research for the Sociology of Education*, Greenwood, New York, pp. 241-258.

Bulkeley, H and Gregson, N 2009, 'Crossing the threshold: Municipal waste policy and household waste', *Environment and Planning A: Economy and Space*, vol. 41, no. 4, pp. 929-945.

Bytheway, B 2012, 'The use of diaries in qualitative longitudinal research', *Timescapes methods guides series 2012, Guide No. 7, Series*, Neale, B and Henwood, K (eds.), Economic and Social Research Council (ESRC), viewed 8 March 2018, http://www.timescapes.leeds.ac.uk/assets/files/methods-guides/timescapes-bytheway-use-of-diaries.pdf.

Carson, E and Kerr, L 2017, *Australian social policy and the human services*, 2nd ed, Cambridge University Press.

Casimar, G and Tobi, H 2011, 'Defining and using the concept of household: A systematic review', *International Journal of Consumer Studies*, vol 35, pp.498-506.

Castells M, Fernáandez-Ardèvol, M, Qiu, J and Sey, A 2007, *Mobile communication and society. A global perspective*, The MIT Press.

Chase, S 1925, *The Tragedy of Waste*, The Macmillan Co, New York.

Church, K (undated), *Mobile technology and its dynamic organisation of the urban field*, School of Architecture and Design, Landscape Architecture, RMIT University, Melbourne.

Church, K, Weight, J, Berry, M and MacDonald, H 2010, 'At home with media technology', *Home Cultures*, vol. 7, no. 3, pp. 263-286.

Claudio, L 2007, 'Waste Couture: The Environmental Impact of the Clothing Industry', *Environmental Health Perspectives*, vol. 115, no. 9, pp. 449-454.

Cook, N et al, 2013, 'Debted objects: Homemaking in an era of mortgage-enabled consumption', *Housing, theory and society*, vol. 30, no.3, pp. 293-311.

Corrigan, P 1998, *The sociology of consumption*, Sage publications, London.

Couldry, N 2012, *Media, Society, World: Social Theory and the Digital Media Practice*, Polity Press.

Couldry, N and Hepp, A 2016, *The Mediated Construction of Reality*, Wiley.

Coutard, O 2008, 'Placing splintering urbanism: Introduction', *Geoforum*, vol. 39, pp. 1815-1820.

Cowan, R 1976, '"Industrial Revolution" in the Home: Household Technology and Social Change in the 20th Century' in *Technology and Culture*, vol. 17, no. 1, pp. 1-23.

Cowan, R 1983, *More work for mother: the ironies of household technology from the open hearth to the microwave,* Basic Books, University of Michigan.

Crowley, D and Heyer, P 2015, *Communication in History: Technology, Culture, Society*, 6th edn., Taylor & Francis.

Cucu-Oancea, O 2013, 'Using Diaries - A Real Challenge for the Social Scientist', *Procedia - Social and Behavioural Sciences*, vol. 92, pp. 231 – 238.

Daly, M 2007, 'Australian cities: The challenge of the 1980s', *Australian Geographer*, vol 19, no. 1, pp. 149-161.

Davidson, G 2008, 'Down the gurgler: Historical influences on Australian domestic water consumption', in P Troy (ed.) *Troubled Waters Confronting the Water Crisis - In Australia's Cities*, Australian National University Press, Canberra.

Deloitte, 2017, *Smart everything, everywhere Mobile Consumer Survey 2017 - The Australian cut*, Deloitte Touche Tohmatsu Limited, Sydney.

den Hond, F 2000, 'Industrial ecology: A review', *Regional Environmental Change*, vol. 1, no. 2, pp. 60-69.

Department of Environment, Land, Water and Planning (DELWP) 2017, *Managing e-waste in Victoria: Policy Impact Assessment*, Department of Environment, Land, Water and Planning, The State of Victoria, Melbourne, viewed 8 March 2018, https://engage.vic.gov.au/application/files/9315/0837/1389/FINAL_E-waste_PIA_v3.pdf.

Department of Infrastructure and Transport 2013, *State of Australian Cities 2013*, Chapter 2, Commonwealth of Australia, Canberra.

Dominish, E, Florin, N, Giurco, D, Corder, G, Golev, A, Lane, R, Rhamdhani, A, Reck, B, Graedel, T, Sharpe, S, Edwards, M, Benns, S and Brooks, G 2017, *Australian opportunities in a circular economy for metals: Findings of the Wealth from Waste Clutter*, Wealth from Waste.

European Union (EU) 2008, 'Environment: Commission proposes revised laws on recycling and use of hazardous substances in electrical and electronic equipment', *Press Release*, European Union Press Release Database, Brussels, viewed 8 March 2018, http://europa.eu/rapid/press-release_IP-08-1878_en.htm.

Evans, D 2018, 'What is consumption, where has it been going, and does it still matter?' *The Sociological Review*.

Evans, D 2011, 'Thrifty, green or frugal: Reflections on sustainable consumption in a changing economic climate', *Geoforum*, vol. 42, pp. 550-557.

Evans, D 2012, 'Binning, gifting and recovery: The conduits of disposal in household food consumption', *Environment and Planning D: Society and Space*, vol. 30, no. 6, pp. 1123-1137.

Feldman, M and Orlikowski, W 2011, 'Theorising practice and practicing theory', *Organisation Science*, vol. 22, no. 5, pp. 1240-1253.

Fortunati, L 2002, 'The mobile phone: towards new categories and social relations', *Information, Communication and Society*, vol. 5:4, pp. 513-528.

Fortunati, L 2006, 'User design and the democratization of the mobile phone', *First Monday*, special issue, no. 7, viewed 23 April 2014, http://journals.uic.edu/ojs/index.php/fm/article/view/1615/1530 and http://firstmonday.org/ojs/index.php/fm/article/view/1615.

Frobler, F 2008, A Practice Theoretical Analysis of Real Time Collaboration Technologies: Skype and Sametime in Software Development Projects, Göttingen, Germany, Cuvillier.

Fuchs, C 2014, *Social Media: A Critical Introduction*, Sage.

Gibson, C, Farbotko, C, Gill, N, Head, L and Waitt, G 2013, 'Environmental issues and household sustainability in Australia', *World Social Science Report 2013: Changing Global Environments*, pp. 316-320, UNESCO, Paris.

Glover, A 2015, 'Characterising elements of practice: the contours of altruistic material divestment', *Journal of Design Research*, vol. 13, no. 3, pp. 265-277. Presented at the Beyond Behaviour Change Symposium, RMIT, Melbourne, November 2012.

Golev, A, Werner, T, Zhu, X and Matsubae, K, 2016, 'Product flow analysis using trade statistics and consumer survey data: A case study of mobile phones in Australia', in *Journal of Cleaner Production*, vol. 133pp. 262-271.

Graham, S and Marvin, S 2001, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, Routledge.

Gram-Hanssen, K 2009, 'Standby consumption in households analysed with a practice theory approach', *Journal of Industrial Ecology*, vol. 14, no. 1, pp. 150-165.

Green, S 2002, *Rational choice theory: An overview*, paper prepared for the Baylor University Faculty Development seminar on rational choice theory.

Gregson, N, Metcalfe, A and Crewe, L 2009, 'Practices of object maintenance and repair: How consumers attend to consumer objects within the home', *Journal of Consumer Culture*, vol. 9, no. 2, pp. 248-272.

Gregson, N, Metcalfe, A and Crewe, L 2007, 'Moving things along: the conduits and practices of divestment in consumption', *Transactions of the Institute of British Geographers*, vol. 32 no. 2, pp. 187-200.

Gregson, N 2007, *Living with things: ridding, accommodation, dwelling*, Wantage: Sean Kingston Publishing.

Haddon, L 2004, *Information and Communication Technologies in Everyday Life: A Concise Introduction and Research Guide*, Bloomsbury Academic.

Hamilton, C 2003, *Growth Fetish*, Allen and Unwin Book Publishing.

Hamilton, C 2010, 'Consumerism, self-creation and prospects for a new ecological consciousness', *Journal of Cleaner Production*, vol. 18, pp. 571-575.

Hamilton, C and Dennis, R 2005, *Affluenza: When Too Much is Never Enough*, Allen and Unwin Book Publishing.

Hancock, D and Algozzine, B 2011, *Doing case study research: A practical guide for beginning researchers*, 2nd edn, Teachers College Press, Columbia University, New York.

Hassan, R 2006, *Empires of Speed: Time and the Acceleration of Politics and Society*, Brill, Leiden.

Hawkins, G 2006, *The Ethics of Waste: How we relate to rubbish*, University of New South Wales Press, Sydney.

Head, L, Farbotko, C, Gibson, C, Gill, N and Waitt, G, 2013, 'Environmental issues and household sustainability in Australia', *World Social Science Report 2013: Changing Global Environments*, pp. 316-320, UNESCO, Paris, France.

Hjorthol, R 2008, 'The mobile phone as a tool in family life: Impact on planning of everyday activities and car use', *Transport Reviews*, vol. 28, no. 3, pp. 303-320.

Horst, H and Miller, D 2006, *The cell phone: An anthropology of communication*, Berg, Oxford.

Jelinski, L, Laudise, R, Patel, C, Graedel, T and McCall, D, 1992, 'Industrial ecology: Concepts and approaches', *Proceedings of the National Academy of Sciences*, vol. 89, no. 3, pp. 793-797.

Jessop, R 2006, 'The state and the contradictions of the knowledge-driven economy', *Ritsumeikan Social Science Review*, vol. 128, pp. 157-175.

Kelley, A 1965, 'International Migration and Economic Growth: Australia, 1865-1935', *The Journal of Economic History*, vol. 25, no. 3, pp. 333-354.

Knapp, M, McDaid, D and Parsonage, M (eds.) 2011, *Mental Health Promotion and Prevention: The Economic Case*, Personal Social Services Research Unit, London School of Economics and Political Science, Department of Health, London.

Korhonen, J 2002, 'Two paths to industrial ecology: Applying the product-based and geographical approaches', *Journal of Environmental Planning and Management*, vol. 45, no. 1, pp. 39-57.

Lane, R, Follett, K and Lindsay, L, In press, 'Unsustainable trajectories of domestic IT use in Australia: Exploring diversity and the life course', *The Geographical Journal*.

Lane, R 2011, 'The waste commons in an emerging resource recovery waste regime: Contesting property and value in Melbourne's hard rubbish collections', *Geographical Research*, vol. 49, no. 4, pp. 395-407.

Lane, R and Gorman-Murray, A (eds.) 2011, *Material geographies of household sustainability*, Ashgate Publishing Limited, Surrey.

Levi, L 2006, 'The European Commission's guidance on work-related stress and related initiatives', in Rossi, A, Perrewé, P and Sauter, S, (eds.), *Stress and Quality of Working Life: Current Perspectives on Occupational Health*, IAP-Information Age Publishing Inc.

Lienig, J and Bruemmer, H 2017, *Fundamentals of Electronic Systems Design*, Springer International Publishing.

Lievrouw, L 1998, 'Our own devices: Heterotopic communication, discourse, and culture in the information age', *The Information Society*, vol. 14, pp. 83-96.

Lievrouw, L and Livingstone, S 2002, *Handbook of New Media: Social Shaping and Consequences of ICTS*, Sage Publications.

Lifset, R and Graedel, T 2002, 'Industrial ecology: goals and definitions', in Ayres, R and Ayres, L (eds.), *A Handbook of Industrial Ecology*, Edward Elgar Publishing, Cheltenham, United Kingdom.

Lindsay, J and Maher, J-M 2013, *Consuming Families: Buying, Making, Producing Family Life in the 21st Century*, Routledge, Taylor and Francis Group, London.

London, B 1932, *Ending the depression through planned obsolescence*, viewed 8 March 2018, https://upload.wikimedia.org/wikipedia/commons/2/27/London_(1932)_Ending_the_depression_through_planned_obsolescence.pdf.

Maher, J-M, Lindsay, J and Franzway, S 2008, 'Time, caring labour and social policy: Understanding the family time economy in contemporary families', *Work, Employment and Society*, vol. 22, no. 3, pp. 547-558.

Malone, K 2007, 'The bubble-wrap generation: Children growing up in walled gardens', *Environmental Education Research*, vol. 13, no. 4, pp. 513-527.

Mansvelt, J 2005, *Geographies of Consumption*, Sage, London.

Mayroft, N 2009, 'Consumption, planned obsolescence and waste', *Working Paper, History of Art and Material Culture*, Lincoln School of Art and Design, University of Lincoln, United Kingdom, viewed 8 March 2018, http://eprints.lincoln.ac.uk/2062/1/Obsolescence.pdf.

McEnhill, L and Taylor-Gooby, P 2018, 'Beyond continuity? Understanding change in the UK welfare state since 2010', *Social Policy and Administration*, vol. 59, no. 1, pp. 252-270.

Moloney, S and Strengers, Y 2014, 'Going green"?: The limitations of behaviour change programmes as a policy response to escalating resource consumption', *Environmental policy and governance*, vol. 10.

Murakami, S, Oguchi, M, Tasaki, T, Daigo, I and Hashimoto, S 2010, 'Lifespan of commodities, Part 11', *Journal of Industrial Ecology*, vol. 14, no. 4, pp. 613-626.

Musson, S, Vann, K, Jang, Y, Mutha, S, Jordan, A, Pearson, B and Townsend, T 2006, 'RCRA toxicity characterisation of discarded electronic devices', *Environmental Science and Technology*, vol. 40, no. 8, pp. 2721-2726.

Navazo, J, Méndez, G and Peiró, L 2014, 'Material flow analysis and energy requirements of mobile phone material recovery processes', *International Journal Life Cycle Assess*, vol. 19, pp. 567-579.

Ninaus, K, Diehl, S, Terlutter, R, Chan, K and Huang, A 2015, 'Benefits and stressors – Perceived effects of ICT use on employee health and work stress: An exploratory study from Austria and Hong Kong', *International Journal of Qualitative Studies in Health and Well-being*, vol. 10, no. 10, pp. 1-19.

Ongondo, F and Williams, I 2011, 'Greening academia: use and disposal of mobile phones among university students' *Waste management*, vol. 31, pp. 1617-1634, doi: 10.1016/j.wasman.2011.01.031.

Opdenakker, R 2006, 'Advantages and Disadvantages of Four Interview Techniques in Qualitative Research', *Forum: Qualitative Social Research*, vol. 7, no. 4.

Osibanjo, O and Nnorom, I 2008, 'Material flows of mobile phones and accessories in Nigeria: Environmental implications and sound end-of-life management options', *Environmental Impact Assessment Review*, vol. 28, pp. 198-213.

Packard, V 1960, *The Waste Makers*, David McKay Publisher.

Pope, K 2017, *Understanding Planned Obsolescence: Unsustainability Through Production, Consumption and Waste Generation*, Kogan Page Limited, London.

Productivity Commission, 2006, 'Waste management', *Productivity commission inquiry overview*, no. 38, Commonwealth of Australia, Melbourne.

Puckett, J (undated), Obsolescence, Basel Action Network, viewed 15 January 2018, https://blogs.ntu.edu.sg/hp3203-2017-28/its-a-trap/.

Radcliffe, L 2013, 'Qualitative diaries: uncovering the complexities of work-life decision-making', *Qualitative Research in Organisations and Management: An International Journal*, vol. 8, no. 2, pp. 163-180.

Reckwitz, A 2002, 'Toward a theory of social practices: a development in culturalist theorizing', *European Journal of Social Theory*, vol. 5, no. 2, pp. 243-262.

Reid, L. Sutton, P. and Hunter, C 2009, 'Theorizing the meso level: The household as a crucible of pro-environmental behaviour', *Progress in Human Geography*, vol. 34, no.3, pp. 309-327.

Reller, A, Bublies, T, Staudinger, T, Oswald, I, Meiβner, S and Allen, M 2009, 'The Mobile phone: Powerful communicator and potential metal dissipator', *GAIA*, vol. 18, no. 2, pp. 127-135.

Ritzer, G and Jurgenson, N 2010, 'Production, consumption, presumption: The nature of capitalism in the age of the digital "prosumer"', *Journal of Consumer Culture*, vol. 10, no. 1, pp. 13-36.

Rogers, E 2003, *Diffusion of Innovations*, Free Press, New York.

Rogerson, D 2010, 'What influence does brand play on the adoption of new converged portable digital media devices amongst young adults in Australia?', *Research Online, SBS HDR Student Conference Paper 1*, University of Wollongong, Sydney.

Røpke, I 2009, 'Theories of practice – New inspiration for ecological economic studies on consumption', *Ecological economics*, vol. 68, pp. 2490-2497.

Sahakian, M and Wilhite, H 2014, 'Making practice theory practicable: Towards more sustainable forms of consumption', *Journal of Consumer Culture*, vol. 14, no. 1, pp. 25-44.

Scheele, C and Papazu, I 2015, 'Changing Individual Behaviours or Creating Green Societies? Advancing from a Behaviourist to a Social Practice Theory Approach', *Ecopsychology*, vol. 7, no. 2, pp. 104-111.

Sheller, M and Urry, J 2000, 'The city and the car', *International Journal of Urban and Regional Research*, vol. 24, no. 4, pp. 737-757.

Shove, E (undated), 'Practice theory methodologies do not exist', Demand Centre Blog, viewed 8 March 2018, https://practicetheorymethodologies.wordpress.com/2017/02/15/elizabeth-shove-practice-theory-methodologies-do-not-exist/.

Shove, E 2003, 'Converging conventions of comfort, cleanliness and convenience', *Journal of Consumer Policy*, vol. 26, pp. 395-418.

Shove, E 2003*, Comfort, cleanliness and convenience – the social organization of normality*, Berg Publishers, Oxford.

Shove, E 2010, 'Beyond the ABC: Climate change policy and theories', *Environmental Planning*, vol. 42, pp. 1273-1285.

Shove, E and Spurling, N (eds.) 2013, *Sustainable Practices: Social theory and climate change*, Routledge, London.

Shove, E and Walker, G 2014, 'What is energy for? Social practice and energy demand', *Theory Culture Society*, vol. 31, no. 5, pp. 41-58.

Shove, E, Pantzar, M and Watson, M 2012, *The dynamics of social practice: Everyday life and how it changes*, Sage Publication Ltd, London.

Shove, E, Watson, M, Hand, M and Ingram, J 2007, *The design of everyday life*, Berg Publishers, Oxford.

Simons, H 2009, *Case study research in practice*, Sage Publications, London.

Sinclair, W 1976, *Process of economic development in Australia*, Cheshire, Melbourne.

Söderholm, P (ed.) 2010, *Environmental policy and household behaviour: Sustainability and everyday life*, Earthscan, London.

Spaargaren, G 2011, 'Theories of practices: Agency, technology, and culture. Exploring the relevance of practice theories for the governance of sustainable consumption practices in the new world-order', *Global environmental change*, vol. 21, pp. 813-822.

Spiller, M 2014, 'Social justice and the centralisation of governance in the Australian metropolis: A case study of Melbourne', *Urban Policy and Research*, vol. 32, no.3, pp. 361-380.

Statista 2018, *Global Apple iPod sales from 2006 to 2014 (in million units)*, viewed 11 March 2018, https://www.statista.com/statistics/276307/global-apple-ipod-sales-since-fiscal-year-2006/.

Straub, E2017, 'Understanding technology adoption: Theory and future directions for informal learning', *Review of Educational Research*, vol. 79, no. 2, pp. 625-649.

Strengers, Y 2009, *Bridging the divide between resource management and everyday life: Smart metering, comfort and cleanliness*, Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy (Social Sciences), School of Global Studies, Social Science and Planning, RMIT University, Melbourne.

Strengers, Y 2010, 'Conceptualising everyday practices: composition, reproduction and change', *Working Paper No. 6*, Centre for Design, Royal Melbourne Institute of Technology (RMIT), Melbourne.

Strengers, Y 2012, 'Peak electricity demand and social practice theories: Reframing the role of change agents in the energy sector', *Energy Policy*, vol. 44, pp. 226-234.

Sutherland, T 2014, 'Getting nowhere fast: A teleological conception of socio-technical acceleration', *Time and Society*, vol. 23, no. 49, pp. 49-68.

Sutton, M 2014, *Mobile phones engineered 'not to last', expert says*. [online] ABC News, viewed 8 March 2018, http://www.abc.net.au/news/2014-10-17/mobile-phones-engineered-with-built-in-obsolescence/5818410.

Tacchi, J, Kitner, K and Crawford, K 2012, 'Meaningful mobility – Gender, development and mobile phones', *Feminist Media Studies*, vol. 12, no. 4, pp. 528-537, doi: 10.1080/14680777.2012.741869.

Technology to Care (undated), 'Knowledge and Skills Sets to Embed Electronic Assistive Technology (eAT) in Social Care', *Skills for Care and Development*, Leeds, viewed 8 March 2018, http://www.technologytocare.org.uk/.

Trentmann, F 2009, 'Materiality in the future of history: Things, practices, and politics', *The Journal of British Studies*, vol. 48, no. 2, pp. 283-307.

Troy, R 2015, 'The challenge of providing challenge: Climbing, movement and risk-taking in playgrounds', *Australasian Parks and Leisure*, spring, pp. 28-29.

Tudor, T, Robinson, G, Riley, M, Guilbert, S and Barr, S 2011, 'Challenges facing the sustainable consumption and waste management agendas: Perspectives on UK households', *Local Environment*, vol. 16, no. 1, pp. 51-66.

Valant, J 2016, 'Planned obsolescence: Exploring the issue', *Briefing*, European Parliamentary Research Service (EPRS), Members' Research Service, PE 581.999, viewed 26 February

2018, http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/581999/EPRS_BRI%282016%29581999_EN.pdf.

Wajcman, J, Bittman, M and Brown, J 2008, 'Families without borders: Mobile phones, connectedness and work-home divisions', *Sociology*, vol. 42, no. 4, pp. 635-652.

Warde, A 1990, 'Introduction to the sociology of consumption', *Sociology*, vol. 24, no. 1, pp. 1-4.

Warde, A 2005, 'Consumption and theories of practice', *Journal of Consumer Culture*, vol. 5, no. 2, pp. 131-153.

Warde, A 2014, 'After taste: Culture, consumption and theories of practice', *Journal of Consumer Culture*, vol. 14, no. 3, pp. 279-303.

Watkins, J, Hjorth, L and Koskinen, I 2012, 'Wising up: Revising mobile media in an age of smartphones', *Continuum*, vol. 26, no. 5, pp. 665-668.

Weilenmann, A 2003, 'I can't talk now, I'm in a fitting room'': formulating availability and location in mobile-phone conversations', *Environment and Planning*, vol. 35, pp. 1589-1605.

Weston, R, Stanton, D, Qu, L and Soriano, G 2001, *Australian families in transition*, Family Matters No. 60 Spring/Summer, Australian Institute of Family Studies, Commonwealth of Australia, Melbourne.

Wieser, H 2016, 'Beyond planned obsolescence: Product lifespans and the challenges to a circular economy', *GAIA*, vol. 25, no. 3, pp. 156-160.

Wilhite, H 2014, 'Insights from social practice and social learning theory for sustainable energy consumption' in *Flux*, vol. 2, no. 96, pp. 24-30.

Wilmer, H, Sherman, L and Chein J 2017, 'Smartphones and cognition: A review of research exploring links between mobile technology habits and cognitive functioning', *Frontiers in Psychology*, vol. 8, Article 605.

Wilska, T 2003, 'Mobile phone use as part of young people's consumption styles', *Journal of Consumer Policy*, vol. 26, no. 4, pp. 441-463.

Wilson, G, Smalley, G, Suckling, J, Lilley, D, Lee, J and Mawle, R 2017, 'The hibernating mobile phone: Dead storage as a barrier to efficient electronic waste recovery', *Waste Management*, vol. 60, pp. 521-533.

Yin, R 1993, *Applications of Case Study Research: Volume 34 of Applied Social Research Methods*, Sage Publications, London.

Zallio, M and Berry, D 2017, 'Design and planned obsolescence. Theories and approaches for designing enabling technologies', *The Design Journal*, vol. 20, sup. 1, pp. S3749-S3761.

Appendix

Appendix 1: Interview and diary questions

Interview questions

The following is an overview of the topics and questions I would like to discuss with you at our meeting, subject to you consenting to participate in the study.

Topic 1: Acquisition of electronic devices

- What factors have driven you in the past to electronic communication devices and why?
- What factors have driven you in recent times to acquire your current devices and why?
- In your household who has acquired specific items recently and how did they go about this?

Topic 2: Using devices (to be asked in relation to specific items)

- How and where do you use your device?
- Have you always used these devices in the same way?
- Are they used by everyone in your household in the same way? If they are different, how?

Topic 3: Managing no longer in use devices

- Where do you keep specific items when you are not using them?
- When do you usually stop using electronic communication devices and why?
- What do you do with the devices once they are no longer in use and why?

Topic 4: Changes over time

- What changes have occurred over your lifetime in how you relate to electronic communication devices?
- For your household, can you identify changes in the use of electronic communications over time?
- What factors have prompted these changes?

Topic 5: Household profile

- Number of people in household
- Gender
- Age profile and intergenerational differences
- Education
- Household income
- Employment type and level of participation
- Household tenure
- Duration in current house
- Family living overseas.

Diary exercise and questions

Supporting information to complete the diary

When I met with you on [date of visit] we discussed the possibility of you providing some more detailed information around your use of mobile communication devices for two specific days in the form of a "reflective diary".

The following is designed to guide you in completing this task. Once again, your contribution to this research is greatly appreciated. (Prompting questions are provided under the headings for each day's entry)

- One diary entry is needed for one day of the standard working week, i.e. Monday to Friday
- One diary entry is needed for one weekend day
- The time for each entry should only take around 15 – 30 minutes
- The entries can be completed in either electronic or hard copy format
- Electronic copies should be emailed through to Kaye Follett at [redacted]
- Hard copy versions should be sent to Kaye Follett, at Monash University in the stamped, addressed envelope supplied

If you would like any further assistance or clarification, please feel free to email me at [redacted] or call me on [redacted]

Entry 1: Working week day

Day of the week

What day of the week is the entry for and why did you select this day?

Using your mobile communication device/s

Feel free to include as much information as you would like under this heading. The following are prompts only:

- The type of device/s used
- How many times the devices were used during the day, for how long, and at what time of the day?
- What functions on the device/s were used and why?
- Where did you use the device/s — within the home or elsewhere?
- What was the purpose of using a mobile device relative to some other method?
- Who or what were you engaging with when you used the device?

Servicing your device/s

Did you charge your device/s on this day and if so where in the house and why this location?

Did you use the device/s whilst it is connected to the power or as a mobile?

Activities and arrangements within and outside your household

When you used the device/s how did this shape or influence other household activities and arrangements, including social interactions and dynamics at the time or subsequently?

Entry 2: Weekend day

Day

What day of the weekend is the entry for and why did you select this day?

Using your mobile communication device/s

Feel free to include as much information as you would like under this heading. The following are prompts only:

- The type of device/s used
- How many times the devices were used during the day, for how long, and at what time of the day?
- What functions on the device/s were used and why?
- Where did you use the device/s — within the home or elsewhere?
- What was the purpose of using a mobile device relative to some other method?
- Who or what were you engaging with when you used the device?

Servicing your device/s

- Did you charge your device/s on this day and if so where in the house and why this location?
- Did you use the device/s whilst it is connected to the power or as a mobile?

Activities and arrangements within and outside your household

When you used the device/s how did this shape or influence other household activities and arrangements, including social interactions and dynamics at the time or subsequently?

Any additional comments and thoughts

Feel free to include here any other ideas, thoughts and comments based on your personal experiences that could contribute to improving our understanding of how and why mobile communication device/s are purchased, used and disposed of by Australian households.

Please include your name. This is for administrative purposes, only.

Thank you for taking the time to complete this diary

Kaye Follett, PhD Candidate, Monash University

[redacted]