The Effect of Representation Format on Consumer Preferences for Apartment Layout Attributes

By

Jacqueline Baker
BEnvDes (Environmental Design), MSc (Environmental Psychology)

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Department of Marketing
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Dedicated to Maani.

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Abstract

This research was conducted to understand whether floor plan representations normally used to communicate layout attributes amongst trained experts are legible from the perspective of laypersons. This was tested by examining whether evaluation scores of apartment layout attributes were influenced by representation format - in the case of this research - floor plan formats. Previous research has established that an individual's ability to imagine built-environment products increases understanding of product attributes. Building on this point, this research posits that when using floor plan formats to imagine building layouts, the importance of layout attributes may be similar or even more prominent than text descriptions of the layouts. This is because floor plans, by their very nature illustrate spatial layout configurations whereas the limitations of language mean that such configurations may have a propensity to be more abstract or ambiguous.

This research used stated preference experimentation to test whether people can articulate their preferences for building layout attributes more fluently using floor plan layouts compared to text descriptions of those layouts. In two experiments, respondents evaluated attribute profiles of hypothetical apartments that included either a floor plan or a verbal representation of the apartment's spatial configuration. In the first study a full factorial 2 x 2 x 2 design was used and 4 apartment layouts were presented to respondents for evaluation before a training treatment and then repeated. The second study was a 3 x 2 fractional factorial design which was adopted to reduce the number of apartments presented to respondent from 32 to 8. Generally, the main effect of floor plans rated higher than the main effect of text descriptions. However respondents evaluated layout attributes in text formats with a greater range

between high and low attribute categorical intensities compared to floor plan formats indicating they were better able to articulate their preferences from the written format.

It was expected that in experiments, if individuals were asked to focus on particular themes, the importance of the attributes related to the themes would increase. Also, with the individual focussing on the particular theme, it was expected that the related attributes would be more prominent for individuals evaluating those attributes using floor plan formats compared with text formats. Although attributes were not more prominently rated on floor plans, respondents in the floor plan condition showed increased sensitivity to dining space when they were in the entertaining-related needs condition. Further, respondents showed increased sensitivity to layout orientation where they were assigned the sustainability condition.

It was also expected that if training was provided in the survey for respondents about the nature of layout attributes: “dining space” and “layout orientation”, rating of apartments and range of attribute level scores would increase. This effect was found for the attribute “layout orientation”. Prior to training, the attribute was scored the reverse of what would be expected, anecdotally ascribed to the fact that many respondents were from the Northern Hemisphere where South facing layout attributes are considered more desirable, and because it was not an attribute that many people in the sample had considered before.

However, after training respondents about the layout attribute, it was scored as expected and showed a vast increase in importance.

The research also tested whether floor plan legibility was greater for individuals who were visual cognitive processors compared with verbal cognitive processors, and for individuals who had a concrete construal mindset compared to those who had an abstract mindset. It was expected that legibility of floor plans for individuals with an abstract mindset would be less than for individuals with a concrete mindset because of a mismatch between their mindset and their ability to interpret representations. It was also expected that visual learners would assign greater importance to floor plan representations of layout attributes (compared with verbal formats). However, the study found that abstract and concrete construal mindsets did not influence representation format evaluation for the sample evaluated.

The main contribution of this research is that it has laid the foundations for floor plans being found to be valid formats for representation and evaluation of housing in Stated Preference (SP) methods. However on the question of validity, more research would be required. The hypotheses testing illustrated that insights about individuals' ability to read floor plans with some fluency was particularly evident when they were trained about layout attributes. After training, the comprehension of layout attributes on floor plans improved results became more similar however when attribute evaluations were compared with text format, the latter showed a greater range of utility estimates than floor plan formats.

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.

Signature: ……………………

Print Name: ………………….

Date: ………………………….

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1. INTRODUCTION

Chapter Overview

This chapter commences with an introductory statement, and then lists the research objectives before justifying how the use of stated preference methods is appropriate to understand the role of visual product features in decision-making. Further, the chapter describes the core research problem and presents the justification and significance of the study. Finally, the research context is established and the research context structure of the thesis is presented and described.

Introductory Statement

Researchers have established that understanding built-environment products using pictures and virtual reality tools can increase the value and importance of product attributes (Vriens et al., 1998, Jansen et al, 2011, Orzechowski et al., 2005, 2012). Using this premise, the importance of apartment layout attributes was observed to gain insights about the extent to which consumers find floor plan representations visualisable, and therefore more legible than text representations (Vriens et al., 1998). Utilising Stated Preference Methods, this research simulates consumer intention to rent apartments represented by floor plans and by text representation. There is no known peer-reviewed literature about understanding property floor plans.

Definitions and Terminology

Many constructs and terms relevant to the study are defined in this section. Examples and references relating to each term and their relevance are explained in later sections.

i. Floor plans: floor plans describes spatial attributes shown graphically, for example walls, room sizes, and symbols;

ii. Representation: a representation can be considered as something physical that stands for (or models) something else in the form of culturally defined, observable words symbols and images;

iii. Spatial: refers to a description of elements, their physical location and the relationships in space between them. In an architectural context, a compilation of space and elements is commonly referred to as a setting. Spatial representations in this research are therefore concerned with modelling real world settings;

iv. Spatial representations: Spatial representations represent settings and can be visual or verbal in nature;

v. Visual representations refer specifically to a visual style of representing phenomena. In the context of this spatial study, visual representation is coined as a visual style of modelling real-world-settings;

vi. Layout attributes: physical arrangement of design features of a building;

vii. User-needs: the requirements related to the goals, aspirations and needs of the user or user community;

viii. Attribute training: attributes are features of products and training provides the consumer with knowledge about those attributes;

ix. Attribute familiarity: familiarity refers to prior knowledge that consumers may have about attributes;

x. Cognitive processing: mental processing construct that describes whether individuals process information visually or verbally;

xi. Construal mindset – the relationship between an individual's psychological distance and the extent to which their thinking is abstract or concrete;

xii. Legibility – whether something is clear and can be read with fluency;

xiii. Imageability – how readily a setting evokes clear mental images;

xiv. Visualise – to imagine an image of a setting. The terms visualise and imagine are used interchangeably through the thesis;

xv. The experts and lay-persons or untrained people – this refers to experts in floor plan legibility (in the construction field including architects, engineers and builders) and those untrained in reading floor plans.

Peer reviewed journals in the fields that this thesis contributes to use different jargon and terminology and it is important to be consistent. The terminology used in this thesis is *stated preference (SP) methods* rather than *conjoint analysis, floor plan and text formats* instead of *floor plan and text representation formats, representation format* rather than *presentation style, representations* instead of *models; conditions*, *groups* and *treatments* are used interchangeably, *layout attributes* is mostly used in the thesis but sometimes *building layout attributes, apartment layouts and spatial attributes* are used; *legibility* is used instead of *readability.*

Research Background

Floor plans represent the spatial configuration of buildings in the form of 2 dimensional scaled drawings (Zhu, Zhang, & Wen, 2014). They are typically used to communicate building layout attributes amongst trained experts in the construction industry. However they are also widely used to communicate layouts to untrained people (Alcock, 2017), for example: emergency plan layouts; shopping centre layouts; indoor google mapping; tourist accommodation layouts; architectural design layouts; and real estate layouts.

When representing property, floor plans are acknowledged in the real estate industry as making a positive difference to sales. Inclusion of a floor plan in marketing communications is linked to "getting a good price" (Tolhurst, 2016, October 9). Properties that feature floor plans in their marketing messages generate 30% more interest (from queries to sales) in property than those without (Da Silva, 23 September 2016).

Floor plans are popular with property marketing material for their ability to describe features and benefits of property or to complement other descriptions such as verbal text and visual photographic images (Milliken, 19 November, 2011). They also describe off-the-plan property, where consumers make purchase judgements sight-unseen. Although the benefits of floor plans in the real estate industry are cited to help the potential buyer to piece the design features together, recall the property post inspection and allow them to imagine and draw their furniture in the prospective home (Milliken, 19 November, 2011), there is no known evidence in the peer-reviewed literature of their ability to assist with imagining the property either before or after inspections.

In the professional field of architectural design, floor plans communicate building instructions such as: working documents; amendments; and, architects amendment documents; (Ewenstein & Whyte, 2009; Gross, 1996). Floor plans utilise lines, together with dimensions, directional orientation and, (in order to minimise clutter) abbreviated words and symbols coded into a language familiar to the experts- supported by legends for translation (Do & Gross, 2001). Although floor plans are capable of being understood by the relevant experts, experts are trained in the reading, drawing and interpretation of these floor plans – something that untrained and inexperienced laypeople are not – which could substantially decrease the usefulness of the floor plans to them.

By making the floor plans used in marketing material aimed at the lay-person more legible and easier for them to interpret, the floor plans may contribute to the target audience achieving a better understanding of the property's attributes and consequently making a more informed decision about whether to inspect the property, or whether to buy or rent it in the case of off-the-plan property.

It is not known whether consumers find floor plans to be legible (O'Neill, 1991) and imageable (Lynch, 1960). "Legibility determines the imageability of a place – how readily it evokes clear mental images" (Lynch, 1960, pg. 9). Imageability of building layout attributes in floor plan representations is closely linked to user-needs, training, attribute familiarity, cognitive processes and mindset (Montello, 2014). This research hypothesises that an individuals' legibility of floor plan representations depends on user-needs (Vischer, 1985) and attribute familiarity (Orzechowski, Arentze, Borgers, & Timmermans, 2012; Schnurr, Brunner-Sperdin, & Stokburger-Sauer, 2017). It also hypothesises that training individuals about the nature of layout attributes will assist with floor plan visualisation (Orzechowski et al., 2012). Further, it is hypothesised that an individuals' understanding of floor plans is greater for those who are visual cognitive processors (Childers, Houston, & Heckler, 1985). Finally, it is hypothesised that individuals are more likely to need detailed (abstract) information to assist with decision-making about renting or buying real estate when they are in a psychologically proximal (construal) mindset (Trope, Liberman & Wakslak, 2007; Zhao, Dahl & Hoeffler, 2014).

Research Rationale

SP methods estimate preferences for features of products by using multi-attribute alternatives of products which individual's rate which is analysed to find the importance of attributes and the relative importance between attributes. Scholars measuring SP traditionally use verbal-based stimuli, rather than visual stimuli for a number of reasons, mostly for the practical reason that they are quicker and less expensive to administer (Orzechowski et al., 2012) rendering the effort in developing visual formats, according to some opinions, not worthwhile (Arentze, Borgers, Timmermans, & DelMistro, 2003).

The literature argues for more SP studies using visual formats because spatial attributes such as building layout attributes are difficult to represent verbally (Dijkstra et al., 1996; Jansen et al., 2009; Levine & Lawrence, 2007; Morrow-Jones et al., 2004; Oppewal & Klabbers, 2003; Orzechowski et al., 2005, 2012; Rid & Profeta, 2011). Yet the debate remains on which visual techniques to choose for studies (Arentze et al., 2003; Holbrook & Moore, 1981; Jansen, Boumeester, Coolen, Goetgeluk, & Molin, 2009; Orzechowski, Arentze, Borgers, & Timmermans, 2005; Rizzi, Limonado, & Steimetz, 2012; Vriens, Loosschilder, Rosbergen, & Wittink, 1998; Wittink, Vriens, & Burhenne, 1994).

Louviere (1987) advises that if a specific visually-formatted representation and a content equivalent verbally-formatted representation are compared in SP tasks and achieve roughly the same preference results, the time and expense of comparing representations is inconsequential for the researcher. Therefore, there is no point in continuing to run two formats of representations in research. Louviere (1987) recommends however that where similarities occur, *visual* representations are best used in SP experiments if possible because, as has been established, they increase the accuracy and realism of SP experiments. As Louviere (1987) suggests, where preference results have not been established for varying types of visual formats, comparison with verbal formats is necessary to test that the attributes achieve roughly the same importance. Establishing similar outcomes when varying representation formats in SP tasks is the desired outcome for research in this area.

The current research measures visual-based stated preferences using floor plans, which have been used in the literature (Gao, Asami, Zhou, & Ishikawa, 2013) however despite active searching no studies have been discovered that tested whether floor plan formats achieve similar attribute importance compared with text formats, for housing products. Therefore the research also tests hypotheses on text-based formats. As the literature has established, language does not have access to all spatial information (Hayward & Tarr, 1995) and therefore it is expected that format-based differences may not be similar when compared in this research.

Visual preference tasks have been the subject of few housing studies and are underrepresented in the housing literature. Scholars have found however that respondents' preference formation is substantially influenced by visual representations of product attributes (Jansen et al., 2009). Whether the increase of attribute importance is a benefit or drawback is, however, context-dependent. If, for example, the presence of housing floor plans increased the importance of an attribute to an individual, and substantially influenced their preferences this could be of benefit to the real-estate industry, particularly in their marketing of real-estate offerings to potential buyers.

This research tested various hypotheses about apartment layout legibility by asking respondents to make judgements about building layout attributes based on their interpretations of floor plans and contrasted those judgements with their judgements made based on their interpretations of the same attributes using verbal representations. These visual and verbal formats of representation were varied in experimental conditions so that judgements can be measured and compared (Jansen et al., 2009; Louviere, et al., 1987; Orzechowski et al., 2005, 2012; Vriens et al., 1998). It is expected that this study could provide the foundation work for future research to determine whether individuals that are able to read floor plans with fluency will demonstrate enhanced *legibility* and *imageability* of layout attributes and are therefore able to better articulate preferences compared with a written format.

Justification of the Research

The premise for this research is that, if people are better able to imagine apartment layouts by using floor plan formats rather than verbal formats, they will be able to better understand layout attributes and therefore they will be better able to articulate their preferences. This effect will be apparent from an increased sensitivity to changes in attribute levels and will be influenced by such things as: user-needs; attribute familiarity; attribute training, cognitive style; and construal mindset.

It is important to understand how floor plans influence judgements and choices when representing apartment layouts to laypeople as floor plans can be a primary tool for conveying information to them. For example, in the case of off-the-plan housing, consumers use floor plans to imagine and compare layouts and other attributes and judge how they stack-up against their household's user-needs as a basis for making purchase decisions prior to their particular property being built.

Another justification for this research is to examine further visual formats yet unused in experimental stimuli and compare them to verbal formats as suggested by such authors as Orzechowski et al. (2012) and Louviere, Schroeder, Louviere & Woodworth, (1987) for the purpose of realism, and accuracy and validity for spatial types of product evaluations.

Research Significance

This section explains how the research is significant in terms of theoretical and managerial contributions.

The research adds to current housing preference literature by comparing the interpretation by laypeople of floor plans versus traditional text descriptions of real-estate products in regard to enhanced legibility and preference formation. Although floor plans have been used in SP experiments (for example (Gao et al., 2013) it is not known whether laypeople find them legible (O'Neill, 1991) and it is not known how their preference formations compare against those formed using text formats (Louviere et al., 1987, Vriens et al., 1998, Orzechowski et al., 2005 Jansen et al., 2009, Orzechowski et al., 2012).

This research investigates the need for training of laypeople in aspects of the tools created by experts, such as floor plans, commonly used to communicate complex spatially-related options. By manipulating attribute training, the research builds on the work of Orzechowski et al. (2012) who compared verbal with virtual reality and compared the results with a subset of subjects that undertook pre-experimental training. It is expected that the range of utility scores for the layout attributes will increase after the respondents have learned about the nature of the attributes;

respondents will be more focussed on the attribute they learned about; and, visualisation using a floor plan will show more articulation of their preferences.

This research seeks to demonstrate that attribute familiarity interacts with representation formats to increase utility estimate ranges on floor plans (Orzechowski et al., 2012; Schnurr et al., 2017), which is expected, particularly when further interacting with attribute training. The research also seeks to show that like attribute familiarity, cognitive processing style influences product attribute preferences.

Lastly, this research seeks to add to the literature about how product appraisal is moderated by mental construal (Trope, Liberman & Wakslak, 2007; Zhao, Dahl & Hoeffler, 2014). It is expected that representation format and construal mindset (psychological distance) would interact to affect the measurement of preferences in floor plan formats. For example, individuals evaluating floor plan formats of apartments (vs. text formats) would assign greater utility ranges to layout attributes if they are in the concrete construal-level mindset (vs. abstract) because of a match in concreteness of mindset and representation style (Trope & Liberman, 2011; Zhao, Dahl & Hoeffler, 2014). The detailed nature of floor plan representations will better align with the concrete-thinking required to navigate through them. This construct will be expanded in the background chapters.

Research Objectives

The main objective of the research is to understand whether evaluations of apartment layout attributes are influenced by floor plan representation formats, from the perspective of the lay-person. This will be established by comparing floor plan representations to text representations when articulating preferences for layout attributes, in experimental conditions (Louviere, et al., 1987; Vriens et al., 1998).

Floor plans are expected to out-perform text representations by finding a greater range of attribute levels. The reason for this is that floor plans are by nature able to explain spatial configuration of layouts in terms of shape and position (de las Heras, Ahmed, Liwicki, Valveny, & Sánchez, 2014). Language on the other hand is limited to specifying relationships more abstractly as observed by Hayward and Tarr (1995).

Furthermore, an objective of the research is to test whether focussing on a particular user-need, and training individuals about their related layout attribute, improves user understanding of floor plans. When individuals are focussed on their needs and the attribute on which they were trained they are focussed on what to look for on floor plans, thereby improving floor plan legibility.

Another objective of the research is to test whether floor plan understanding is actually improved for individuals who are visual cognitive processors (Childers, et al., 1985), in a concrete construal mindset (Trope, Liberman & Wakslak, 2007; Zhao, Dahl & Hoeffler, 2014). Legibility of floor plans for individuals with an abstract mindset is expected to be less than for individuals with a concrete mindset because of a mis-match in concreteness of mindset and representation. Visual learners are expected to assign a greater range of attribute utility when attributes are represented by floor plan formats (compared with verbal formats).

In summary, seven objectives underpin the research, summarised as follows:

I. To compare and explain differences in preference in visual and verbal representations of building layouts when using SP methods;

II. To test whether visualisation of layout attributes improves preference articulation and floor plan legibility;

III. To test for a conditional effect of user-needs on preference;

IV. To test for a conditional effect of attribute training on preference articulation of layout attributes for untrained individuals;

V. To test for a conditional effect on preference outcome between different categorical intensities of attribute familiarity in individuals;

VI. To test for a conditional effect on preference outcome between different categorical intensities of cognitive processing style in individuals; and

VII. To test for a conditional effect on preference outcome between different construal mindsets.

Research Context

The research is split into two separate experimental studies so that insights could be gained into the intention to procure apartments by two consumer groups. These groups were tenants seeking a rental property and buyers seeking to purchase property, in both cases, the research covered both "off the plan" property and constructed property.

Floor plans are two dimensional, scaled drawings of buildings which are according to the real estate industry one of the most effective property marketing tools (Clarke, 2013). This is because it helps buyer to visualise the spaces of the property and they generate competition if they are widely advertised. The benefits of floor plans in property marketing messages however are unclear in the literature; and the question arises, do floor plans make a difference to how much an apartment is liked (or rated)? The role of floor plans in consumers' intention to inspect and procure property has not to the researcher’s knowledge been the subject of any peer reviewed housing preference and choice studies to date.

Floor plans are traditionally used as a spatial visual communication tool between experts such as designers and construction personnel. In the expert setting of architectural design, they are more often than not working documents, communicating ideas and instructions that are subject to many amendments throughout the process of design, documentation and construction of buildings. Floor plans utilise line work with dimensions and orientation and, in order to minimise clutter, abbreviated words and symbols are used, requiring legends for translation. Although floor plans are universally understood amongst experts, intuitively speaking, the use of floor plans by untrained and inexperienced lay people could present problems with comprehension, requiring some kind of translation. In fact, there is no evidence to indicate how laypersons actually process floor plans.

This issue is not unique to property consumers (Stylianou & Silver, 2004). Other examples of laypeople using expert-designed visual spatial instructional material are: house design documents communicated between designers and clients; self-assembly furniture instructions used by firms such as IKEA; navigation and way-finding instructions such as those found on emergency exit maps; hospital layout information (Løvs, 1998); spatial instructional teaching material such as diagrams; “you are here” maps in shopping centres (Dogu & Erkip, 2000; Klippel, Freksa, & Winter, 2006); plans; photographs; 2d & 3D drawing software; and virtual reality for students of engineering, medicine, geography, architecture and many trades (Sorby & Baartmans, 2000).

By improving floor plans used in marketing material for laypeople as well as combining them with other visual formats, they will have a better understanding of the properties and an opportunity to make a more informed decision about whether to inspect the property and/or buy or rent it. For example Clarke (2013) advises that it is important to choose the right style of plan to showcase your home. She suggests that coloured plans and textured plans show off internal and external attributes. Furniture can help buyers to understand how their furniture may fit into the apartment. She also advises (p.1) about combining floor plans with other visual formats:

> The most sophisticated plans, 3D artist impressions, are generated from detailed building plans by special 3D software, and used for bringing yet-to-be-built properties to life in a highly realistic fashion. An effective way to combine your photographs and floor plans is through an online interactive floor plan. Symbols on the plan indicate the angle a photo was taken from, allowing buyers to easily navigate through a home by clicking on each photo, giving them a great feel for its flow and layout.

Thesis Structure

The standard thesis structure, which this thesis follows, is comprised of four components (Evans, Gruba, & Zobel, 2011), the introduction, background, core and synthesis.

The introduction has stated the problem, the aim and scope of the research (Chapter 1). The background provides the knowledge for the reader to understand the research. It describes the context of the research which includes the location and the people of interest to the study. It begins at the research context section of the introduction (Chapter 1). The background also establishes an understanding for the reader of the current practises and technologies in field of housing (Chapter 2). It then identifies current theory, discoveries and debates comprising of those of most interest to the research such as representation of property products (Chapter 3) and critiques cognitive measures and factors (Chapter 4).

The core section contains the original research including model, hypotheses, design, analysis, the results and a synthesis of the results. First it describes the model (Chapter 5), then navigates the reader through the studies to follow by describing the method and the procedure (Chapter 6). By outlining the methodology, theoretical perspective, method, preparation of variables for hypothesis testing and describing data collection, ethics and sampling. The research is split into two separate experimental studies (Chapters 7 and 8). Each study describes first the data collection procedures and then presents the results. Following this, the results are discussed and conclusions are drawn.

The synthesis component of the thesis brings together the thesis contributions to the context and literature, it critically examines the results summarised from the core of the thesis and conclusions are drawn. The synthesis is basically the final chapter (Chapter 9), it relates back to the critiques and debates from the background chapters and the discussions following the results in the core section.

Chapter Summary

The introduction chapter commenced with an introductory statement and continued with the importance of studying floor plan legibility in the context of SP methods. From there the justification, significance and objectives were presented, followed by the study context. Then research context was established and finally the research context structure of the thesis was presented and described.

2. HOUSING STUDIES

The previous chapter introduced the thesis topic and presented the research context. This chapter presents an understanding of current practices and technologies in the housing field and justifies the selection of the appropriate method to gather data for the studies prior to the methodology chapter.

Introducing Housing Preference and Choice Practices

This chapter presents a review of the main themes in housing preference research over the past fifteen years. The first part of this chapter focusses on just four key papers which are important because they have similar questions and contributions to the current study such as examining stimulus presentation in SP methods, having housing contexts, comparing the evaluation scores of attribute levels in visual and verbal styles of representation, examining whether people can better understand visual (compared with verbal) representations of spatial information, questioning inconsistencies in scoring of verbal and different visually represented products and whether verbal representations are realistic enough in SP methods. The discussion considers the limitations of the studies and the authors' recommendations for future research.

Critique of Housing Preference and Choice Methods

Jansen et al. (2011), list nine analytical methods and techniques that have been utilised in past housing preference and choice studies, as illustrated in Table 1. The methods are separated by three main dimensions; nature of the data - revealed or intended, (denoted by RP or SP in the table - definitions explained below), the freedom of attribute choice (denoted respectively by yes or no in the table); and the attribute-based versus alternative-based approach (denoted by C for compositional and DC for decompositional - definitions explained below).

Table 1: Comparison of nine methods for housing studies

(Table adapted from tables 1.1 and 1.3 in Jansen et al, 2011, pp. 18, 20)

	Methods	**Research Goal**	**SP/RP**	**Attribute Choice**	**C/DC**
1	Traditional Housing Demand Research Method	To obtain accurate insight into the current and future demand for housing quantitatively and qualitatively	SP	No	C
2	The Decision Plan Nets Method	To reveal people's choice process based on individual mixes of dwelling (environment) characteristics that are deemed essential, those that can be compensated for and those that are deemed irrelevant	SP	Yes	C
3	The Meaning Structure Method	To assess what people's housing preferences are and why they have them	SP	Yes	C
4	The Multi-Attribute Utility Method	To make a rational choice between available alternatives based on the dwelling profile that yields the most utility	SP	Yes	C
5	Stated Preference Methods	To estimate a utility function that can be used to predict utility of residential profiles and thus to compare residential alternatives in terms of people's preferences	SP	No	DC
6	The Residential Images Method	To examine preferences for new alternatives holistically	SP	No	DC
7	Lifestyle Method	To build/restructure/distribute dwellings according to lifestyle group preferences	SP	No	N/A
8	Neo-Classical Economic Analysis	To rank and assess the preferences for alternatives	SP & RP	No	N/A
9	Longitudinal Analysis Method	Analysis of a specific research question regarding the question how characteristics or circumstances at one point in time shape individual outcomes or decisions at a later point in time	SP & RP	No	N/A

Assessment of the study aims against these dimensions (Jansen et al., 2011), is that the study design will be looking at a particular behavioural intention therefore, SP methods rather than RP methods are required. SP methods measure future intention whilst RP methods measure existing or historical behaviour. Further, the study will choose and vary attributes relevant to the research questions rather than take the approach of requesting respondents to choose attributes, and so, in terms of the above table, the attribute choice dimension is “yes”. Finally, the study takes the decompositional approach in order to break down the results from alternatives into the contributions of separate attributes and attribute levels. This leaves two out of nine methods from which to choose, SP methods and the residential images method. The latter method focusses on representing the house-hunting process using pictures, drawings (sometimes combined with text) and photographic images. Yet despite its relevance to the study topic, the method does not have the capability of comparing verbal representations with visual and therefore only one option, SP methods is a suitable housing preference method for this study. The SP method is detailed below.

Critique of Stated Preference Methods

This thesis compares the outcome of preference experiments using graphical versus verbal representations of apartments, using the theory of the SP method approach as the basis for its analysis.

Appropriateness of SP Methods

Housing preference and choice research is underpinned by three main theoretical perspectives. Firstly, the life-cycle and life-course models (Jansen et al., 2011) explain and forecast residential mobility (such as Rossi, 1955 and Mulder & Hooimeijer, 1995); secondly, the theory of planned behaviour is a widely used behaviour model based on attitudes, behaviours and social norms (Jansen et al., 2011) and thirdly; a model of decision-making applied to the specific case of housing

(Jansen et al., 2011). The current research is underpinned by the third theoretical perspective, the decision-making model, due to its ability to simulate and manipulate hypothetical housing preference scenarios and examine trade-offs of attributes that individuals make when considering alternatives. According to Jansen et al., 2011, people who are browsing for a new residence are unlikely to have well-articulated preferences and the preferences are partly constructed during the problem-solving process itself.

The reason why SP methods are chosen over other methods of user-evaluations of built environments, is because of the high number of factors, their trade-offs and effects, that this method can handle. As an experimentation method, SP allows the main effects of multiple attributes to be estimated independently of each other, whilst estimating or controlling for attribute interactions, although typically some interactions have to be assumed negligible (Molin, Oppewal, & Timmermans, 1996).

Advantages of Preference versus Choice Modelling

Preference modelling is based on evaluations in which respondents rate products and choice modelling gives respondents binary (or more) choices of their preferred product. The three main advantages of ratings-based modelling of preferences are as follows. Firstly, Preference Modelling specifies the variate, a linear combination of effects of independent variables (levels of attributes) on the overall preference rating. Secondly, it estimates a separate model for respondent groups. Thirdly, preference modelling can be undertaken using parametric analysis techniques where statistical power is stronger than for non-parametric tests and, significant differences between group means can be tested. The preference modelling in this research is analysed using mixed-effects models. These are detailed in the methodology chapter. The main advantage of choice-based designs are that the categorical data can be analysed with logistic regression, which is also employed to analyse the data for RP discrete choice models, random utility modelling (McFadden, 1974). The choice-based designs will not be used in the thesis due to the time and length it would take to analyse everything in the research instrument.

Theory

Underpinning SP methods is a theory on information processing in judgement and decision-making that plots a particular course for the process of complex decision-making. Consumers commence with the acquisition of information; researching the available alternatives, then bundling a set of characteristics important to them to use for comparison and evaluation of product alternatives within the limits of their search such as price range and suburb. Figure 1 is reproduced from Louviere (1988, pg.10) , and demonstrates symbolically how individuals integrate attributes to evaluate and choose , as they progress through four stages: 1) Psychophysical Judgements 2) Attribute Evaluations 3) Overall Evaluations and 4) Choice or Purchase Decisions.

Figure 1: Complex Decision-making

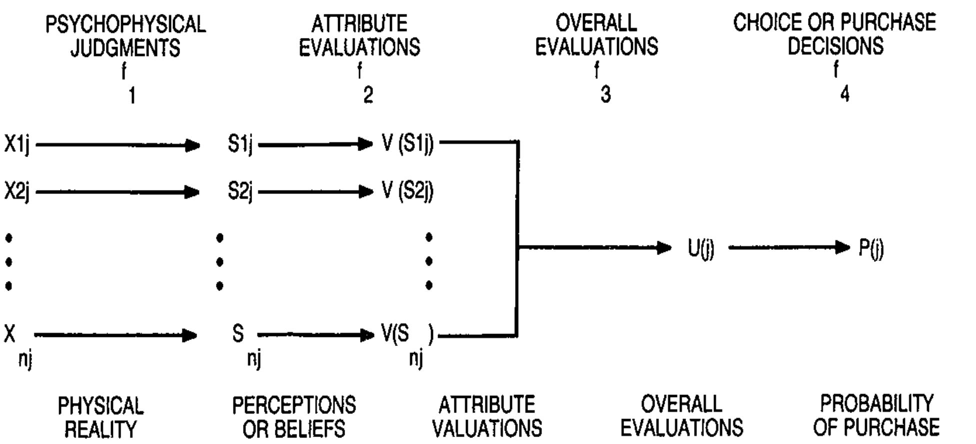


Figure 1.1 Complex Decision Making

Assumptions of SP Methods

SP assumptions are very different to many other models, having the least restrictive set of model estimation assumptions than other types of analysis (Hair, Black, Babin, Anderson, & Tatham). Most tests performed for other parametric data, such as normal distribution, homogeneity of variance and independence methods (Field, 2009), are not necessary for SP methods because of their structured design and generalised nature. Also, the profiles or alternatives of SP methods are statistically based and this ensures that the estimation is not confounded and the interpretation of results can use the assumed composition rule. However, despite having a very restrictive set of statistical assumptions, for SP methods, the conceptual assumptions are greater than many other parametric analyses. SP methods involve designing experiments where a general form of the model consists of main and interaction effects and this needs to be specified before the research is actually designed. And so, once the model is designed followed by the research design, the model cannot be changed. The design, estimation and interpretations of SP methods are therefore theory-driven. Basic assumptions of information integration theory are: that the overall utility that an individual has in mind for each attribute is linearly related to a rating scale, meaning that the rating scales used in preference models are assumed to measure overall utility; the ranking scale used in appropriate experimental scenarios and conditions are close to an interval measurement level; and, it is assumed that the responses of consumers did indeed reflect their judgements and decisions (Louviere, 1988a).

Justification of Stated Preference for This Research

SP methods measure preference or choice for intended behaviour (Louviere, Hensher & Swait, 2000) . This is different to Revealed Preference (RP) methods which model actual observable choice (preceding or current) in real-life situations (Train, 2003). For many reasons, social scientists work with SP data over RP data (Louviere et al., 2000) . The reasons include: SP data can estimate demand for products that are hypothetical and do not exist; RP can only model what exists and is time consuming for the researcher; fractional factorial designs help SP methods to handle large designs; SP data enables the researcher to use visual experimentation formats; and to vary or compare them.

SP data can estimate demand for products that are hypothetical and do not exist

Demand can be estimated for new products with SP methods. This enables modelling of hypothetical modifications of products without the expense of making prototypes. By using SP data, experiments can find the optimal new product or new features without the expense of testing it out in the real market. When modelling intended choice and preference, combinations of attributes that do not exist in reality can be presented to respondents for consideration, enabling the prediction of preferences that have not yet been tested in the market place and saving marketers the cost of real-world product testing (Green, Krieger, & Wind, 2001). The benefit of this to this thesis is that many experimental combinations of apartments may not exist in reality, enabling insights into intentions to view an apartment, beyond what would be possible using extant stock - which has particular relevance in an industry that typically looks at historical data to estimate trends in property.

RP can only model what exists and is time consuming

RP data is of limited use because it cannot model what does not exist. RP data can be time consuming and expensive to collect. SP data can be collected relatively quickly and inexpensively compared to RP data. Although RP methods are powerful statistically, particularly when combined with SP data, this study is not concerned with historical or actual behaviour, but rather with intentions to procure a housing product.

Fractional factorial designs help SP methods to handle large designs

The use of fractional-factorial designs in SP data enables researchers to limit the number of alternatives presented to respondents when evaluating big designs by selection of a subset (fraction) of the full set of combinations of the attribute levels. This is done by using only a fraction of the level combinations specified by the full factorial design. Which combinations to make and which to leave out is a matter of choosing designs that include only the most important combinations of the variables. A statistical design plan was used to decide the subset of profiles and choice sets. The experimental designs used in the current research capture all possible effects of product features on the dependent variable (study 1), and a reduced set of effects when the nature and variation of features were too large to use the full factorial design (study 2).

SP data enables the researcher to vary or compare visual experimentation formats

In the context of this study, SP methods offer the ability to compare and vary the representation format of the experimental stimuli (apartment alternatives) in order to capture insights about how consumers' preferences are affected when apartment features are expressed graphically compared with verbally.

However, an ongoing debated limitation of SP methods is that it may not reflect actual choice behaviour, in other words, what respondents claim they would do in a hypothetical situation, they may not actually do if the situation were real (Louviere, 1974).

Alternatives

In this thesis, SP methods are used to present respondents with hypothetical preference alternatives in the form of two or more representation formats of attribute profiles. The alternatives are typically made up of features, also called attributes. They are determined prior to the experiment as each feature has two or more categorical intensities called levels and they therefore effect the experimental design. An example of such an attribute is "view" (Oppewal, Poria, Ravenscroft, & Speller, 2005), which has three categorical intensities (levels): 1) view of park; 2) view of building; and, 3) view of tree.

Estimation of Preference Models

SP methods offer two techniques, depending on the type of experimental design used, ratings-based design - called preference modelling (Green & Srinivasan, 1978), and choice-based experimental design - called choice modelling (Louviere & Woodworth, 1983). Preference modelling uses continuous data from the rated alternatives as the dependent variable by testing the significance of effects, using a linear mixed-effects regression analysis. Although choices are measured in the research instrument, choice modelling is outside the scope of this research. Preference modelling for both studies, involved asking respondents to consider alternative layouts and then rate each separately.

The Utility Function

The result of SP analysis is a utility function that describes to what extent each attribute level (part-worths) contributes to the overall utility (total-worth) of apartment options or alternatives. This is called the preference structure and the extent to which attributes contribute to the product utility is known as the attribute importance. Importance increases when the range of utility value increases. So if the means of attribute categorical intensities are similar, that attribute is not considered important to the sample. Using utility values, the researcher can predict preferences with any combination of attribute levels, even those combinations not presented to each individual participant in the experiments (Houthakker, 1950; Tinessa, Papola, & Marzano, 2017; Walker & Ben-Akiva, 2002).

The utility function can be expressed as follows:

$$U_{nsi} = \sum_{k=1}^{K} \beta_k x_{nsik} + \varepsilon_{nsi}$$

Let U_{nsi} denote the utility of apartment alternative *i* perceived by respondent *n* in choice situation *s*. U_{nsi} is made up of two components: the estimated model, $\sum_{k=1}^{K} \beta_k x_{nsik}$ and an added un-modeled component that accounts for random error, ε_{nsi}. The modelled component is assumed to be a linear summation of part-worth utility contributions from each attribute level, x_{nsi}, and their corresponding parameter weights, β. The un-modelled component, ε_{nsi}, accounts for individual differences of respondents. The parameter weights for the coded attributes are denoted by *k*.

Data Collection Types

SP methods have a number of data collection types such as: full profile techniques; compositional techniques; hybrid techniques; and adaptive conjoint analysis (Green, Krieger, & Wind, 2001). The type depends on 6 options 1) Preference model; 2) Data collection method; 3) Stimulus set construction; 4) Stimulus presentation; 5) Measurement scale for the dependent variable (in the case of the rating model); and 6) Estimation method (Green & Srinivasan 1978, 1990). The option of particular interest to this study is the "stimulus presentation" - option (4) because part of the intention of the study is to compare the preference outcome variables when varying representation formats.

Over the last 30 or so years, SP has become an accepted method in housing choice and preference studies. Researchers have focussed on many aspects of housing, in particular the choices and preferences of end-users of housing options and related products and services. A review by this thesis of publications spanning the past fifteen years has revealed a number of themes, all of which are of interest to this study. The themes (although not exhaustive) are: 1) Specific market groups; 2) Type of dwelling; 3) Dwelling design; 4) Neighbourhood location; 5) Access and transport related features; and 6) Intention to move. They are shown in Table 2 with examples of publications of each theme - mainly from the past fifteen years.

The representation format of each study is documented in the table as a quick reference before the discussion that follows. Some other housing themes in the literature that date further back than ten years, are group preferences, complex decision-making and impact of environmental amenities. These themes will not be discussed in this document however for further reading, refer to Molin et al., (1999) and Molin et al., (2000) for group preferences; Earnhart (2002), for impact of environmental amenities; and Louviere and Timmermans (1990) and Van de Vyvere, Oppewal, and Timmermans (1998) for complex decision-making.

Table 2: Themes Found in SP Housing Studies in Past 15 years

	Themes	Author(s)	Representation Format
1	Tenant Preferences	Rental : Walker et al. (2002)	Verbal
		Student halls: Oppewal et al. (2005)	Verbal
2	Dwelling Design	Orzechowski et al. (2005)	Verbal and Visual
		Orzechowski et al. (2012)	Verbal and Visual
		Oppewal and Klabbers (2003) Gao et al., (2013)	Verbal Visual
3	Transport Access	Borgers et al. (2008)	Verbal
		Katoshevski and Timmermans (2001)	Verbal
4	Type of Dwelling	Iman et al. (2012)	Verbal
		Wang and Li (2006)	Verbal
5	Neighbourhood Location	Kim et al. (2003) Patterson et al. (2017) Mostofi Darani (2014)	Verbal Verbal and visual Verbal and visual
6	Intention to Move	Kim, Pagliara and Preston (2003)	Verbal
		Jansen et al. (2009)	Verbal and visual

Tenant Preferences

The first theme is similar to the present study because it is concerned with the preferences of specific market groups; tenants. Both examples given Walker et al. (2002) and Oppewal et al. (2005), measure the amount of rent tenants would be willing to pay (WTP) extra should certain attributes be provided in housing. For example, Walker et al. (2002), found that tenants of public housing would not necessarily take cheaper housing options if they were made available to them because other attributes were more important to the tenants than saving money on rent. Oppewal et al., (2005), ran experiments to elicit preferences of tenants for student halls at a university accommodation facility. Once again, price was not that important relative to other attributes, having the smallest effect on room ratings. Price had the smallest effect on room ratings than any of the other attributes. Similar to Walker et al. (2005), this could mean that price did not matter; perhaps the reason was because the rent for this tenant type is commonly paid by parents. Neither example used visual representations in the SP experiments despite having spatial attributes. For example "floor area" in Oppewal et al. (2005) was not presented visually but in a square meter (m^2) text format, with three categorical intensities, $9m^2$, $6m^2$ and $4m^2$. They were presented in dimensional terms such as $6m^2$ (2 x 3) assumingly, to help individuals to imagine the room size. Interestingly, size was the third most important room attribute to respondents and the greatest increase in utility for room size was between $6m^2$ and $9m^2$ categorical intensities. This is not really surprising because the $9m^2$ size is the only room that meets student room standards. The four m^2 level is spatially inadequate for the function of a student room. Firstly it does not meet the 1985 Housing Act UK standards for student room sizes (Buildings, 29 April, 2017), and further, it is not possible to accommodate a single bed, a closet, a desk and space to move around in a room of $4\ m^2$. $6\ m^2$ is also below standard. The result illustrated that the respondents were able to adequately imagine room sizes without visual stimuli.

Dwelling Design

The second theme is dwelling design. Oppewal & Klabbers, (2003) investigated the effect of room positioning, aspect, and room size on residential preferences presented in a verbal format. Four approaches of preference measurement were compared in this study, making visual representation too difficult a consideration despite all the attributes being spatial in nature. Orzechowski et al. (2005) asked respondents to choose between different options of extensions and costs to a base house design, in a study that compared visual and verbal versions of the features. The visual representation used was multimedia, using virtual reality and text. One of the problems found with describing the attributes verbally was that they were too "wordy" to comfortably fit into the usual SP verbal profile format. To combat this, the verbal descriptions were converted into codes, with the full description available at the click of a mouse. The visual version presented the options as a non-interactive virtual reality walk through of the extensions with verbal text on the screen for the prices. The results showed no significant difference between the two representation formats in terms of internal and external validity, suggesting that the elicitation of preferences is not influenced by representation format. The internal validity was determined by comparing the results of the two representation formats and the external validity was measured by predicting the choice using two representations with a holdout profile. The multimedia task had a lower error variance associated with it (although not significant), which could infer that respondents gave fewer inconsistent or random responses. This may indicate that visual representation formats can increase the reliability of measurements. Orzechowski et al. (2005) point out that although visual representation format can assist with visualising and thus with comprehension of design options, it can also mean that extra information is provided some of which may not be relevant to the measurement task.

In a later study, Orzechowski et al. (2012), designed a similar experiment, one in a verbal format and the other in a multi-media presentation format. Additionally, respondents were asked to complete a design session where they learned about the attributes while designing their own home using a virtual reality tool. A subset did this task prior to the experiment and another subset afterward. Where it was undertaken prior to the preference task, the condition was viewed as pre-experimental training. In summary, the results of the study found that using virtual reality to assist respondents to learn about the nature of the attributes in the experiment, significantly improves the validity of the results. This is independent of which version of the experiment was taken by the respondent (verbal or multi-media). Therefore, the authors suggest that in future experiments, additional time that respondents spend on attribute training is worthwhile and improves the validity, compared with saving respondent's time and commencing immediately with the experiment.

Preferences for dwelling design was also elicited from housing consumers by measuring preferences for floor plans (Gao et al., 2013) for medium sized apartments in Beijing. In this study, floor plans were used for experimental measurement. The most important preferences for consumers were privacy, orientation to the sun, storage and number of rooms. Goa et al., (2013) found that floor plan preference strongly depended on the family group and suggested therefore that a high level of customisation of marketing messages about layout is necessary. Seven floor plans were given to respondents for analysis. Out of 314 respondents only 21 (7%) were removed because they were confused by the floor plans. This low number indicates that floor plans could be a useful tool for evaluating floor plan alternatives using SP for providing: 1) detailed and spatially accurate preferences; 2) improving housing design; and 3) eliciting group preferences.

Transport Access

The third theme is proximity and access to amenities. Borgers, Snellen, Poelman, and Timmermans (2008) conducted a study to find out the effects of restrained car access on new developments and how the negative effects could be compensated by other transport related options. However most individuals do prefer to live in areas where access to their car is proximal. Katoshevski and Timmermans (2001) also looked at preferences for new developments, but from an urban design point of view, with the goal of designing future urban residential areas that are attractive for new immigrants. They asked respondents to trade-off attributes concerning house type, population mix, and travel time to places like school and work. Their contribution was based on the outcome of a multinomial logit model fitting the data well which was a good result because multinomial logits were not commonly used in the urban design literature at the time of the study.

Dwelling Type

The fourth theme is type of dwelling. As previously discussed, Iman, Pieng, and Gan (2012) conducted a study in Malaysia which measured preference for housing products, enabling them to find important information for developers about what buyers want in terms of preferred floor area and type of dwelling (for example). The results found that middle to high income earners preferred a double-storey semi-detached house, trading off larger floor areas and design features to have this house type. This was preferred over the clustered or super-linked house, possibly because the semi-detached house only shares one wall. Wang and Li (2006) conducted two studies in China which till recently did not have a housing market and as such is in a transitional housing system. Respondents were asked to imagine buying a home in a choice experiment that elicited joint choice of dwelling and neighbourhood. This involved the trading-off of neighbourhood and location-related attributes and dwelling-related attributes to make choices. The respondents attached greater importance to the neighbourhood-and location-related attributes than to dwelling-related attributes and were willing to pay large sums of money to trade a dwelling in the least preferred district for one in the most reputable district. This was also experienced in the real-estate industry in Australia (Quelch, 10 February, 2016).

Neighbourhood Location

The fifth theme is neighbourhood location. Kim, Pagliara and Preston (2003) demonstrate their findings with the combined estimation of two stated preference experiments. The preferred location for a new housing development varied with commuting patterns, spatial job distribution, and the changes of attributes influencing residential location choice. The results show that transport related attributes significantly impact residential location choice. Quality of neighbourhood school also has a significantly positive effect, while higher density and central city location have a significantly negative impact on residential location choice. Patterson et al., (2017) researched neighbourhood choice comparing text-based formats to virtual reality simulation. Concerns were raised from the experimentation that text formats are reliant on mental imaging whereas preferences from the visual survey were from the displayed (or external) images, therefore the accuracy of representations is important when measuring outcomes of location choice. A further study (Mostofi Darbani, 2014) compares text versions with gaming versions of neighbourhood choice, to test for effects of nature and quality of responses to the survey. Attribute choices made with the gaming formats tended to be less important compared with text only formats which is different to the findings of Jansen et al., (2009) and Orzechowski et al., (2005). However, respondent attention was greater for data from gaming platforms resulting in better models of neighbourhood choice (compared with text formats).

Intention to Move

In a further study, Kim, Pagliara and Preston (2005) investigated the impacts of the current dwelling, household characteristics, and alternative properties on the probability of moving (the sixth theme) and residential location choice. They found that residential location choice highly correlates with the decision to move. Transport and transport related factors were found to be very important to both "intention to move" and "residential location choice". In a study about moving and housing choices, Jansen et al. (2009) compared verbal and visual versions of descriptions of dwelling and dwelling-related attributes. They presented profiles using text only, text and colour photographs, and text and black and white photographs. Each respondent was required to evaluate all three versions of each profile. Interestingly, visually presented attributes had the effect of increased importance compared with the verbally presented attributes. The authors offered two types of explanations for the finding of unequal importance of attributes. Firstly, it could have been because additional detail was inadvertently included in the images, causing the estimation to be biased. Secondly, it could have been because verbal and visual information were processed differently and individuals could have had a preference for either a visual or a verbal mode of cognitive processing.

All of the six themes are of some interest to this study. They are either related to the chosen attributes or the hypothetical scenario that respondents will be asked to imagine prior to undertaking the experimental task.

The studies of most interest to this thesis are those which have worked on the area of stimulus presentation within SP methods, bringing to housing preference and choice studies the debate about whether to include visual formats in representations. Orzechowski et al. (2005); (2012); and Patterson et al. (2017) compared text with virtual reality formats, Jansen, et al. (2009) compared images and text formats and Mostofi, (2014) compared gaming platforms with text. Each of the studies compared verbal and visual presentation stimulus.

Conversations about whether visual representations are worthwhile utilising in SP methods and the extent to which they should be compared to the text-only approach was also found in fields other than housing, such as environmental planning (Alberini, Riganti, & Longo, 2003); urban planning (Bateman, Day, Jones, & Jude, 2009); and transport (Arentze et al., 2003). Visual representation is therefore an established method of presenting SP method experiments, generally. The issue of the inadequacy of verbal representation has been discussed before in the marketing field, such as when considering consumer choices about design and styling of products (Jaeger et al., 2001, Page & Rosenbaum, 1992; Srinivasan et al., 1997).

Non-verbal representations have received less attention than verbal formats in the literature and it is noted that the issues pertaining to pictorial and prototype stimuli representations are as a result, less resolved in the literature (Jaeger & MacFie, 2001). Yet in some instances, visual representation has been found to make the task more realistic and enhances external validity where choices depend strongly on the inspection of products (Loosschilder, 1997; Vriens et al., 1998). Wittink et al. (1994) suggests that research is required to examine whether stimuli representation influences preference responses and in particular: the extent to which substantive conclusions differ between representation formats; differences in predictive validity of marketplace behaviour between different modes of stimulus presentation; and the feasibility of realistic pictorial representations.

Interestingly, literature comparing verbal and visual formats of attributes was inconsistent when measuring importance. For example, Louviere et al. (1987) found few differences in part-worth utilities between representation format (verbal and photographic images) and similarly, Mueller, Lockshin, Louviere, and Hackman (2007) in a choice task involving a best-worst web based survey, gave respondents the option of clicking for additional information which was visual. The two styles showed no difference in choice outcome and no difference in perceived attractiveness. In contrast, Vriens et al. (1998) found that some design attributes were more important when photographic images were shown compared with verbal attributes.

This inconsistency was also found in four recent housing studies that are key papers for this thesis, Jansen, et al., (2009), Orzechowski, et.al. (2005; 2012) and Patterson et al., (2017). These papers are discussed in more detail in the next chapter.

Chapter Summary

This chapter commenced with an introductory statement, and then critiqued Housing Preference and Choice Methods. Several methods were discussed and the method chosen for the research is in the methodology chapter. The next chapter will review the literature on representation particularly in the context of SP methods, visualisation techniques, internal and external representation and comparing visual and verbal SP evaluations.

3. REPRESENTATION

Chapter Overview

This chapter continues identifying current theory, discoveries, and debates about the literature relevant to this thesis. The structure of this section begins with discussing representation, followed by visual and verbal representation formats and finally floor plan formats in SP experimentation. It is important to note that this research utilises SP methods and its underlying theory whilst also making contributions to this method. The theory, findings and debate used in this thesis are therefore mostly derived from within this SP context.

Representation

There are three main points that the background literature makes to illustrate representation of spatial or layout attributes. The first explains language representation, the second the relationship between representations and cognitive load and the third begins to make a case that spatial information uses less cognitive load when visually represented than when verbally represented.

The first area of background literature review presented in this thesis concerns the relationship between language representations. Hall, 1997, pg. 4, said, “Languages work through representation. They are systems of representation.” This means that whatever format language takes (visual, verbal), they all use some element to stand for (represent) what one wants to say. They all convey meaning (Grinblatt & Keloharju, 2001) and are influenced by culture. Culture is a collection of expressions of meaning that are held by a group whose members make sense of the world in a similar way and communicate in ways which are understood by each member (Jiang, 2000). Language is one of several means to communicate these meanings, and is therefore the medium by which meaning is produced and communicated to the culture. This section discusses the benefits and limitations of language representation using theory, written format, mental representations, interacting with external representations and spatial limitations of written formats.

Representation Theories

Considering that a representation can be considered as “something physical that stands for (or models) something else in the form of culturally defined, observable words symbols and images” (definition section, Chapter 1), it is clear that representations are in fact complex. According to Hall (1997) there are three different approaches to explaining how representation of meaning (through language) works. They are the reflective; the intentional; and the constructionist approaches.

The reflective, is a representation that conveys an exact replication of meaning, by reflecting the true meaning as it exists in the real world. It is also called mimetic. For example, the word “rose” reflects the true meaning of a real-world rose and for one person to understand the language of the other, the code linking the word with the real flowers “rose” must be learned.

The second approach, the intentional approach, inverts the meaning of the first. The intentional approach argues that the meaning in representation is in fact in the representation itself, the author of which imposes a unique meaning on the world through the language of the representation.

The constructionist approach, argues that neither the things represented, nor the users of language can fix meaning in language. Meaning is constructed by social actors using cultural language systems of signs such as sounds, images, words and drawings, to communicate meaning to others within the culture (Wood & Fels, 1986) (Piotrowski, 2017). Saussure (2006) defined signs as the union of the form (the signifier) and the idea (the signified). In other words, the signifier co-exists with the concept, the signified. For example, when the respondent reads the words "semi-detached house" (the form or signifier), it correlates with the concept of two houses joined by the side wall (the idea or signified). This thesis therefore uses the constructivist approach in its interpretation of the meaning attributed to representations.

Writing about spatial relationships

Written format does have some ability to adequately describe spatial relationships. In SP Methods, verbal language formats are the traditional vehicle for measurement in experiments. Even when describing spatial relationships, verbal formats have been successfully utilised by reframing to aid spatial interpretation. One such example is an urban design study by Katoshevski and Timmermans (2001), in which hypothetical new towns were presented to respondents containing attributes that depicted varying conditions about dwellings - their setting and their relative location. Rather than visually representing the spatial attributes they were reframed into more easily understood text descriptions. For example, one attribute containing distance measurements between places was converted into travel time, likely because travel time can be imagined more easily from text descriptions than distance can. Another example, (Iman et al., 2012) describes a design feature using text because the attribute (smart-home features) was easily understood by the sample rendering visual representation unnecessary.

How to help individuals to visualise from mental representations

When researching the nature of representations in cognition (Zhang, 1997) stated that there are two main types of representation, internal and external. The former refers to representations which individuals construct themselves mentally, the latter refers to physical external stimuli that help cognition (Scaife & Rogers, 1996). When considering internal representations, language also has the ability to be coded in a spatial array if the verbal data allows it, which helps individuals to internally visualise messages. Within internal representation, individuals move from abstractly remembering words and phrases to visualising if the data allows it (Mani & Johnson-Laird, 1982). People code verbal descriptions of spatial relations in two main ways (Mani & Johnson-Laird, 1982). The other way people code is an abstract propositional way, memorising the words and sentences. Secondly, they code the information in a spatial array - called spatial mental representations, mental modelling, visualising or mental mapping. In the second way, the coded information is much more memorable. The assumption is that the mental process usually involves moving from propositional mental representations through to spatial mental representations if the data allows. The propositional representation remains in the memory whilst the mental model is built and then is supposedly discarded. Mental models are not constructed if the descriptions are indeterminate or not concise. In this instance people keep the spatial descriptions coded as whole sentences, keeping them in the memory in a verbatim way. It is clear here that the SP task needs to carefully design determinate descriptions when using verbal representations; this will assist in construction of mental representations of a spatial nature which in turn are more memorable.

External representations may be more effective

Related to this, the benefits of interacting with an external representation are especially clear for complex structures. Whilst increasing the complexity of a visual structure increases the complexity of the explanation when using sentences, construction of similar representations using physical drawing is less cognitively complex. Even though some people can visualise complex things mentally that others cannot, there is always a point where internal cognitive powers are overwhelmed and physical realisation is advantageous (Kirsh, 2010).

Verbal representations are limited in explaining spatial relationships

There is an ongoing debate in SP Methods that linguistic formats lack the ability to concisely and simply describe shape and position (Dijkstra et al., 1996; Jansen et al., 2009; Levine & Frank, 2007; Morrow-Jones et al., 2004; Oppewal & Klabbers, 2003; Orzechowski et al., 2005, 2012; Rid & Profeta, 2011). Hayward and Tarr (1995), have shown that visual and linguistic representations of space are actually quite similar because they share underlying structural similarities. In a series of experiments, respondents were asked to generate linguistic and visual representations of objects and their spatial relationship. The two styles of representation compared well, in particular when the objects were in vertical or horizontal alignment. However, despite the inherent ability of humans to talk about what they see, language does not have access to all visual information (Hayward and Tarr, 1995, p.40). Linguistic experience of objects and their spatial relationship compared to visual or graphical experience is selective and coarse, leaving out some of the information of the visual experience. For example, schematic relationships are well covered in language coding, such as “above”, “under”, and, “adjacent” however coding of spatial properties such as the exact position and dimensions of objects in space and their relationship to other objects may not be adequate in some cases of verbal spatial description. To expand on this, a further example is taken of specifying a proposed kitchen cupboard installation to an existing kitchen. This could involve such information as: “900mm x 600 mm x 1920mm kitchen cupboard, benchtops finished with square end, commercial grade floor vinyl coved to 150mm and 600mm high splashback” and so on. It could be specified that it is to be installed adjacent to the refrigerator. Although measurements are stated in text, graphic representations will enable one to draw and dimension the cupboard unit to describe many spatial relationships that the cupboard has with itself and other fit out objects in the existing kitchen. Experts use graphics to describe such spatial detail and leave the specifications (text) to nominate products and instructions on the entire construction process.

Representations and Cognitive Load

The effects of representation format on cognitive load is pertinent to this project for the reasons noted below. Preference behaviour is affected by how individuals can internally visualise from the meaning conveyed in representations. Mental representation is therefore included in this project because it is important to understand the way in which the brain makes sense of spatial representations for a more targeted approach to the design and variation of representations which is central to this study. This section discusses translation of representations, minimising translation, understanding representations and spatial sketching. From this section, it is clear that although representations need to suit the messages being conveyed to consumers, the smaller the cognitive load, the better individuals are able to commit it to memory.

Translation of Representations

If an individual is required to translate or interpret the external representation, the cognitive load increases. High-task load is caused by respondents needing to match the external representation to their internal representation via some kind of interpretation or translation. For example, if an individual was to read a verbal spatial description of an object, visualising it mentally, then afterwards view an image of the object, the image may not match the visualisation. Further, it has been argued that reading about spatial relations interferes with internal visualisation of spatial relations because it takes longer than with other styles to form the vision. Experiments were run (Brooks, 1967; 1970) to compare visualising from reading with visualising from listening. Brooks found that the process of reading about spatial relations resulted in visualising slower than when visualising after listening to the same information. The findings were determined by timing respondents' process of visualising after being exposed to the two modes of verbal representations.

Minimising translation

The easiest way to assist individuals with understanding representations is to avoid or minimise translation by closely representing human cognition. External representations waste cognitive load if they require translation so they are not always the most appropriate stimuli to use in SP tasks. In order to achieve accurate mental visualisation of spatial representations, it is important that individuals do not need to translate the representations.

Understanding Representations

Thirdly, it has been suggested by some scholars that visual representations in SP methods reduce the risk of cognitive overload (Arentze et al., 2003, Brooks, 1970; Walker, Marsh, Wardman & Niner, 2002).

Johnson (1998) reviewed literature about architectural CAD representations and advised that designers of representation material need to match external representations with internal representations to prevent translations from being required and prevent distraction. He says that the answer to making software less complicated to operate is to “base the software on representations that facilitate human cognition and design” (p. 15), meaning that reduction of cognitive load requires representations that are easy to understand.

Spatial Sketching

Sketching reduces cognitive load and can reveal the spatial thinking of the sketcher. Although not used in this research, due to the limited time that the surveys were allocated in the laboratory, sketching could be a good method to test spatial skills in future housing layout studies (Suwa & Tversky, 1997). When people think through problems and ideas using a sketch technique, they reduce cognitive load because the memory and cognition functions of the brain are externalised (Tversky, 2002). Drawing and sketching architectural ideas are forms of external representations that reveal the schematic spatial thinking of the author (Suwa & Tversky, 1997). This type of representation is different from others discussed in this project because it involves experiencing it from start to finish as a process that articulates the progressive thinking and engenders problem solving. A benefit is that finite resources of the mind are both facilitated and preserved by the externalisation of memory and cognition into a drawn frame. The sequence in which the drawing is organised relates to the organisation of the domain, and the lines and symbols that are chosen relate to the information that the author thinks is important to their direct visual conversation (Tversky, 2002). Although this study uses pre-constructed visual representation in the experiments, it is acknowledged that real-time sketching is an important tool used to explain spatial ideas and problem solve graphically.

Visual Representations Reduce Cognitive Load

Representations and their ability to reduce cognitive load on working memory is presented in this section. Six points are discussed that affect cognitive load on working memory and the significance of this effect. These are visual representation and memory, visual representation and perception bias, representation using 1:1 fragment, visual representations in cultures and groups, the effect of cognitive processing style on visualisation and the benefits of virtual reality.

Visual Representation and Memory

It has been argued that visual representations of spatial information can actually reduce cognitive load compared with verbal representations (Girard, 1964). The style of representation can affect the limited resources of cognition, such as attention and short-term memory, in their ability to handle tasks involving existing knowledge and problem-solving according to Johnson (1998). Where tasks exceed the capacity of short-term memory and attention, individuals forget the information they are using and lose track of the task at hand Girard (1964) Johnson (1998) Tversky (2003). For SP tasks the implication here is that where tasks exceed the capacity of short-term memory and attention, individuals forget the information they are using and lose track of the task at hand. The relevance of representations in cognition is such that they link very closely to thought processes and behaviour. The challenge is therefore to design representations that do not overload limited cognitive resources but rather maximise impact on thought processes. Short-term memory has a number of components one of which is a visual-spatial component that is used to form mental pictures. The components are independent however, when individual components reach capacity, the performance of the others becomes inhibited. Tversky (2003) agrees that visual representations can reduce cognitive load on working memory. This is achieved because memory and cognition are effectively externalised in the entity of the external representation, and therefore the need to record and think internally is preserved.

Visual Representation and Perception bias

Visual representations are limited in that they can bias perceptions (Crilly, Moultrie, & Clarkson, 2004; Lurie & Mason, 2007). They must be very carefully designed as they can bias individuals' impressions and focus attention where it is not intended. Lurie and Mason (2007) look at the visualisation of data for the purposes of evaluation and decision-making by marketing managers. They fear that the visualisation of data may bias decisions by focusing attention on a limited set of alternatives and encouraging inaccurate comparisons. Crilly et al. (2004) advocate that the visual appearance of products and consumers' wants and desires (rather than needs) play a significant role in the evaluations of consumers. It might therefore be helpful, when experimenting with choices that an attractive visual component is presented in representations.

Representation using 1:1 Fragment

Visual representations are also limited in that individuals find it difficult to imagine a whole setting when given only a swatch or a fragment of that setting, even if it is a full scaled sample. Fragments do not convincingly represent settings because too much mental translation is required by individuals (Zhao & Meyer, 2007) . In a study involving a 1:1 swatch of a wallpaper design, Zhao & Meyer, (2007) asked respondents to visualise an entire room treated with the wall-paper design, and found that the visualised versions were different than what the room would have been in reality. The authors explained that an anchoring and adjustment process accounted for the skewed result. It could be thought of also, that the small but full-scaled representation required too much translation by the mental visualisation component of the brain such that inaccurate appraisals were made. However, representations are generally small-scaled layouts of large-scaled referents. The spatial ability to perceive real 1:1 settings from small-scaled layouts and vice versa depends on individual differences in environmental spatial ability (Hegarty, Montello, Richardson, Ishikawa, & Lovelace, 2006). Age is also a large determinant of spatial understanding of representations. Children tend to develop spatial abilities in late childhood (Perry, 2000).

Visual Representations in Cultures and Groups

As has been established, cultures and groups with similar conditions and study samples perceive visual representations differently. However, it would be interesting to note which styles of representations are preferred. Some researchers have demonstrated that 3D spatial representations are perceived more positively than 2D spatial representations. For example, in product design, Ozok and Komlodi (2009), found that 3D representations of products resulted in higher satisfaction for consumers in a study that measured user preferences and satisfaction of electronic products. The 2D representations contained less information and were perceived as less accurate and not as much fun. In a study of affective appraisal and affective response, van Lammeren, Houtkamp, Colijn, Hilferink, and Bouwman (2010), show that the type of visual representation can impact the affective appraisal of the spatial environment represented. Bower (1972) found that learning was enhanced through visual spatial imagery and memory of association. Learning by association was found to further improve when individuals interacted with a virtual objects (Schlosser, 2006) rather than observed still images.

User-Needs and Motivations for Preference

Floor plan representation is influenced by the buildings user's needs. User-needs are an important consideration in architecture. Family types, for example are a determinant of apartment preferences (Gao et al., 2013). The goal of the designer is to afford desired user-experiences rather than imposing those experiences (Pucillo & Cascini, 2014). Some researchers are working on a technological tool for the identification of user-needs and the decision-making that is needed to identify those needs (Zinas & Mohd Jusan, 2017). Scholars have also proposed a means-end chain (MEC) theory (Zinas & Mohd Jusan, 2017) to examine housing preferences and choices, for the purpose of understanding the motivations for these choices.

Vischer (2008), says that post occupancy evaluation of user-needs assessment is typically performed by measuring satisfaction, but measuring dissatisfaction when the physical environment is not appropriate to needs and not amenable to change will provide more pertinent knowledge of user-needs. Conversely, Vischer (2008), goes on to say that to assess the quality of the built environment based solely on what users tell us they need - given they may not be direct users, and other important factors such as design factors may be unknown - could be inappropriate.

(Vischer, 2008, p. 239) found that user-needs are not commonly thought about:

> User considerations are rare and unfamiliar in conventional building procurement processes, perhaps because they appear complex and elusive in comparison to the relatively simple and technology-oriented tools of the builder's trade. As a result, society often makes do with a built environment, the users' experience of which represents a continual compromise between what is needed to perform activities well and what is occupied, *faute de mieux.*

In the context of new builds, user-designer dialogue can be challenging. The transfer of user-needs knowledge to architects has been shown to benefit users (Luck, 2002). On the flip side, as discussed, Vischer (2008), found that designing the built environment based solely on what users tell us they need, given they may not be direct users and other important factors such as design factors may be unknown, could be inappropriate. When user-needs are taken into consideration at the initial design stages of buildings, designers dislike briefs that are presriptive and solution based, prefering to find solutions to problems.

The Effect of Cognitive Processing Style on Visualisation

Representations, whether verbal or non-verbal, are concerned with conveying information that feeds into the mental visualisation mechanism of the brain. Mental visualisation is therefore an important consideration when designing SP experiments that vary the style of representation. When individuals are able to visualise the attributes as they are intended to be visualised (Vriens et al., 1998) this will assist the individual to engage with the hypothetical task as if it was a real situation. But how can SP researchers know which style of representation will best represent their attributes? There may be an intrinsic logic in the assumption that visual representations could more effectively describe spatial arrangements than verbal representations, however the SP housing literature does not seem to explain the nature of attributes that would be better off represented visually. This is further explained, with examples, in the hypotheses development section.

The Potential of Virtual Reality

Virtual reality techniques in SP spatial studies have been utilised quite extensively, particularly in representation of small-scale land use alternatives in the field of environmental economics, for example see Kennedy and Bishop (2008); Bateman et al. (2009); Olschewski, Bebi, Teich, Wissen Hayek, and Grêt-Regamey (2011); and Bishop, Stock, and Williams (2009). Virtual reality techniques have also been used in a few larger scale applications such as architectural applications. Dijkstra, Van Leeuwin, and Timmermans (2003) designed a study requiring respondents to evaluate design alternatives of office spaces using virtual reality panoramic views. They found that SP methods can be used to evaluate design options replicating how the options might be experienced. It was not possible to include a virtual reality task in this thesis due to the limited length of the surveys in the project.

Visual and Verbal Formats

There are four main points that this review discusses to illustrate how and why visual and verbal representation formats are used in SP methods. The first justifies the process of comparing visual and verbal stimuli in experiments. Secondly, it examines whether and why experimental evaluations differ when comparing visual and verbal representation formats. The third point addresses the long-running debate in SP methods about whether verbal representations actually represent real-world settings and how visual stimuli could mitigate this issue (Dijkstra et al., 1996; Jansen et al., 2009; Levine & Frank, 2007; Morrow-Jones et al., 2004; Oppewal & Klabbers, 2003; Orzechowski et al., 2005, 2012; Rid & Profeta, 2011). Finally, key papers that compare visual and verbal stimuli in experiments are described and compared.

Comparing Evaluations Using Verbal and Visual Formats

In some disciplines (planning and transport) the non-traditional format of visual SP Methods has been established as a valid method. However, the use of visual SP Methods has yet to be fully validated in marketing literature compared to other disciplines although it is acknowledged that verbal formats may be inadequate for particular attributes. This section is explained in four points.

In fields such as environmental planning (Alberini et al., 2003); urban planning (Bateman et al., 2009); and transport (Arentze et al., 2003) visual representation is an established method of presenting SP experiments. The issue of the inadequacy of verbal representation in the marketing field has been discussed before such as when considering consumer choices about design and styling of products (Hagtvedt & Patrick, 2014, Jaeger et al., 2001; Page & Rosenbaum, 1992; Srinivasan et al., 1997; Yang & Lynn, 2014). Non-verbal representations have received less attention than verbal formats in the marketing literature and it is noted that the issues pertaining to pictorial and prototype stimuli representations are, as a result, yet to be fully resolved in the literature (Jaeger et al., 2001). Yet in some instances, visual representation has been found to make the task more realistic and to enhance external validity where choices depend strongly on the inspection of products (Loosschilder, 1997; Oppewal, Louviere, & Timmermans, 1994; Vriens et al., 1998). Wittink et al. (1994) suggests that research is required to examine whether stimuli presentation influences preference responses and in particular: the extent to which substantive conclusions differ between presentation formats; the differences in predictive validity of marketplace behaviour between different modes of stimulus presentation; and the feasibility of realistic pictorial representations.

Representation inconsistencies in attribute importance

In addition to the point above, the literature comparing evaluation scores of verbal and visual representations of a product is inconsistent. For example, Louviere et al. (1987) found few differences in utility estimates of attributes between presentation modes (verbal and photographic images) and similarly, Mueller et al. (2007) in a choice task involving a best-worst web based survey, gave respondents the option of clicking for additional information which was visual. The two styles showed no difference in choice outcome and no difference in perceived attractiveness. In contrast, Vriens et al. (1998) found that some design attributes were more important when photographic images were shown compared with verbal attributes.

The inconsistency noted in the preceding paragraph was also found in recent housing studies, Jansen, et al. (2009) and Orzechowski, et.al. (2005; 2012). Jansen, et al. (2009) found a difference of importance between verbally presented and photographic versions of attributes, like Vriens et al. (1998). Two studies by Orzechowski, et.al. (2005, 2012), found no difference of attribute importance, just as Louviere et al. (1987) did. However, Orzechowski, et.al. (2005, 2012), used virtual reality, whereas Louviere et al. (1987) used photographs as the visual presentation stimulus. There is no clear answer from the literature to explain the inconsistencies.

As noted above, the comparison of images and verbal formats found differences in evaluation scores. However, comparison of virtual reality and verbal formats found evaluations scores to be equal. Jansen et al. (2009) found that the part-worth model utilities (each attributes level score is a part worth) were different in a rating task but more similar in a choice task. In contrast, the results of Orzechowski et al. (2005) comparing goodness of fit of the models suggested the verbal only representation was a slightly better fit. The internal and external validity were tested for both models and found to be equal. In summary, Orzechowski et al. (2005) found that representation format, at least for the medium of virtual reality (VR) does not influence elicitation of housing preferences, however, the findings of Jansen et al. (2009) using the medium of photographs, disagrees with this.

Verbal Formats and Representation of Real-World Spatial Settings

This section addresses the long-running debate in SP methods about whether verbal representations actually represent real-world settings and how visual stimuli could mitigate this issue (Dijkstra et al., 1996; Jansen et al., 2009; Levine & Frank, 2007; Morrow-Jones et al., 2004; Oppewal & Klabbers, 2003; Orzechowski et al., 2005, 2012; Rid & Profeta, 2011).

Scholars are sceptical about the ability of verbal representations of spatial attributes to realistically represent actual settings. Some scholars believe in relevant cases, visual representations help respondents to make choices just as they would in the real world (Dijkstra, Roelen, & Timmermans, 1996; Green & Srinivasan, 1978; Vriens et al., 1998; Wattnick et al., 1994).

Culture is explained as a construct that influences how convincingly representations represent real settings. The perception of spatial representations is in the embedded culture of those for whom the representation is designed, for example refer Gauvain (1993), Siegel and White (1975) and Blades and Spencer (1994). Different cultures have different words and symbols with which to communicate representations and this influences the way space is thought of and visualised (Hall, 1997).

Key papers comparing visual and verbal formats

This section addresses the difference in importance between visual and verbal preferences for housing attributes in key papers and the problem they all identify that experimentation in SP methods may not be realistic. It also discusses in detail how the studies were conducted and their contributions, based on

Table 3.

In the contributions section (see Table 1), Jansen et al. (2009) found a difference of importance between verbally presented and photographic versions of attributes such that attributes were more important when presented in pictures, like Vriens et al. (1998). Neither study by Orzechowski, et.al. (2005, 2012), found differences in the importance of attributes, just as with the study of Louviere et al. (1987). However, Orzechowski, et.al. (2012), found that attribute training increased attribute importance. Patterson et al. (2017) found unlike Jansen, et al. (2009), that visually presented attributes did not have greater importance than verbal. There is no clear answer from the literature to explain the inconsistencies.

As can be seen in

Table 3, scholars are concerned with the problem that profiles and attributes might not be fully understood - which presents the problem that respondents may find the experimental tasks unrealistic and so the experimental results could lack validity. In order to make the experiments more “real”, studies were conducted that compared the representation format of profiles and attributes, with one type of presentation being verbal and the other non-verbal and one study (Orzechowski et al., 2012) also added a pre-experimental training task to help respondents to become familiar with the attribute profiles prior to undertaking the experiment.

Table 3: Illustration of Design and Analysis of 4 key papers

	Orzechowski et al. (2005)	**Jansen et al. (2009)**	**Orzechowski et al. (2012)**	**Patterson et al., (2017)**
Problem	Do spatial attributes represented visually make SP tasks more realistic?	Do spatial attributes represented visually make SP tasks more realistic?	Do spatial attributes represented visually make SP tasks more realistic?	What is the impact of varying presentation mode for SP surveys on attribute preference?
Model	Part-worth model	Part-worth model	Part-worth model	Part-worth model
Data collect. method	Laptops Online in laboratory	Laptops Online in laboratory	Laptops Online in laboratory	Laptops in coffee shops
Respondent source	Real estate company	Access to respondents of another survey	Real estate company	Consumers in coffee shops
No. of Respondents	64	36	64	184
No. profiles	32 choice sets	24 profiles	16 choice sets	6 choice scenarios
Stimulus presentation	Respondents presented with 1 of: 1. verbal 2. VR	Respondents presented with all: 1. verbal 2. verbal + colour image 3. verbal + black image	Respondents presented with 1 of: 1. Verbal pre-experiment + VR 2. VR pre-experiment + Verbal 3. Verbal + VR post-experiment 4. VR + VR post-experiment	Respondents presented with 1 of: 1. verbal 2. Unity (Unity3D.com) gaming engine
DV Measure scale	Discrete choice (which one) for set of 3	scale 1-10 + Discrete choice (yes/no) for each rated profile	Discrete choice (which one) for set of three	Discrete choice (which one) for set of two
Estimation method	Multinomial Logit Model	Ordinary Least Squares regression model Binomial Logit model	Multinomial Logit Model	Binomial Logit model
Task	Choose the most preferred option	Rate each profile 1-10 yes/ no (would you move here)	Choose the most preferred option	Choose the most preferred option
Contribution	Differences between stimuli not statistically significant	Attributes in image format were more important	Attribute training increases attribute importance	Visual attributes did not have greater importance than verbal

The model chosen for each of the studies was a multi-attribute preference model. All data was collected online using laptops, where the experimental component of the questionnaire was carried out by respondents individually. One of the studies, Jansen et al. (2009) also performed eye-tracking on respondents whilst they undertook the experiment. For all the studies, the full factorial calculation was much too high to present every possible attribute level combination to respondents. They therefore used a fractional factorial version which estimated only main effects. In the case of Jansen et al. (2009) respondents had only 24 profiles to consider, however, they consisted of three versions of just 8 profiles and the task was a little bigger than the other two studies as it involved a choice question for each profile and a rating of each profile. In contrast, both the other studies involved respondents being presented with sets of three profiles and they were asked to choose one profile from each set. Orzechowski et al. (2005) presented respondents with 96 profiles to consider, in sets of three, leaving only 32 force-choice responses, with each answer corresponding to one of the possible three profiles presented. The respondent group was split in half, with half of the respondents completing the task in a verbal format and half in the non-verbal, unlike Jansen et al. (2009). Orzechowski et al. (2012) split the respondents into 4 groups to measure different training and presentation effects as shown in the table. Each respondent was presented with 48 profiles in sets of three, giving 16 choice sets. This is half the number of sets compared to the 2005 study, however each respondent was also required to undertake a non-visual training/design session. (Patterson et al., 2017) presented respondents with 6 choice sets.

The estimation method for Jansen et al. (2009) was the Ordinary Least Squares regression model for the rating data and the Binomial Logit model for the choice data. The remaining studies used Multinomial Logit Model.

As mentioned earlier, the studies were motivated by a problem - the questioning in the literature about the validity of SP methods and in particular, the question of whether individuals can properly comprehend the experimental tasks in the typically verbal format, and whether individuals are able to truly articulate responses that relate the hypothetical options to choice options in real markets. Orzechowski et al. (2005, p. 361) argues that it is not known from previous studies whether different presentation styles will result in:

(a) Different estimated housing preferences and attribute utilities;

(b) When comparing utilities, they are equal however the deviation of the error of their observed value from the true value is the same; and,

(c) When comparing utilities, they are equal however the deviation of the error of their observed value from the true value is different.

Orzechowski et al. (2012) repeated the study design of 2005 by using the standard verbal presentation stimulus and comparing it to a modified non-verbal version. Comparison of the two preference models with a modified Chow test confirmed that there is no significant difference between the multi-media and verbal only representation models, as before. However, Orzechowski et al. (2012) also contributed to making experimental tasks more realistic and thus more understood to respondents by adding a further preference model that measured choices after a specialist training session that taught respondents about the attributes using multi-media (VR). The internal validity was tested by checking the effects of task order (all possible orders of training and representation format were included in the study design). It was found that where the attribute training sessions using virtual reality to help respondents to understand attributes, significantly improved the validity of the analysis and if the results are repeated, the finding shows that spending time on training individuals will increase validity and reliability of results of further studies. It was also found that pre-experimental training improves the ability to predict the holdout profiles. Further, the authors tested the external validity by testing whether individuals could relate the hypothetical options to choice options in real markets. Comparing the models to real choices, the pre-experimental training model was better able to predict real life choices than the other models.

Patterson et al. (2017) uses a gaming engine to create the platform for both text-based and visual-based formats, acknowledges that few studies have attempted to compare the difference between representation modes in SP studies. Some examples exist that compare text formats with visual formats (for example Orzechowski et al. (2005) but no research has been found that compares multiple visual formats with text formats. Studies have found mixed results, some finding that visual attributes take on more attribute importance than text, others find a reduction of importance of visual attributes.

Floor Plan Formats in SP Experimentation

As explained in the introduction chapter, floor plans are defined as a visual type of format, although they may require interpretations by the lay-person and, translation impacts cognitive load. This section builds on what has been established and presents the current information and debates about representing floor plan representation formats in SP experimentation. Specifically, it discusses the appropriateness of floor plans in experimentation, understanding floor plans from the perspective of lay-persons, user-needs and motivations for choice, cognitive load and attribute familiarity, increasing attribute importance with training, and construal mindset and representation formats.

Other methods that support floor plans

Virtual reality, using a walk-through technique has been found to convincingly represent street settings and architectural layout. This was illustrated by Orzechowski et al. (2005), Orzechowski et al. (2012), and Davies, Laing, and Scott (2002). This is also a topical industry issue. Mahdjoubi, Moobela, and Laing (2013) designed an interactive building model to assist developers, and buyers to support and/or replace conventional building surveying and Computer drafting using a 3D laser scanning approach. In another example, Rohrmann and Bishop (2002) demonstrated the validity of their representation style by measuring affective and cognitive appraisals of a suburban setting against a computer simulation of the same setting. They found that for appraisals of environments, their simulation, using a walk-through technique, was convincing as a representation of the real setting and it was even more believable when suburban sounds were added.

Understanding Floor Plans from the Perspective of Lay-persons

Floor plan representation of layout information is well covered in expert literature and is mostly technical information (Ahmed et al., 2014; Brandão de Vasconcelos, Pinheiro, Manso, & Cabaço, 2015). However, few scholars have researched evaluations of buildings using floor plan stimuli representation from the perspective of non-experts. Gao et al. (2013) researched apartment preferences and how they related to family types. Some attempts have been made to design web-based tools that assist untrained end-users to customise architect designs (Stouffs, Janssen, Roudavski, & Tunçer, 2013) however these tools are made for user groups, and were encumbered by limitations that included conflicts between individual needs and differences in design knowledge amongst the groups. Some studies have asked respondents to assess their satisfaction of different floor plan types by reference, for example, to social interaction, (James, 2014) but there was no linking of satisfaction to floor plan features. Other non-expert ways to understand floor plans included using smart phones to read indoor maps for able bodied people and also where iPad floor plans touched by the user are translated into audio instructions for people with special needs (Goncu, Madugalla, Marinai, & Marriott, 2015; Jayakody & Murray, 2014). Further, researchers (Slone, Burles, Robinson, Levy, & Iaria, 2014) tasked respondents with reaching destination points in two different buildings using floor plans differing in complexity that they had not previously visited. It was illustrated that the ability of individuals to navigate unfamiliar places is affected by layout complexity. Despite the research outlined above, there is no known peer-reviewed literature about understanding property floor plans.

Cognitive Load and Attribute Familiarity

It is expected that floor plan representation requires less cognitive load when the individual is familiar with the layout attributes. Familiarity with spatial representations affects the cognitive load of the working memory. When people are experienced in a particular visual task, such as designers using AutoCAD, they combine chunks with automated processes. Pazzaglia and De Beni (2001) found the way in which individuals prefer to mentally represent spatial information can be divided into two groups: survey (adopting spatial processing strategies) and landmark-centred (adopting visual and verbal processing strategies). Using a spatial representation questionnaire developed by Pazzaglia, Cornoldi & De Beni (2000) respondents were categorised into either survey or landmark-centred for the way they prefer to represent spatial information internally. In a subsequent way-finding test, respondents showed evidence of internally representing space in one of the two groups by adopting either visual-verbal or spatial strategies to negotiate a spatial way-finding task. Two conditions were given - maps and verbal descriptions. The map condition was superior to the verbal condition regardless of group membership, taking less time to commit to memory and commanding greater confidence in the task. Individuals who mentally represent space in the landmark-centred group did significantly well with verbal descriptions. When the task required mixed strategies from both groups, performance was similar for both spatial and verbal-visual strategies. Further, the accuracy with which spatial representations are perceived, depends in part on how convincingly the representation represents the real setting and therefore the appropriateness of the representation format. But it can also depend on culture, and psychological factors such as inherent and familiarity-based spatial ability.

Increasing Attribute Importance

When lay-persons are trained about layout attributes, understanding of atttributes is increased and subsequently articulation of preferences is such that attributes become more important to individuals. Orzechowski et al. (2012) repeated the study design of 2005 by using the standard verbal presentation stimulus and comparing it to a modified non-verbal version. Comparison of the two preference models with a modified Chow test confirmed that there is no significant difference between the multi-media and verbal only representation models, as before. As explained previously Orzechowski et al. (2012) also contributed to making experimental tasks more realistic and thus more understood to respondents by adding a further preference model that measured choices after attribute training. Comparing the models to real choices, the pre-experimental training model was better able to predict real life choices than the other models.

Chapter Summary

This chapter commenced with discussing representation, followed by visual and verbal representation formats and finally floor plan formats in SP experimentation. It is important to note that this research utilises SP methods and its underlying theory whilst also making contributions to this method. The theory, findings and debate used in this thesis are therefore mostly derived from within this SP context.

4. COGNITIVE MEASURES AND FACTORS

Introduction

This chapter commences with discussing individual differences relating to spatial and cognitive styles and the Santa Barbara Learning Style Questionnaire (SBLSQ) (used in study 1) and Style of Processing (SOP) are introduced (used in study 2). A further measure was also in the survey for study 1 and was analysed (the Rational Experiential Inventory) however is was not found to be suitable and it is therefore not included in this chapter. Further the, construal mindset and construal level theory are discussed and a measure, the Behaviour Identification Form (BIF) commonly used as a manipulation check, is discussed.

All of the measures in this chapter have been analysed and prepared for hypothesis testing but as this is not a results chapter and it is a lengthy analysis involving measurement of Chronbach's alpha to determine internal consistency, data reduction involving factor analysis, data extraction and factor rotation and interpretation it is therefore included as Appendix 23.

Individual differences in Spatial Ability

It will now be examined how individual differences influence the ability of lay-persons to understand spatial (layout) attributes. Four dimensions are discussed: mental representation, cognitive style, processing ability and spatial ability.

Mental Representation

Firstly, Pazzaglia and De Beni (2001), found the way in which individuals prefer to mentally represent spatial information can be divided into two groups: survey (adopting spatial processing strategies) and landmark-centred (adopting visual and verbal processing strategies). Using a spatial representation questionnaire developed by Pazzaglia, Cornoldi & De Beni (2000), respondents were categorised into either survey or landmark-centred for the way they prefer to represent spatial information internally. In a subsequent way-finding test, respondents showed evidence of internally representing space in one of the two groups by adopting either visual-verbal or spatial strategies to negotiate a spatial way-finding task. Two conditions were given, maps and verbal descriptions. The map condition was superior to the verbal condition regardless of group membership, taking less time to commit to memory and commanding greater confidence in the task. Individuals who mentally represent space in the landmark-centred group did significantly well with verbal descriptions. When the task required mixed strategies from both groups, performance was similar both spatial and verbal-visual strategies.

Cognitive Style

There is a vast body of literature published on individual differences in information processing and a subset of this categorises differences into two main groups of cognitive style, also called the “Cognitive Style Construct” (Felder & Soloman, 2000; Mayer & Massa, 2003; Richardson, 1977). They are visual cognition (which has visual and spatial attributes); and verbal cognition (which has verbal attributes). Authors have typically looked at testing for style types and proposing new tests as well as examining characteristics of the types of styles (Mayer & Massa, 2003). The construct has been examined by such areas as cognition, psychology and education amongst others. Many authors agree on two main styles of cognition (or thinking).

Processing Ability

Henry (1980) designed an information processing task that tested individual differences in processing ability and information complexity. The processing ability dimension measured the accuracy with which individuals could reproduce information about the brands represented. Information complexity measured how respondents managed added attribute dimensions for eleven brands. Individual differences explained a large variation of information processing. Henry concluded that: “To the extent that accurate reproduction of presented information affects choice… Large segments of the consuming public may be limited in dealing with complex information-processing situations” Henry (1980, p. 47).

Spatial ability

There is a body of literature that has found significant differences in the spatial ability between gender groups. In practical terms this means that gender could be an indicator of visual and verbal cognition processing styles. Collaer and Nelson (2002) for example, found that males judged spatial information more accurately than females, possibly because attention-related processes vary by gender such that males are more sensitive to geometric spatial cues. However, Kirasic (2000) found that spatial knowledge was influenced by age rather than gender. Kirasic found older men and women learned less about environmental layout than younger men and women in a landmark-learning task. However older women had more difficulty than older men and younger men and women at selecting priority landmarks from a given route. Kirasic concluded that the procurement of spatial knowledge was the sole predictor of way-finding behaviour. With correlations between age, spatial ability, environmental learning and way-finding behaviour, Kirasic (2000) found that spatial ability was a significant mediator of age differences and environmental learning when procuring spatial knowledge. However, Kirasic also found a significant unmediated relationship also exists between age and environmental learning.

Individual differences in Cognitive Processing Style

In examining the “visualiser-verbaliser” hypothesis that some people are inherently better at processing pictures and others are better at processing words - also called the visual-verbal dimension, by Mayer and Massa (2003). It was found in a factor analysis, that of 14 existing and original cognitive measures loaded most heavily onto one measure only, of cognitive (or spatial) ability cognitive style, or learning preference. The facets are shown in Table 4: Three facets of the Visualiser-Verbaliser Dimension reproduced from Mayer and Massa (2003, p. 838). The testing revealed one of two outcomes for each construct and they either correlate with visual or verbal.

Table 4: Three facets of the Visualiser-Verbaliser Dimension

Facet	Types of learners	Definition
Cognitive ability	*High spatial ability*	*High proficiency in creating, holding and manipulating spatial representations*
	Low spatial ability	*Low proficiency in creating, holding and manipulating spatial representations*
Cognitive style	*Visualiser*	*Uses visual modes of thinking*
	Verbaliser	*Uses verbal modes of thinking*
Learning preference	*Visual learner*	*Prefers instruction involving pictures*
	Verbal learner	*Prefers instruction involving words*

Amongst the 14 measures tested were the Santa Barbara Learning Style Questionnaire (SBLSQ) along with the Verbaliser-Visualizer Questionnaire, (VVQ) and the Verbal-Visual Learning Style Rating (VVLSR), which loaded heavily on the Cognitive Style facet (apart from the VVQ, the tests were original). A correlational analysis was performed to check the Pearson product–moment correlation for all possible pairings of the 14 measures and the SBLSQ and the VVLSR were found to correlate significantly with many of the measures across the three facets. To test internal consistency, Cronbach's alpha coefficients were computed with SBLSQ: α =0.76, VVQ: α =0.71 and as the VVLSR was the original measure it was not tested.

And so, based on the results above it seems that the SBLSQ is the most robust out of the 14 measures tested. As for validity testing of SBLSQ, it appears that this has not yet been performed however, the SBLSQ was developed from theory and prior research so the content validity is assumed to be robust. The SBLSQ is included as Appendix 1.

The SSLSQ is a modified version of the VVQ (Richardson, 1977) which is a 15-item questionnaire that requires participants to choose a true-false response. All the "true" responses relate to visual whilst "false" responses relate to verbal - so visual learners score highly and verbal learners low. The SQLSQ modified the VVQ by reducing the items to 6 and by changing the categorical answers to a 7-point Likert-type scale ranging from 1 (strongly agree) to 7 (strongly disagree).

A further measure of interest to the study is the Index of Learning Styles (ILS) questionnaire (Felder & Soloman, 2000). However, this study measured three additional constructs other than the visual/verbal and was not used in this study. The ILS is based on the Felder-Silverman learning Style Model (Felder & Silverman, 1988). A web-based version of the ILS was adapted by Felder and Soloman. It's a free on-line test and is taken by up to a million times per year with the data providing respondents with instantaneous results, including interpretation, and also providing data for many ongoing studies[1].

The test measures had 4 dimensions, the sensing/intuitive, visual/verbal, active/ reflective and sequential/global. Each dimension has 11 force-choice items, with each answer corresponding to one of the possible two categories of the dimension. At the end of the 11 questions, the answers for each category in the dimension are added together, then the larger number subtracted from the smaller to reveal the score. The score is then assumed to be on the category scale of the category that received the most answers.

Building on their work about facets of cognitive ability, Massa and Mayer (2006), later argue that the effectiveness of separately tailored on-line learning material for verbal and visual learners is doubtful. However, they think that prior knowledge could temper this effectiveness, such that tailored instructional methods that benefit beginners do not necessarily benefit experienced learners.

A summary of each of the measures follows.

SBLSQ Measure

The SBLSQ, introduced in the previous section, is a simple self-rating questionnaire about learning style which could be an effective substitute for longer, more time-consuming instruments according to Mayer and Massa (2003). The SBLSQ measure contained only 6 items on which participants were asked to rate the degree to which they are more verbal or more visual learners on a 7-point scale. The SBLSQ consists of two sub-scales, the first containing three items collectively named “visual learner”

[1] https://www.researchgate.net/publication/228403640_Index_of_Learning_Styles_Questionnaire

items and the second also containing three items, collectively named “verbal learner” items. The scale was not successful with this sample - refer Appendix 1.

SOP Measure

The SOP scale is a self-rating 22-item questionnaire about processing style developed by Childers, Houston, and Heckler (1985). “Processing style” was conceptualised as a “preference and propensity to engage in a verbal or visual modality of processing” (pg. 130, 1985). The scale asks for agreement (on a 4-point bipolar scale), with 11 statements related to preference for visual style of processing such as “I generally prefer to use a diagram than a written set of instructions” and 11 statements related to preference for a verbal style of processing such as “I do a lot of reading.” The 4-point scale consisted of choosing from “always true”, “usually true”, “usually false” and “always false”. The SOP was made up of two sub-scales, the first containing 11 items collectively named “verbal processor” and the remaining 11 items collectively named “visual processor”. 406 respondents participated in the questionnaire.

The purpose of including the SOP into the survey instrument of this thesis was to determine whether participants evaluate apartments differently if their mental processing is either more visual or more verbal. An individual’s style of processing is also believed to influence how they use working memory by dividing the total scale score into 3 equal groups of processing style so as to capture a middle group that were neither strongly visual neither strongly verbal. The groups were: highly visual; highly verbal; and neither strongly visual nor verbal. The SOP measure is included in Appendix 2.

Construal Mindset and Psychological Distance

Construal mindset, a construct based on construal level theory that posits that individuals are either in an abstract (distal) mindset or a Concrete (proximal) mindset at any given time, influences the perception of visual formats. Firstly, there is a relationship between shape and colour of representations and construal mindset (Lee, Deng, Unnava, & Fujita, 2014; Lee, Fujita, Deng, & Unnava, 2016) and secondly, psychological distance, is:

> a construct that posits that when psychologically distant things (objects, events) are those that are not present in the direct experience of reality influences the perceptions of representation formats (Liberman, Trope, & Stephan, 2007, p. 353).

Many researchers have examined the effect of visual and verbal marketing messages on consumer behaviour in the context of construal level theory (Chang & Lee, 2009; Dhar & Kim, 2007; Dotson, Beltramo, Feit, & Smith, 2016).

Asking respondents to visualise a particular scenario prior to making choices is a technique used in the literature. Research on perceptions of representations over time reveals temporal distance influences on consumer preferences (S. B. Day & Bartels, 2008). Individuals tend to make decisions concerning the immediate consequences using a concrete method of appraisal such as how feasible the alternative is. Similarly, they make decisions about more distant future consequences, using abstract appraisal methods, for example how desirable the product is. Zhao, Hoeffler, and Zauberman (2011) found that it was possible to mitigate preference inconsistency over time by asking respondents to focus on a particular mental visualisation prior to making choices. Zhao et al. (2011) show this technique, can be used to change construal levels thereby achieving consistent preferences across different temporal distances.

A review of the marketing literature reveals that product appraisal is: 1) impacted by construal (Trope, Liberman, & Wakslak, 2007); 2) impacted by information processing (Thompson, 2006); and 3) moderated by product representation (Zhao, Dahl, & Hoeffler, 2014). This research combines these two variables to further understand decision-making with regards to the procurement (buying or renting) of real-estate. Specifically it examines whether construal moderates appraisals of real estate acquisition depending on how the product is represented to consumers. It is expected that people evaluating floor plan representations of apartments (vs. text) will award higher utility scores if they are in the low construal-level mindset (vs. high) because floor plans contain detailed information about real-estate. That is individuals are more likely to need detailed information about how layouts suit their user-needs to assist with decision-making about renting or buying real estate when they are in a psychologically proximal mindset.

Psychological Distance

There are several inter-related dimensions of psychological distance: temporal; spatial; social; and probabilistic distance (Trope and Liberman, 2010, 2011; Liberman and Trope, 2007, Trope et al., 2007). It is known from the real estate literature that both temporal and spatial factors impact product perception and appraisal. Many articles model spatial and temporal house price information to explain and predict property trends (Case, Clapp, Dubin, & Rodriguez, 2004; Dolde & Tirtiroglu, 1997; Huang, Wu, & Barry, 2010) including outlier-type patterns due to property bubbles.

Further, the literature reveals that, in the context of marketing, the perceptions of products vary depending on the consumers' distal or proximal psychological distance to those products (for example, Dhar and Kim, Fiedler, 2007). This thesis uses the dimensions of temporal and spatial psychological distance to test whether they are main effects of apartment evaluations and whether construal moderates these evaluations indirectly through representation format, described in the methodology chapter.

Zhao et al. (2014) experimented with construal level and product evaluation scores, using only the dimension of temporal psychological distance, finding that when consumers use representations to evaluate new products, the score of concrete versus abstract representation depends on the temporal mindset of the consumer. Zhao et al. (2014) illustrated this by comparing appraisal scores of a detailed text description (concrete condition) versus a very general text description (abstract condition) and matching that to the temporal perspective of the respondent. However, as only temporal psychological distance was manipulated in Zhao et al. (2014), and only text was used as a visualisation aid, the current study takes the opportunity to extend the work by manipulating spatial and temporal psychological distance. In addition, the study explores the construal effect on verbal and visual representations of products.

The construal literature in business and marketing has thus far not utilised floor plan representations when manipulating product representations and construal. However, there are several examples that manipulate pictures and words, for example, Amit et al., (2009) argues that individuals process pictures and words differently and that pictures can be used to convey proximal messages and words more distal messages. Bar-Anan et al., (2007) agrees with the viewpoint that one is able to process stimuli more easily if they match the mental construal state of the individual. These findings implicate construal mindset as an important dimension of psychological distance.

The current study seeks to manipulate a stimulus that has not yet been used in construal studies. Although floor plans and pictures both contain contextual information additional to the product descriptions, floor plans are expected to be more difficult to read than pictures as they are expert tools that laypeople do not usually easily understand (as they do with pictures). It is not known however whether consumers understand floor plans and without being trained to read them. Imagining stimuli that are not understood used in SP experiments would create inaccurate visualising (O'Neill, 1991).

When looking at the type of visual representations that trigger greater preference-share of consumer evaluations of products, there is a growing body of literature such as Lee et al., (2016) that have attempted to classify representations as concrete or abstract. Lee et al., (2016) found that shape and colours moderate product appraisal. Higher appraisal scores were found for people in low-level construal that appraised products represented by colour, and higher scores were found for people in high-level construal where products are represented by shapes. This study seeks to contribute to this growing body of research by classifying floor plans as generally either concrete or abstract representations.

The two styles of representation examined in this thesis are text and floor plans. The floor plans contained graphical descriptions of attributes related to the study and other spatially related attributes, for example walls, room sizes, symbols and so on (Zhu et al., 2014). By contrast, the text descriptions were more abstract, concisely describing the attributes related to the study (Nelson & Towriss, 1995). As found by (Jansen et al., 2009), the visual representation contained many more attributes than those being measured in the study which could bias the findings.

BIF Measure

The effectiveness of individuals' construal level and psychological distance manipulation were assessed using the responses to the experimental task as well as a Behaviour Identification Form (BIF); which tests whether participants are thinking in an abstract-related way or a concrete-related way at the time of the survey. (Vallacher and Wegner, 1989). The BIF form was taken directly from Vallacher and Wegner, 1989 for use in this research. It was included in this study because it is commonly used to gauge the efficiency of construal manipulation (Yan & Sengupta, 2011). In particular, it is used to gauge the effectiveness of the spatial and temporal manipulation.

The purpose of the BIF assessment was to increase confidence in the effectiveness of the psychological distance manipulation assessment and construal manipulation task (how/why). This particular form of construal manipulation assessment was selected for the manipulation check because it has been commonly used in prior research to assess construal level and psychological distance (Liberman and Trope, 1998).

The BIF, was coded as follows: participants who chose the item described with lower level concrete identification were given the score of 0 and the participants who chose the item described with higher level abstract identification were given the score of 1. The scores for each participant were added and the total was divided by the total number of items, producing a construal level index. Interpreting this, the higher the individual's score, the higher the level of abstract identification.

Table 5 is a 25-item dichotomous questionnaire used to assess individual differences in action identification level. This can also be found in Appendix 8. Action identification level means the level at which people identify with specific behaviours. The scale consists of 25 items which are every-day type behaviours, for example the activity of eating, or writing, or exercising. Behaviour can be described in many ways. For example, one person might describe singing as "making musical sounds with the voice," while another person might describe the same behaviour as "telling a vocal story". The BIF focuses on individual preferences for describing a number of different behaviours. Two action identification levels are described for each item which distinguish between two levels of construal mindset. The two construals are described by Vallacher and Wegner, 1989, as being: 1) low-level that focussed on how to perform the actions (the means of achieving it); and 2) high-level that focussed on why the action was performed (the reason for performing it).

As established, for each item, two descriptions are suggested, one of them describes the item in terms of higher level abstract identification - for example chewing and swallowing, and the other describes the item in terms of lower level concrete identification - for example “getting nutrition”. The idea was that respondents would be asked to choose one description from the two given that best described the item for them using a forced choice format. It was suggested the order of the 25 items was randomised so that the influence is no longer subject to ordering bias (Perreault, 1975).

Table 5: BIF items

Activity / Behaviour	Description
Eating	Chewing and swallowing Getting nutrition
Tooth brushing	Moving a brush around one's mouth Preventing tooth decay
Resisting temptation	Saying "no" Showing moral courage
Having cavity filled	Going to the dentist Protecting your teeth
Talking to a child	Using simple words Teaching a child something
Locking a door	Putting a key in the lock Securing the house
Greeting someone	Saying hello Showing friendliness
Cleaning the house	Vacuuming the floor Showing one's cleanliness
Washing clothes	Putting clothes into the machine Removing odours from clothes
Making a list	Writing things down Getting organised
Reading	Following lines of print Gaining knowledge
Joining the army	Signing up Helping the nation's defence
Picking an apple	Pulling an apple off a branch Getting something to eat
Chopping down a tree	Wielding an axe Getting firewood
Measuring room for carpeting	Using a yardstick Getting ready to remodel
Painting a room	Applying brush strokes Making the room look fresh
Paying the rent	Writing a cheque Maintaining a place to live
Caring for houseplants	Watering plants Making the room look nice

Voting	Making a ballot Influencing the election
Climbing a tree	Holding on to branches Getting a good view
Filling out a personality test	Answering questions Revealing what you like
Taking a test	Answering questions Showing one's knowledge
Growing a garden	Planting seeds Growing fresh vegetables
Travelling by car	Following a map Seeing countryside
Pushing a doorbell	Moving a finger See if someone's home

Vallacher and Wegner, 1989, initially started with a 60-item behavioural identification form, finding that a single dimension was being tapped and reporting a Chronbach’s alpha of .84 (n = 274).

Respondent’s level of personal agency was defined by Vallacher and Wegner, 1989, as the number of high-level alternatives chosen on the BIF. The consistency was tested further by sampling 13 (mainly) university undergraduates at several universities. Mean BIF scores proved to be similar across the 13. The BIF therefore provides an internally consistent and temporally stable means of assessing individual differences in level of identification across an array of (25) actions.

Chapter Summary

This chapter began with discussing spatial and cognitive factors and measures related to the research. Further, it introduced construal mindset and explained the manipulation check commonly used in construal studies, the BIF. All of the measures are analysed in Appendix 23.

5. MODEL AND HYPOTHESES

Introduction

This chapter identifies the gaps found in the reviewed literature including methodological gaps. It also develops the gaps into a conceptual model, after which hypotheses are developed.

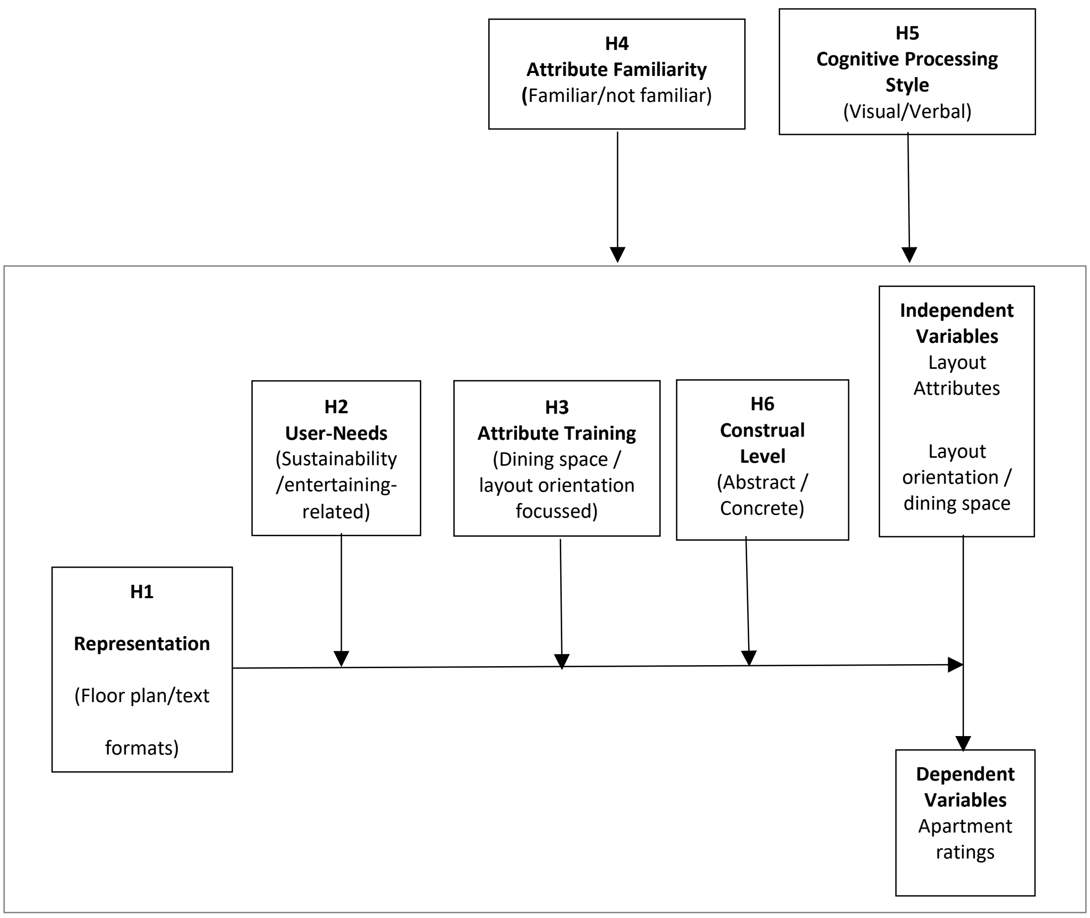
Literature Gaps

Several relevant points or gaps have been found in peer reviewed journals. In point form, these are that the housing literature has not: 1) used floorplan simulations and compared them with text formats in experimentation; 2) tested whether attribute importance is different for layouts in text and floor plan formats; 3) tested whether focussing on a user-need helps untrained people to achieve better articulation of preferences for floor plan attributes; 4) tested whether attribute training helps untrained people to achieve better articulation of preferences for floor plan attributes; 5) tested whether individuals familiar with attributes achieve better articulation of preferences for floor plan attributes; 6) tested whether the visual dimension of cognitive processing style enables untrained people to achieve better articulation of preferences for floor plan attributes; and 7) tested whether an induced construal mindset helps untrained people to better understand floor plans. These apparent gaps have been developed into a research model addressed in the following sections.

Conceptual Model

Figure 2: Research Model, proposes that representation format moderates evaluations of layout attributes. It further proposes how user-needs, atttribute training and construal minsdet moderate representation format of evaluations of layout attributes interact with representation format. Attribute familiarity and cognitive processing style test whether individual differences effect the manipulated variables and the rating of apartments. These relationships are discussed in the hypothesis development section to follow, then hypotheses are summarised in the research model.

Figure 2: Research Model



Hypothesis Development

Orzechowski et al. (2012) recommends the use of non-verbal formats for stimulus representation in housing preference and choice studies. Few non-verbal styles have been used in housing studies (some examples that have been used are pictures, virtual reality and gaming platforms), yielding inconsistent attribute importance. Perhaps with more studies using visual representations, more concrete insights could be gained into the inconsistencies of results in the literature.

Floor plans are realistic formats to use in preference tasks in the real-estate industry because they are scaled versions of housing products. However, due to the nature of floor plans being a tool that is traditionally used to communicate amongst experts, it is expected that some amount of translation will be required for respondents that have no experience with them or other spatial instructional material of a visual nature. With limited understanding of layout attributes respondents are likely to yield different utility ranges (visual vs. verbal) in rating experimentation. It is hypothesised therefore that:

(H1) Apartment layout attributes represented by floor plans, will be more important in preference tasks than content-equivalent verbal descriptions;

This research hypothesises that the legibility and subsequent visualisation of floor plan representations depends on user-needs, an important variable because individual's attribute trade-off behaviour depends on their particular user-needs (Vischer, 1985), and so the current study examines whether: 1) respondents were more sensitive to layout attributes when they were related to their user-needs; and 2) whether their user-needs related preferences were better articulated on floor plan representations because of focussing on those needs. It is therefore hypothesised that:

(H2) Where apartment layout attributes are represented by floor plans and user-needs are aligned with specific attributes, the attribute related to the user-need increase in importance in preference tasks;

Orzechowski et al. (2012) recommend that prior to the experiment, teaching respondents about the attributes (attribute training) and their levels with the medium of virtual reality is very realistic; because the “walk through” nature of the medium assists individuals to understand and engage with the attributes. Further, Orzechowski et al. (2012) advised researchers that, in light of finding that pre-experimental attribute training improves the internal, external, and predictive validities, instead of improving the time it takes respondents to respond to a set of alternatives, researchers should be designing pre-experiment tasks to teach respondents about the nature of alternatives. It is hypothesised therefore that:

(H3) Where apartment layout attributes are represented by floor plans and attribute training aligned with specific attributes, these attributes will increase in importance in preference tasks;

Note that this study also refers to the layout attribute as the “spatial attribute”. That is because, by nature, this attribute concerns the description of objects and their relationships in space and with one another (as defined in Chapter 1).

It is expected that floor plans will require translation because, as explained, they are expert documents with symbols, line-work and so on that the lay-person may not understand. For some individuals less translation will be required where they are familiar with layout attributes. The study will therefore test for a conditional effect of attribute familiarity on preference outcome. It is hypothesised that:

(H4) Attribute familiarity moderates preferences for apartment layout attributes such that the more familiar individuals are with layout attributes and representations the more they gain in importance.

Jansen et al. (2009) says that a possible explanation for the results is that although visual presentation can help respondents to understand attributes, sometimes additional information is provided inadvertently, some of which may not be relevant to the measurement task. Another two explanations offered (by Jansen et al., 2009) are that visual information is processed differently to verbal and individuals could be affected by an inherent preference for one of the other.

To check whether cognitive style (or learning preference) can somewhat explain the higher importance of non-visual representations; this study will test the possible conditional effect of cognitive style on the preference and choice outcomes. As for the dissimilar processing of verbal and visual information, a review will be conducted to further understand how the two styles are mentally processed and represented. This study will test respondents' preference for visual and verbal thinking or learning and check for a conditional effect on the preference outcome. It is hypothesised:

(H5) Where apartment layout attributes are represented by floor plans and individuals have a visual cognitive processing style, their preference articulation of layout attributes will be increased.

As has been established from the literature, when people are focussing on the present in great detail, they are less likely to focus on the secondary features of products or the gist of the of the product (Fujita, Trope, Liberman, & Levin-Sagi, 2006) and therefore they are more likely to be in a concrete state of construal. This logic was applied when preparing the formats used in hypothesis six (refer below). Since floor plans may contain detailed information they assist more in situations where the product is psychologically proximal. By comparison, it is assumed the text descriptions assist more in situations that are more distal. It is hypothesised that:

(H6): Construal level moderates the impact of representation format on apartment evaluations such that when individuals are in a concrete mindset and apartment information is represented by floor plans (vs. text) the importance of layout attributes will be higher than for individuals in an abstract mindset.

The hypotheses are listed below. They describe the relationships drawn in the conceptual model.

List of Hypotheses

(H1) Apartment layout attributes represented by floor plans, will be more important in preference tasks than content-equivalent verbal descriptions;

(H2) Where apartment layout attributes are represented by floor plans and user-needs are aligned with specific attributes, the attribute related to the user-need increase in importance in preference tasks;

(H3) Where apartment layout attributes are represented by floor plans and attribute training aligned with specific attributes, these attributes will increase in importance in preference tasks;

(H4) Attribute familiarity moderates preferences for apartment layout attributes such that the more familiar individuals are with layout attributes and representations the more they gain in importance.

(H5) Where apartment layout attributes are represented by floor plans and individuals have a visual cognitive processing style, their preference articulation of layout attributes will be increased;

(H6): Construal level moderates the impact of representation format on apartment evaluations such that when individuals are in a concrete mindset and apartment information is represented by floor plans (vs. text) the importance of layout attributes will be higher than for individuals in an abstract mindset.

Chapter Summary

This chapter was presented in four sections. It identified gaps in the literature that will be examined in two studies; presented a conceptual model; developed hypotheses; and listed the hypotheses that this research will test.

6. METHODOLOGY

Chapter Overview

In the previous chapter the conceptual model and hypotheses were developed. This chapter describes the method for two studies that measured preferences for apartments using SP experiments in order to test the hypotheses drawn from the research model. The studies determined whether people evaluate apartment attributes differently when they were presented apartment layout information in different styles, affected by their measured dispositional processing style (visual or verbal) and their manipulated state of mental construal (abstract or concrete).

This chapter commences with the positioning of the research, then it describes the sample, instrumentation, data collection procedures, and finally it describes the data analysis.

Philosophical Perspective

Prior to choosing a method for the research it was necessary to decide on the philosophical positioning of the research. According to Crotty (1998) this involves starting from establishing the theoretical underpinning of the research. The research takes the world-view of the post-positivist paradigm, a critique to the positivist paradigm (Morrow & Brown, 1994). There are three main elements that inform one another when establishing the paradigm of the research (Lincoln, Lynham, & Guba, 2011), these are ontology, epistemology, and methodology.

Ontology, according to Schwandt (2007, p. 190), is “the worldviews and assumptions in which researchers operate in their search for new knowledge”. According to the table of paradigm alternatives (Lincon, Lynham, & Guba, 2011, p. 102, table 6.5), post-positivist research's ontological belief is in critical realism. It views reality as only imperfect and probabilistic in nature. The post-positivist focus of critical realism supersedes the naïve realism of positivism.

Epistemology can be described as the nature and scope of knowledge. According to Lincoln et al. table of paradigm alternatives, (Lincon et al., 2011, p. 102, table 6.5) the research takes a modified objectivist approach, believing that human knowledge is biased and based on many realities. Post-positivist studies use propositions and hypotheses that are justified rather than the unchallengeable knowledge and beliefs of the positivist paradigm.

Methodology can be described as the process by which scientific knowledge is acquired. Generally, post-positivist methodology subjects the propositions and hypotheses to empirical conditions and falsifies them. It also takes an experimental/manipulative approach and practises the use of multiple/mixed methods of enquiry.

This research fits into the paradigm of post-positivism and is underpinned by the ontology, epistemology and methodology that defines post-positivism.

Research Method

After considering the philosophy of the research from the previous section, an appropriate research design was chosen to test the hypotheses. There are three main types of design: descriptive, exploratory, and causal. Descriptive research focusses on the covariance between variables (Zikmund & Babin, 2007) and exploratory research focusses on gaining insights (Aaker et al., 2007). Causal designs identify cause-and-effect relationships (interactions) between the variables (Aaker et al., 2007). This research takes the causal research approach because the hypotheses in both studies, address causal relationships between the variables. Experimentation is the main method used in causal research (Zikmund & Babin, 2007) and as established, is also commonly used to conduct post-positivist research. It enables researchers to: 1) manipulate variables whilst controlling the remaining variables; 2) manipulate designed conditions and capture the precise effects hypothesised; 3) replicate experiments to increase confidence in the results; and 4) conduct parametric tests such as analysis of variance, which enable assumptions to be made about the study conditions.

Experimental Design

There were two experimental studies used in the research. However, before describing the studies it is imperative to first explain that the main focus was to compare attribute preferences for verbal and floorplan formats. In summary, if their attribute utility ranges are similar, it could be said that verbal formats are not necessary to measure preferences because floor plans are a more realistic format, leading to more reliable results and a lower error variance compared to verbal formats. And so the estimates of visual formats in this instance will yield more precise utility estimates.

The first study used a 2 x 2 x 2 between-subjects factorial design to test hypotheses 1, 2, 3, and 4. The independent variables were: (a) representation format; (b) user-needs; and (c) attribute training. Respective levels of the independent variables were: floor plan or text stimuli for representation format; size and orientation focus for user-needs; and size or orientation focussed training. A pre-post-test design element was also present in the first study, with “before training” and “after-training” measurements conducted, both involving the measurement of the three independent variables. The attribute independent variables were layout orientation and dining space and their respective levels were north and south-facing for layout orientation and with dining space and no dining space for the dining space attribute.

The second experiment was between-subjects 3 x 2 factorial design to test hypothesis 5 and 6. The independent variables were: (a) representation format (text, floor plan with text, floor plan with limited text); and (b) construal manipulation (concrete and abstract). A measure was also added to the design to test whether cognitive processing trait (visual or verbal) influenced the outcome of the experimental design.

The table above presents a summary of the variables used for each study, distinguishing between attributes and the manipulated conditions and scales. As shown, both studies measure preferences of apartment attributes, they both employ representation format as one of the factors, and they have the similar dependent variables.

The main difference is that for the first study, an individual's processing style was not manipulated as it is a salient individual trait (and therefore can't be manipulated as a moderator). However, in the second study, variations in construal can be temporarily induced through manipulations (Trope and Liberman, 2003, 2010), so construal is manipulated as a moderator. The number of profile attributes differ from study 1 to study 2. The first study contains two manipulated variables which are spatial layout attributes. It also contained four other attributes which did not vary: total area of floor space; size of living rooms; built-in robes in bedroom; and compact laundry in cupboard. The function of these four attributes was to prime the respondents to think about and engage with the attributes, as well as strengthening the preference analysis results. Respondent preferences for the two varying attributes were measured in the varying levels of factor groups (for example representations). The second study added three further manipulated attributes, and respondent preferences for those attributes were also measured in the varying levels of factor groups. The three additional attributes were chosen using an affordance-based housing preference approach (Coolen, 2015) that focussed on affordances and user-needs.

Sampling

This section describes and provides the rationale for the specific sampling procedures used for study 1 and 2 and the source and number of participants.

The type of sampling used in the research was a convenience sample. Participants were obtained by first registering an expression of interest for the project in the Marketing Subject Pool during 2013-2016, then once approved, the Monash Business School Behavioural Lab manager booked the study to particular dates and sessions. The Project was entitled "User Perceptions of Property Floor Plans"

The questionnaire for study 1 pre-test and main study was administered to two cohorts of first year marketing undergraduate students from the pool at Monash University. Sessions for the first cohort (Marketing theory and Practice) were run as tutorials, where attendance was strongly recommended but not actually mandatory. The latter cohort (Marketing Research Methods) were invited to participate in the research as a course option where they could either take part in the research for one course credit or complete a written assignment. Participation was entirely optional even though taking surveys was encouraged as a way to gain experience in a scientific research project.

Working out the appropriate number of subjects involved multiplying the treatment levels together and then multiplying them by 30, because, as established in the literature, conditions in between-subjects experiments require around 30 respondents per cell as a generally agreed rule. This is because at 30, the sample means start to behave as normally distributed.

Many scholars however, like to use up to 50 per condition as a precaution. For this study we used 50 respondents per condition to calculate the sample sizes. The 3 conditions in study one are: representation format; needs focus; and, training focus. Each one of the conditions has 2 levels, which results in a 2^3 design, a sample size of 8 treatment levels x 50 subjects per condition = 400 participants in total. Study two conditions are: representation format (3 levels) and psychological distance (2 levels); this is a 3 x 2 design, a sample size of 6 treatment levels x 50 = 300 subjects in total.

The actual samples for study one and study two were 840 and 260 participants respectively. Although data collected for study one exceeded the calculated sample size by more than double, this was fit for the purpose of the study because the data was also used to test effects of non-manipulated factors such as cognitive processing style and attribute familiarity. As for study two, the sample of 260 equates to more than 40 subjects per condition and is therefore an adequate sample size.

Instrumentation

The instrumentation section justifies why the research instrument employed by the studies was the best and most appropriate for the population and the setting. It also describes the manipulation and measurement characteristics of the instrument; and, describes how the experiments, scales and other survey data were administered and scored.

The Instrument

Both studies used a lab-based computer survey to collect data, derived from the following five data sources within the one instrument: 1) demographic and property browsing questions; 2) ranking attribute task; 3) experimental task; 4) self-administered scales; and 5) a construal level manipulation task. Each of the components were ordered to make the survey flow logically and to minimise discomfort or task overload to the respondent. The procedure of the surveys for two studies are described below.

Measurement Characteristics

This section describes the reliability, validity, and structure of the measures employed in the studies as well as the measurement characteristics of the experimental tasks.

Reliability and validity

Reliability in the context of the experimentation undertaken for both studies, is concerned with whether SP data is reliable. It is concerned with whether the results would be consistent if data was collected at some future time (Freeman, 2003). Although it was found by Jain and Zongker, (1997) that different SP task formats, such as full profile or sub-sets, produce the same data, other studies found no significant differences in performances between formats (Oppewal & Klabbers, 2003; Van de Vyvere et al., 1998). Some researchers found that the full-profile task format of attributes were more reliable (Malhotra, 1982; Reibstein, Bateson, & Boulding, 1988; Segal, 1982). The studies in this thesis use the full profile format, where each alternative presented to respondents for consideration contains a full set of attributes and levels rather than other formats such as sub-sets.

As mentioned in a previous section, internal validity is about the extent to which the results are attributable to the independent variable and not a different explanation, in the context of rating the alternatives in this study (Molin, Oppewal, & Timmermans, 2002). The order of preference tasks was rotated so that internal validity could be strengthened. External validity is about the extent to which the results are generalizable to other contexts (Louviere, 1988b). However, because of the hypothetical nature of SP experiments, the true measure cannot be known, so external validity was not tested.

Structure and Design of SP Measures

Preference Structure

One type of preference measure applies to this research: the degrees of preference. Although the research instrument collected discrete choice data for apartment alternatives, it was outside of the scope of the thesis to analyse the discrete choice data. Preference measures were gained from evaluating the experimental measures - which for study 1 were 5-point bipolar scales and for study 2, were 7-point bipolar scales.

The preference estimates are reported in the results chapters, however the structure of the scales of the research instrument is described in the measures chapter along with all the other scales and measures adopted by both studies.

Type of Design

Stated preference measurement in both study 1 and study 2 required respondents to distinguish between alternative apartments by rating them and choosing the most preferred (Fabbris, 2013). As established, this instrument does not have any subscales, and uses a full-profile for each alternative, meaning, each alternative is made up of attributes that are common to all alternatives. The number of alternatives is determined by the multiplication of all attribute levels, to exhaustively contain each attribute level combination, called a full factorial design (study 1). When all combinations result in a number of alternatives that are too many for respondents to comfortably consider, then fractional factorial designs can be used (study 2). They enable experimental designs to reduce the number of effects presented to respondents without losing design integrity (Elrod, Louviere, & Davey, 1992; Green & Srinivasan, 1990; Kuhfeld, Tobias, & Garratt, 1994; Louviere et al., 2000). The stated preference alternatives were designed to enable respondents to capture the stimuli information quickly, both in the text representation format condition and the floor plan.

Operationalisation of Independent Variables

Attributes and categorical intensities

In the case of study 1, the dependent variable was either the rating or choice of apartments, depending on the task (although analysis of choice of apartments was beyond the scope of this thesis). There were 2 apartment attributes of 2 levels each, that when combined became 4 alternatives, as illustrated in Table 6 where V_1= attribute 1 (orientation) and V_2 = attribute 2 (dining room). Orientation consisted of 2 levels, north-facing and south-facing. Dining room consisted of levels dining room, and no dining room, as shown in Table 7.

There were an additional four fixed attributes, as explained in the previous section, but these were not varied. After responding to all four combinations, an attribute training instruction sheet was presented to respondents, followed by a repeat of the same design so that the effect (if any) on scoring of attributes could be established. The remaining treatments were between-subjects and the respondents were in those treatments for the duration of the experiment.

Table 6: Full Factorial Design - Study 1

<table>
<tr><td></td><td colspan="4">Alternatives</td></tr>
<tr><td rowspan="3">Before Instructions</td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>V_1=1</td><td>V_1=1</td><td>V_1=2</td><td>V_1=2</td></tr>
<tr><td>V_2=1</td><td>V_2=2</td><td>V_2=1</td><td>V_2=2</td></tr>
<tr><td colspan="5">Attribute Training Treatment</td></tr>
<tr><td></td><td colspan="4">Alternatives</td></tr>
<tr><td rowspan="3">After Instructions</td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>V_1=1</td><td>V_1=1</td><td>V_1=2</td><td>V_1=2</td></tr>
<tr><td>V_2=1</td><td>V_2=2</td><td>V_2=1</td><td>V_2=2</td></tr>
</table>

Table 7: Attribute Levels - Study 1

Attribute	Level 1	Level 2
Orientation	South Facing	North Facing
Dining room	No dining space	With dining space

In the case of study 2, once again the dependent variable was rating of apartments. There were 5 attributes of two levels each which multiplied out to 32 alternatives. Applying a fractional factorial design, 16 alternatives remained, as illustrated in Table 8.

Where V_1= attribute 1 (orientation) and V_2 = attribute 2 (dining space), V_3 = attribute 3 (gym), V_4 = attribute 4 (commute time) and V_5 = attribute 5 (rent price). As explained previously, the attributes consisted of two layout attributes from study one, and a further three that were not layout attributes or spatial in the second study. A fractional factorial design table was utilised to reduce the number of alternatives from 32 to 16. The design table for the 16 profiles is shown in Table 8. A further reduction from 16 to 8 alternatives was achieved to ensure the task did not cause task overload for respondents; to ensure the task length fitted into the time of the laboratory session; and, to remove unrealistic alternatives. This was achieved by randomly presenting respondents one of two blocks which consisted of: 1) alternatives 1-8; and 2) 9-16, for evaluation. The 8 alternatives were presented randomly to respondents in 2 lots of 4 pairs, 4 pairs before a manipulation task, and the same 4 pairs afterward.

Table 8: Fractional Factorial Design – Study 2

Profile number	V_1	V_2	V_3	V_4	V_5
1	1	0	1	1	0
2	0	0	1	1	1
3	1	1	0	1	0
4	0	1	0	1	1
5	1	1	1	0	1
6	0	1	1	0	0
7	1	0	0	0	1
8	0	0	0	0	0
9	1	1	1	1	1
10	0	1	1	1	0
11	1	0	0	1	1
12	0	0	0	1	0
13	1	0	1	0	0
14	0	0	1	0	1
15	1	1	0	0	0
16	0	1	0	0	1

The Attributes and levels of study 2 are shown in Table 9: Attribute levels - Study 2.

Table 9: Attribute levels - Study 2

Spatial attribute	**Low-level (Level 1)**	**High-level (Level 2)**
Layout orientation	South Facing	North Facing
Dining space	No dining room	With dining room
Rent value	$400 per week	$350 per week
Commute time	15 minutes	5 minutes
Gym	No gym nearby	Gym nearby

Manipulations

Treatments in the first study included user-needs, representation format, and attribute training, as explained in the background chapters. They each contained two groups as shown in Table 7 and further described in the following sections. Treatments in the second study included representation format in three levels (Floor plan with limited text; Floor plan and text; and text only) and construal mindset in two levels (abstract and concrete). As previously explained, they were included because it was hypothesised that representation format and construal mindset could interact to affect apartment rating. All of the manipulated variables were expected to be moderators of apartment preference and choice.

Table 10 below lists the manipulations across both studies. They are further explained in the commentary below the table.

Table 10: Manipulated variables with levels, both studies

Treatments	**Level 1**	**Level 2**
User-needs	Entertaining	Orientation
Representation format*	Floor plan	Text
Attribute Training	Size	Orientation
Instruction before after	Before instruction	After Instruction
Construal Mindset	Abstract	Concrete

*Representation Format had 3 levels in study 2, text format, text and floor plan format and also, a middle level that contained floor plan and text that was not able to be explained graphically (such as gym, rent price and commute time).

Representation Format

The first experimentation manipulation - representation format, was expected to act as a moderating variable (Ahmed et al., 2014; Brandão de Vasconcelos et al., 2015; Gao et al., 2013; James, 2014). Representation format refers to the style of stimulus presentation, the stimulus being the apartment profiles. It was designed to vary in two ways: verbally in the form of text descriptions; and graphically in the form of floor-plans (participants either viewed text descriptions of apartments or floor-plans, (refer Appendix 9 and Appendix 10).

Representation format is also an independent moderating variable for study 2. It was modified to include a third level of representation format. The three levels are: 1) text descriptions; 2) floor-plans with accompanying text; and 3) floor plans with limited text. This was to test whether the layout attributes, which were represented by floor plan in the limited text level, showed different preference functions to the remaining levels (Figure 8).

User-needs

The second experimental manipulation was the respondents' user-needs, expected to act as a moderating variable (Gao et al., 2013; Pucillo & Cascini, 2014; Vischer, 2008; Zinas & Mohd Jusan, 2017). It was explained at the beginning of the survey in the form of a scenario which respondents were asked to imagine whilst undertaking the experiment. One of two categories of user-needs was assigned randomly to respondents, the first associated with assessing the capacity of the apartment to entertain and the second associated with assessing the sustainability of the apartments. The two user-need focus categories were chosen as they relate strongly to the apartment attributes. The entertaining-related user-need identifies with dining space and the sustainability-related user-need identifies with the apartment's orientation to the sun. Where the assigned user need related to an attribute it was expected that preferences scores would increase compared with an attribute that did not relate to the user-need. By asking respondents to focus on one of the attributes as their needs focus, it was expected that importance of the corresponding attribute in the SP task will increase. For example, if the needs focus was on sustainability, it was expected that the orientation attribute would be more important to respondents than whether or not it had a dining space. Only one needs focus category was assigned (randomly) to each participant. There were several rating questions asked of respondents (dependent variables) that were analysed using the needs focus manipulation, as explained in the dependent variable section of this chapter. The two levels of user-needs are included as Appendix 14.

Attribute Training

The third core experimental treatment, also expected to act as a moderating variable, was attribute training which was presented to respondents in a written format in study 1, after evaluating the apartments in the experiment. The instruction was designed to assist respondents in the task of evaluating apartments (Orzechowski et al., 2005; Orzechowski et al., 2012) by focussing them on a specific attribute either: dining space, in text format (Appendix 3) or floor plan format (Appendix 4) or, layout orientation in text format (Appendix 5) or floor plan format (Appendix 6).

The approach of the training was to equip the respondents with some more understanding of property descriptions, which could be floor plans or text, depending on the representation groups the respondent was in. There were two types of training, the first addressed assessment of space for the user - need of entertaining. One of the important points made in the training was:

> Assessing whether or not the apartment has enough space for our needs can be done with the assistance of the scale and by considering the shapes of rooms and the way in which they relate to each other.

The training concludes with:

> If, for example, you are looking for an apartment to accommodate dinner parties you will realise by using the scale and taking the clues from the furniture, that this apartment is not big enough (a floor plan follows)

The second training method (participants were randomly assigned to training attribute themes) addressed assessment of layout orientation, for the user-need of sustainability. One of the important points made in the training was:

> When assessing the position of property in relation to the sun, check the direction of the North Point adjacent to the floorplan. North indicates roughly the direction of the sun at midday. The sun rises to the east of north and sets to the west of north.

The training concludes with:

> The floorplan shown below indicates that the apartment is positioned poorly in relation to north. None of the windows are penetrated by direct sun and so this apartment would not receive any direct sunlight and would not be naturally warm in winter. This could have the drawback of feeling cold and dark and heating bills would be higher than apartments facing north (a floor plan follows).

Evaluations Before or After Training

Operationalisation of the "attribute training" manipulation was possible when combined with the instruction before-after manipulation, by comparing the levels of importance of apartment attributes *before* the instruction focus manipulation and *afterward* (Orzechowski et al.; 2012). It was expected that apartment evaluations *after* the instruction focus manipulation would have a higher utility range than evaluations *before* the manipulation because participants would perceive that their assigned user-need and/or attribute would be more important than *before.*

Attribute Familiarity

The independent variable attribute familiarity was arrived at by asking a question in the survey requesting that respondents indicate the number of rental properties inspected in the past 2 years. By inspecting multiple properties it was expected that respondents will have some familiarity of layout attributes. It was expected that the count would not be high for the sample due to the age-range, so categories were: 1, 2-4, 5-9, 10 or more, with a further category for none. By physically inspecting multiple properties, it is expected that there would be some level of appraisal of the layout features of properties and that this could be a moderate representation format, such that the more experience an individual has with appraising property, the more likely the person is familiar with layout attributes Pazzaglia, Cornoldi & De Beni (2000); Pazzaglia and De Beni (2001).

Cognitive Processes and Styles

The scales used in the research have been described and critiqued in the chapter "Cognitive Processing". In summary, the 6-item Santa Barbara Learning Style Questionnaire (SBLSQ), and the 22-item Style of Processing (SOP) scales were adopted by the research to test hypothesis 5. It was expected that the scales could be used to identify visual from verbal learners by measurement in self-administered questionnaires. By applying the variable cognitive processing style as a moderator of representation format, it was expected that visual (verbal) processors would better understand floor plan (verbal) representation format. This was because visual (verbal) learners prefer to process information that is presented graphically (In written format). Therefore, where visual (verbal) processors were assigned the floor plan representation format condition, their overall rating of apartments show more importance of layout attributes than if they were assigned the text (floor plan) condition. Further to the critique of the measures in this research (presented in chapter 3), discussion and analysis of each of these measures are included as Appendix 23.

Construal Mindset

According to Trope and Liberman (2010), the more *abstract* an individuals' mindset is (construal level) depends on how *distal* the object is perceived to be (psychological distance)., and this is based on construal level theory (CLT). The first treatment presented to respondents in the second study (see Figure 30) was a scenario that combined spatial and temporal psychological distance-in two groups: concrete (the proximal levels); and abstract (the distal levels), for the purpose of examining whether construal mindset acts as a moderator of representation format (Trope et al., 2007; Zhao et al., 2011). In the case of the current research, psychological distance refers to the combination of a spatial and temporal variable. The two higher level conditions (high-level spatial and high-level temporal) were paired (Sydney 1 year) and called the abstract condition; and the two lower levels were paired (Melbourne 2 months) and called the concrete condition. These conditions are explained in detail in the procedure section of this chapter and chapter 7. In summary, they were based on the idea that Sydney 1 year, although the abstract option, was not too far away in location and time to imagine in an abstract way. The idea behind choosing Melbourne and 2 months is that Melbourne is the place where the respondents all live (proximal), and 2 months is a short but reasonable time to pack up a house and move. Spatial and temporal psychological distance are important variables in real-estate procurement (Trope et al., 2007; Zhao et al., 2014). For example, if one is moving to another place, the time of the move is a relevant detail. Construal of apartment features is affected by whether one is in a concrete construal state (here and now) or an abstract construal state (there and later). The conditions were operationalised as priming scenarios, to help respondents to visualise the move, strengthening the construal. They were selected because psychological distance manipulation formed the first part of the two-part construal priming of respondents.

Administration and Scoring of SP Measures

Scoring for the experimentation involved collecting scores on a rating scale. The bipolar rating scales were presented alongside individual apartment alternatives to obtain individual ratings for each apartment alternative (all four text apartment alternatives are included as Appendix 9 and Appendix 10).

The dependent variable employs a 5-point interval scale where 1= dislike extremely; 2 = dislike very much; 3 = neither like nor dislike; 4 = like very much and 5 = like extremely.

In the case of study 2, the rating scale was increased from 5 to 7 points, to increase response options a little without increasing frustration level of respondents. They ranged from 1 = like a lot; 2 = like moderately; 3 = like a little; 4 = neither like nor dislike; 5 = dislike a little; 6 = dislike moderately and 7 = dislike a lot. This is actually reversed from the scale used in Study 1, in in this case, a lower score means a more attractive apartment.

After decomposition of the scores, the rating scale data enabled relative preferences for apartments to be found for each respondent and each apartment alternative. The use of interval scales enabled the researcher to justify the use of the arithmetic mean as the measure of average. Analysis of variance of mean testing enabled parametric analysis to be conducted, testing mean scores to find effects.

Data Collection Procedures

This section describes the steps of the data collection procedure as follows: 1) ethics approval; 2) explanatory statement and informed consent; and 3) lab-based online survey.

Ethics Approval

This section describes the ethics approval process. Approval of the project was granted by the Monash University Human Research Ethics Committee (MUHREC). The Human Ethics Certificate of Approval was granted from 15 August 2013 and is included as Appendix 11: Human Ethics Certificate of Approval. The number given to the project was CF13/2329 – 2013001230. One of the terms of ethics approval was to provide a final report to MUHREC at the conclusion of the project. Other terms included instruction for data storage, auditing, project amendments, serious unexpected effects and conditions of ethics approval. The project is regarded as "Low Risk" research, and the only foreseeable risk is that of discomfort.

Explanatory Statement and Informed Consent

Respondents began their survey by first reading through the Explanatory Statement which is included as Appendix 12: Explanatory Statement. It referred to the MUHREC and advised the process should they wish to make a complaint about the research and provided the full contact details of the research team, consisting of the supervisor, second supervisor, and the project author. At the end of the statement, respondents were informed that continuing to the next page implied informed consent. All respondents continued onto the survey, so consent was given by all who participated.

Pre-test Study 1

Pre-testing was undertaken using 125 marketing student subjects in order to test whether the design and other aspects of the survey were going to successfully test the hypotheses. Reporting of the pre-test is included as Appendix 13 and the changes made afterward are in the next section.

Changes Made After Pre-testing

After pre-testing, a few additions were made to the survey. It was found that the home country of many of the respondents was in Asia, predominantly China. Some respondents indicated that south-facing apartments were preferred to north-facing and others didn't have a preference for either, suggesting that their home country was on or close to the equator (such as Singapore). If unaccounted for, this could compromise the effects of the attributes and the orientation needs focus. Melbourne is in the southern hemisphere and preferences for orientation of apartments (in Melbourne, Australia) were expected to be north-facing. It was decided to ask each respondent to indicate their home country so that reversed preferences from Asian respondents could be accounted for in the "before training" condition.

Further, when the Santa Barbara Learning Style Questionnaire (SBLSQ; Mayer and Massa, 2003) was subjected to preliminary analysis, it did not work for the sample as most respondents indicated on the self-administered scale that they were visual cognitive processors and the processing style variable was not suitable for testing as a moderator of apartment preferences. As an alternative, another scale was added to the main study data collection; Style of Processing (SOP; Childers et al.; 1985).

Study 1 Procedure

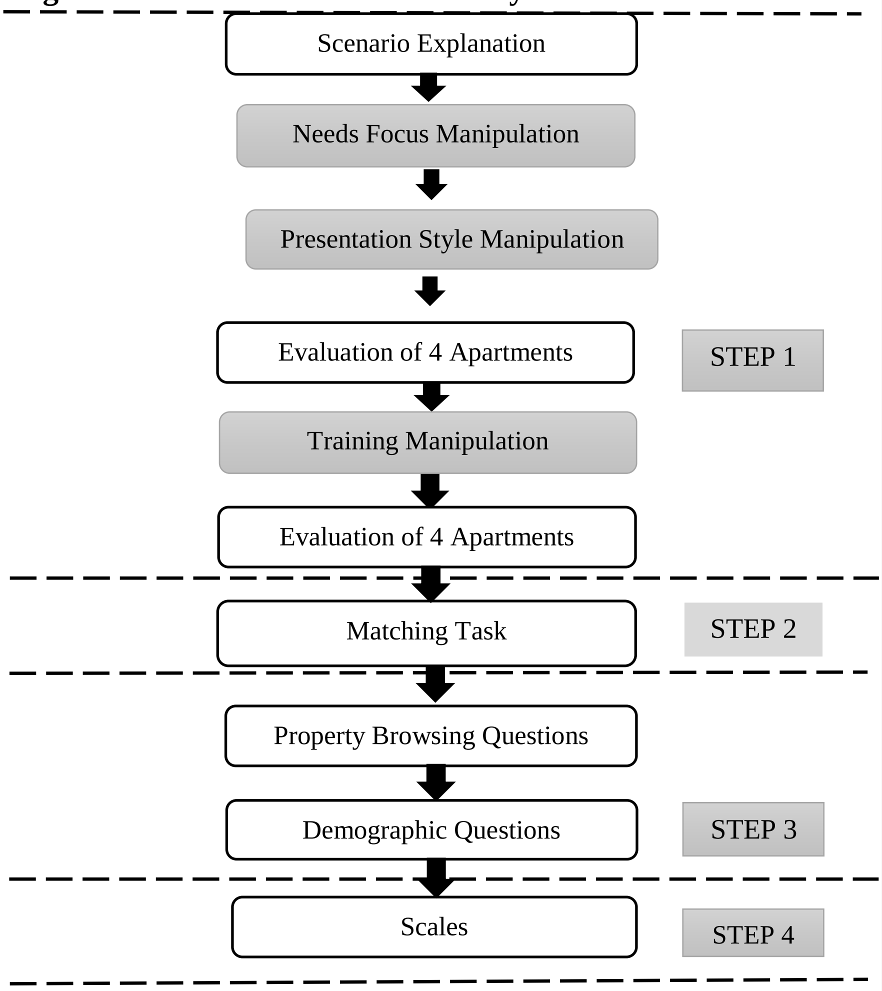
Data for study 1 was collected in the Monash Business School Behavioural Laboratory, as described in the sample description section. The sample size was 845.

As students joined the study at staggered times after completing a questionnaire for another study, they were allocated a work station from those available, students were provided with an online link on their work station and were asked to wait for the researcher's instructions with respect to clicking on the link. Once clicked, the survey was accessed immediately, commencing with the explanatory statement (refer Appendix 12) which described the study and sought consent, as explained in the Explanatory Statement and informed consent section of this chapter. The following sections illustrate the research instrument and explain the four-step procedure undertaken by respondents when navigating through the survey.

Research Instrument

Figure 3 shows the research instrument designed and administered for study 1.

Figure 3: Research Instrument Study 1



Procedure Step 1

The procedure for Study 1 involved four steps. It commenced with an experimental task, of which there were seven components. This was followed by a matching task which was designed to test whether respondents could recognise the same layout in the two formats. Then respondents were asked questions about their experience as well as questions about browsing and viewing property and demographic questions. Finally, respondents were asked to complete self-administered scales about their learning style.

The research instrument commenced with a set of instructions: “We are interested in people's decision-making process when renting apartments”. The following scenario, Figure 4, was given to all respondents because it was a scenario they may be faced with once they have graduated and it was hoped that the students could therefore relate to it.

Figure 4: Scenario Explanation

Suppose you have graduated.
You have decided you want to live alone.
You have decided you'll search for a 1 bedroom apartment on-line.
You have selected South Yarra in Melbourne, Australia, as your preferred location.
You have determined you can afford to pay \$350-\$400 per week rent.

Now imagine that you enter your search criteria on-line using a real estate portal such as realestate.com:
Property type: Apartment
Number of bedrooms: 1
Location: South Yarra (Melbourne, Australia)
Price: \$350 - \$400 per week

The purpose of this scenario was to prime respondents into imagining the setting in which the experiment was predicated. At this time, respondents were split into two randomly selected treatment groups, composed of the sustainability and the entertaining space user-needs; they were asked to imagine that they had specific needs related to either one or the other. Appendix 14 shows the needs focus manipulation groups. Respondents were also split into two randomly selected manipulation groups in the condition representation format. Approximately half of the respondents were given information in text format and the remaining in floor plan format. It was explained that four apartments would be presented for evaluation. Figures 5 and 6 contain the four apartments that were presented in text format and floor plan format respectively. The apartments represented are real apartments, in a 3-level apartment building in Windsor, Melbourne. The building has a central staircase that accesses 4 apartments on each level. Two apartments per level have street frontage and two face the carpark at the rear of the building. The apartments with street frontages feature a dining space whilst the carpark-facing apartments do not have a dining space. The apartments facing the street have windows that are exposed to the low angled winter sun whilst the rear- facing apartments do not get any direct sun. All of the apartments are privately owned and rent prices are not necessarily impacted by the orientation or the addition of a dining space. An example of each representation format is shown in Figures 5 and 6. The size of the smaller apartments are 50m^2 (without dining space). This complies with current minimum apartment size standards, although the apartment building was constructed in 1970.

As the text and floor plan versions show, the description of dining space status is reflected in the overall apartment size and the size of the open plan living area to help the respondent to understand that where a dining space is included, the apartment is bigger to allow for that space.

Figure 5: Representation Text Format, Study 1

Apartment 1
Total floor space 60square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows and all-day direct sun
Dining space seats 6
Compact laundry in cupboard

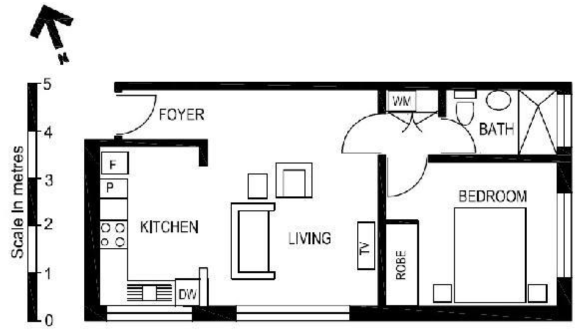
Apartment 2
Total floor space 50 square meters
5.9m x 3.5m open plan living and kitchen
Built-in robe in bedroom
Large windows and all-day direct sun
No dining space
Compact laundry in cupboard

Apartment 3
Total floor space 50 square metres
5.9m x 3.5m open plan living and kitchen
Built-in robe in bedroom
Large windows but no direct sun
No dining space
Compact laundry in cupboard

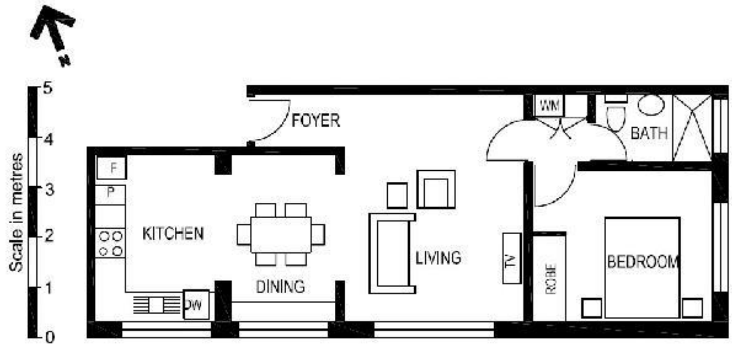
Apartment 4
Total floor space 60 square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows but no direct sun
Dining space seats 6
Compact laundry in cupboard

Figure 6: Representation Floor Plan Format, Study 1

Floorplan 1

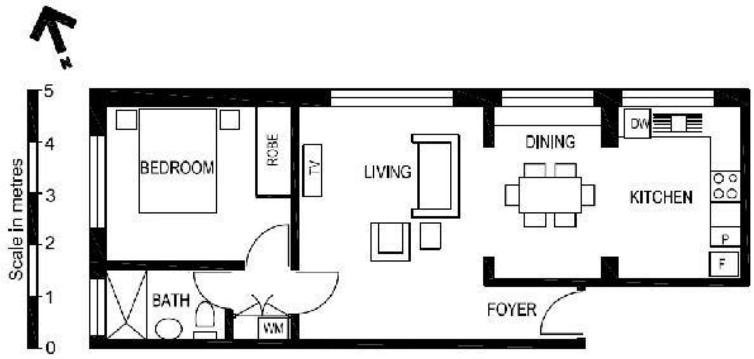


Floorplan 2



Floorplan 3

Floorplan 4



Respondents were asked to consider each apartment alternative, and to evaluate its ability to accommodate their requirements. Those in the sustainability user-needs group were asked to consider how well each apartment was able to “dry clothes on a clothes airer”, and provide “natural warmth in winter”. These questions were included to prime respondents to think about the effect that the apartment’s orientation had on apartment features. For example, in a north-facing apartment, drying washing indoors with a clothes airer will be able to be accommodated. The respondents in the entertaining space user-needs group were asked to consider how well each apartment was able “to hold dinner parties for 6 people” and have “room for friends to sleep-over”. As well as these questions, respondents were asked how well apartments accommodate “a separate foyer and “a compact laundry”. Both the orientation and entertaining space needs focus groups were asked these questions. Finally, respondents were asked to rate each apartment and to decide whether or not they would inspect this apartment. All of these evaluation questions are analysed in chapters 4 and 5 - apart from the “choice” question which was outside the scope of the research. These questions as well as all of the dependent variables are included in the research instrument in Appendix 21: Research Instrument Study One. Table 11: Experiment Questions (Dependent Variables) lists all of the dependent variables in the research (refer to the dependent variable section of this chapter).

Table 11: Experiment Questions (Dependent Variables)

Manipulation	Dependent variable	Scale / discrete
Needs Focus (Entertaining Space)	How well does the apartment accommodate dinner parties for 6	5-point scale
	How well does the apartment accommodate having friends for sleepovers?	5-point scale
Needs Focus (Orientation)	How well can the apartment accommodate drying clothes on a clothes airer:	5-point scale
	What chance does the apartment have at being naturally warm in winter?	5-point scale
All manipulations	How well does the apartment accommodate a separate foyer	5-point scale
	How well does the apartment accommodate a compact laundry?	5-point scale
All manipulations	Given your needs, how much do you like this apartment?	5-point scale
All manipulations	Given your needs, would you be interested in inspecting this apartment?	Choice – yes, no or maybe

The four apartments were presented to respondents individually in either text or floor plan format. All alternatives of text format are included as Appendix 9 5 and all alternatives for floor plan format are included as Figure 6.

Once the four experimentally designed apartment profiles, with two varying attributes (layout orientation and dining space), respondents were presented with an attribute training manipulation, with two groups. Group assignment was randomised so that in some cases, respondents were given training about the attribute they were assigned to focus on and others that did not match the attribute they were focussed on. For the latter, they may have been in the layout orientation groups and the attribute training was about the dining space orientation. The instructions are included as Appendices: 3, 4, 5 and 6 showing variations representation format as well as user-needs. After the instruction manipulation, a further 4 apartments were presented to respondents for evaluation. These were the same apartments as prior to the instruction manipulation so that the researcher can test for a significant difference pre-manipulation (training) to post manipulation (training). The attribute training manipulation used floor plans and text depending on whether the respondent was in the floor plan or text format group.

After the attribute training it was decided to ask respondents whether they understood the training. “With respect to the evaluation questions that you've answered so far, to what extent did you consider whether the apartments were north-facing (or whether they had space to entertain for the other group) so that they could accommodate your needs? Respondents were given a 5-point scale with the following points: never; rarely; sometimes; often; and all of the time. The survey was instructed by the researcher to force a response for this question. A further question was asked, “How useful has this information been?” A 5-point scale was given for respondents to make their choices from: very useless; useless; neutral; useful; and very useful. A forced response for this question was also prescribed in the survey software. The purpose of the questions was to facilitate further thinking about the user-needs to reinforce this manipulation.

Procedure Step 2

After the experimental task, respondents were asked to participate in a matching task, as explained previously in the research instrument section. They were split into two groups, depending on whether they were in the floor plan or the text group. They were asked to match a text description to a floor plan where they were in the floor plan group, and a text description to a floor plan where they were in the text group. The purpose of this task was to analyse how well respondents understood one layout presented in two formats and how that affected their preferences. The tasks are included as Figure 5 (text condition) Figure 6 (floor plan condition). The apartments were randomised to control for order effect and respondents were forced to provide only one response.

Procedure Step 3

From there, respondents were asked to answer some questions about their past property browsing behaviour (Appendix 17) and this was followed by demographic questions, included as (Appendix 18). The former were questions that could be used to determine how much experience respondents have with browsing for property and inspecting property. Questions included:

1) Have you ever searched for rental property online?
2) How many properties have you inspected over the past two years?
3) What method have you used to search for rental property? and,
4) On which property portal have you searched?

All questions were multiple choice and the third and fourth questions asked respondents to select as many choices as were applicable.

The demographic questions asked respondents to indicate their age group, their gender, their living situation (renting, sharing etc.), their home country, and the amount of time they have lived in Australia.

Procedure Step 4

The final task for respondents was a self-administered scale which measured cognitive processing style. The Santa Barbara Learning Style Questionnaire (SBLSQ), was a 6-item forced response questionnaire. The items were divided into two sub-scales, one for visual learners and one for verbal learners. The SBLSQ measure (Appendix 1) was scored on a 7-point bi-polar scale.

After achieving poor validity in factor analysis, a further measure was added to the survey. The second scale was the Style of Processing (SOP) scale consisting of 22 items with a four-point bi-polar scale. The SOP is included as Appendix 2.

Order Rotation and Randomisation

The order of the items that are used in experiments could potentially bias the results obtained, called an "order effect". To average out any such bias and improve internal validity, the design was rotated to balance the order where the four apartments evaluated by respondents were rotated in their order of presentation. The rotations were assigned to respondents randomly and equally by survey software Qualtrics.

Pre-tests Study 2

Pre-tests were undertaken in order to test whether the design and other aspects of the survey were going to successfully test the hypotheses. The details of the pre-tests are included as Appendix 19.

Changes Made After Pre-tests

After conducting the pre-tests, the following changes were made to the research instrument. It was expanded to a two-part construal priming process, psychological distance (temporal and spatial) and a construal level manipulation task – the latter to reinforce the initial construal mindset. Representation format was also expanded into three styles: text only; text and floor plan; and, a third that used a floor plan to illustrate the layout attributes and text to describe the remaining attributes. There were five attributes: rent ($350 or $400 per week); commute time to work (5 or 15 minutes); gym (nearby or not nearby); entertaining space (dining space or no dining space); and orientation to the sun (direct sunlight or no direct sunlight). The BIF manipulation check was not included in the survey. Dependent variables were how much respondents liked the apartment.

A ranking task was added to the survey after the pre-test, requesting that respondents rank apartment attributes pre and post experimentation. Firstly the ranked information assisted the researcher to attempt to classify the attributes themselves as either abstract or concrete (for example,Wan & Agrawal, 2011) which is different to construal mindset which is tested in hypothesis 6.

Secondly, a ranking task was given to respondents post the experiment so that it could be established whether the experiment caused a change of attribute construal classification. It was posited that the experiment could cause change in attribute ranking because respondents were forced to trade-off attributes. The ranking task does also require respondents to trade-off attributes however they are presented only as a single level attribute (no levels). Although carried out, this analysis is not part of the research model and is therefore not in the thesis however it is included as in the "ranking task" section of Appendix 22.

Study 2 Procedure

This section describes the procedure of the research instrument modified after undertaking pre-testing. Data was collected over three days, and the survey was taken online in the Monash Business School Behavioural Laboratory, as described in the sample section. The sample was 260.

When students were allocated seats in the laboratory, their work station had an online link and they were asked to wait for the researcher's instructions with respect to clicking on the link. Once clicked, the survey was accessed immediately, commencing with the explanatory statement (refer to Appendix 12) which described the study and sought consent as explained in the Explanatory Statement and Informed Consent section of this chapter. The following sections illustrate the research instrument and explain the five-step procedure undertaken by respondents when navigating through the survey.

Research Instrument

Figure 7: Illustration of Research Instrument Steps for Study 2.

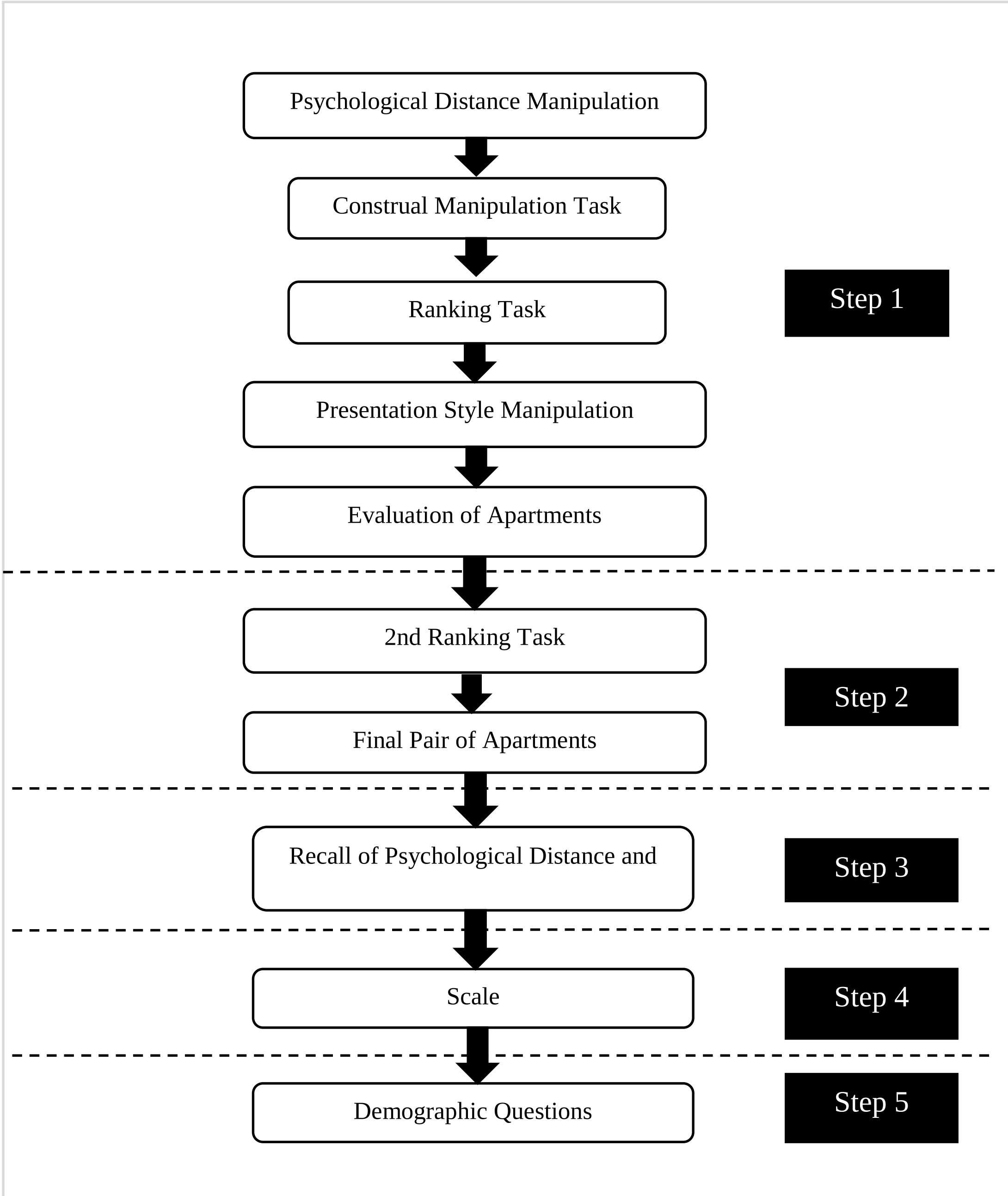


Figure 7 illustrates the research instrument steps for study 2.

Procedure Step 1

There are 4 components to step 1. It commences with a psychological distance manipulation, followed by a construal manipulation task, then a ranking task, and finally the experimental task.

Psychological Distance Manipulation

The psychological distance manipulation was presented to respondents as a scenario. For more detail, refer to Appendix 20 where there is a summary of the manipulations, followed by a description of the variables. The two scenarios advised participants that 1) they were moving to Sydney CBD in a year to take up a graduate position and they are browsing online for an apartment to rent or, 2) they were moving to Melbourne CBD in 2 months to take up a graduate position and they are browsing online for an apartment to rent.

Construal Manipulation Task

The construal manipulation task involved directing respondents to think in a low or high-level construal by administering "how" (low-level) and "why" (high-level) thought exercises. Respondents were asked to describe how (why) they would move to Sydney (Melbourne) in 1 year (2 months). After all combinations of: How; Why; Sydney 1 year; and Melbourne 2 months, have been exhausted, there were 4 groups in this manipulation. The high level (abstract) psychological distance scenario, asking respondents to think of three reasons *why* they should engage in a move to the given place in the given timeframe contained the following scenario:

> As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three reasons **WHY** you would move from your current accommodation to a new apartment in **Sydney** in **1 year**

All levels of the construal manipulation task are included as Appendix 20.

The survey requested that respondents write 3 reasons why (how) they would move to Sydney (Melbourne) is 1 year (2 months). The purpose of this was to reinforce the individuals' mindset into the construal level that the scenario had induced. For example, where the scenario was for Sydney and 1 year, the individual would be expected to be in a high-level state of construal whereas if the scenario was for Melbourne and 2 months, the individual would be expected to be in a low-level state of construal. High level thinking is regarded as abstract, big picture thinking, where an individual deals with the "why" questions but not the detail of the situation (Trope et al., 2007). By contrast, low-level thinking is regarded as concrete, detailed thinking, where an individual deals with the "how" questions of a given situation.

The "how" and "why" written answers were not of particular importance to the study so there was no scoring of the answers apart from coding whether or not respondents had engaged in the task which was of interest because the purpose of the task was to strengthen the construal mindset that respondents were assigned in the psychological distance manipulation (in the initial scenario). For example, where respondents were assigned to the abstract (concrete) psychological distance mindset and were given the "why" ("how") construal manipulation task, their construal is strengthened in the abstract (concrete) condition.

Ranking task

Following this, respondents were asked to rank five apartment attributes. Respondents were asked to click the first feature they would be interested in knowing about when renting a new apartment. This indicates that this feature is the most important to them. Once they had indicated an attribute, they were again asked to click the first feature they would be interested in, with the remaining attributes. This was repeated until there was only one attribute remaining. The five attributes were as follows:

- Whether the rent is closer to $350 or closer to $400 per week;
- Whether it has a commute time of closer to 5 or closer to 15 minutes;
- Whether there is a gym nearby;
- Whether it has a dining space;
- Whether it gets direct sunlight.

The purpose was to examine whether the attributes would remain in the same order of importance when they were ranked compared with trading-off attributes against one another. Further analysis on the ranking tasks is included in Appendix 23.

Experimental Task:

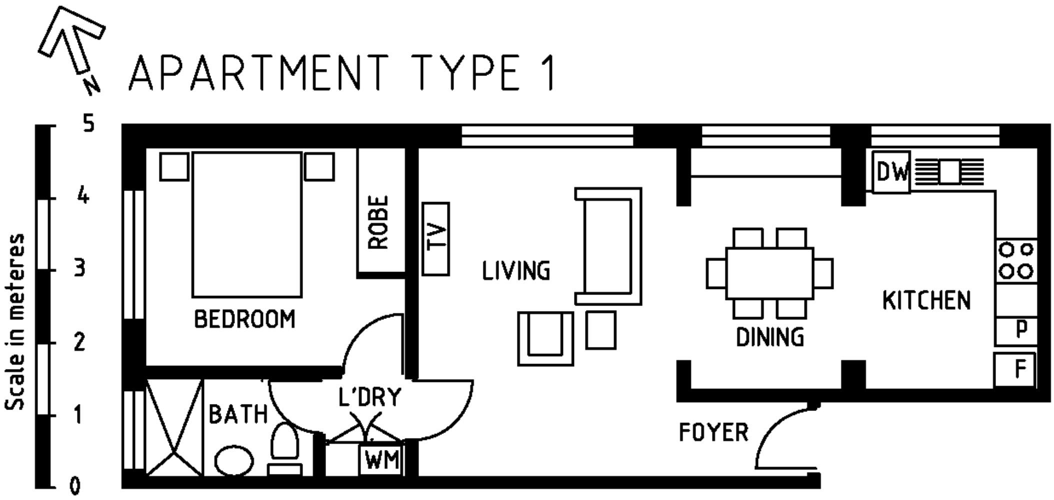
The next section was the experiment. Respondents were randomly divided into one of three representation format groups: text only; text and floor plan; and floor plan with limited text. The style that includes limited text with floor plans varies the dining space and orientation attributes using floor plans as they are layout attributes and are able to be presented graphically. An example of each style is shown in Figure’s 8, 9 and 10.

Figure 8: Representation Format 1 Study 2

Apartment Type 1

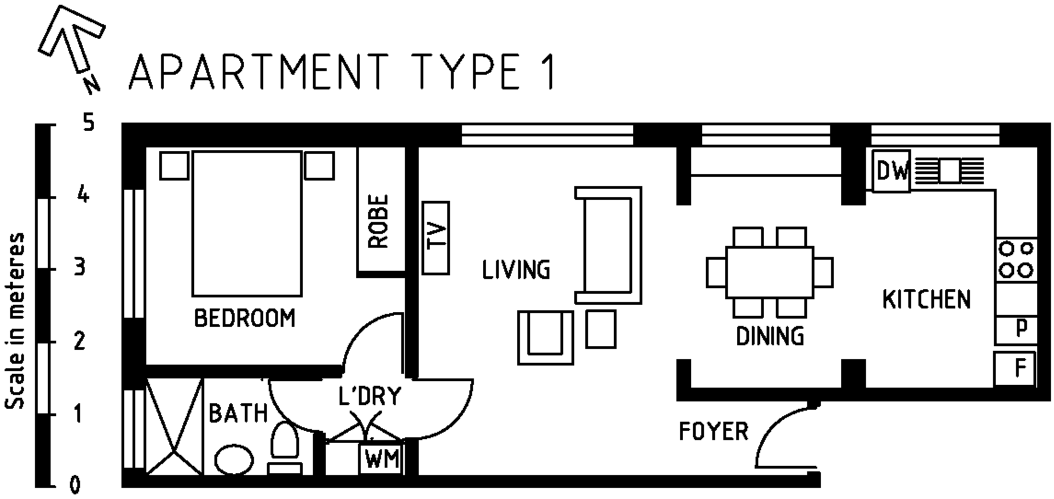
Rent $400 per week
15 minute commute to work on train
No gym nearby
with dining space
All-day direct sunlight

Figure 9: Representation Format 2, Study 2



Rent $400 per week
15 minute commute to work on train
No gym nearby
With dining space
All-day direct sunlight

Figure 10: Representation Format 3, Study 2



Rent $400 per week
15 minute commute to work on train
No gym nearby

As explained previously, the experimental design consisted of a 16-alternative fractional factorial design. To avoid possible task overload respondents were given only 8 alternatives to consider. The 16-alternative design was therefore achieved by randomly giving each respondent either alternatives 1-8 or, alternatives 9-16. It was explained that four pairs of apartments (8 in total) would be presented for evaluation, in the psychological distance group (Sydney in 1 year versus Melbourne in 2 months) assigned to them, and they were reminded of their manipulation group. Respondents were asked to consider each apartment alternative and rate it and to also consider each pair of apartments and choose which one if any, they would be interested in living in. Accompanying each apartment, was the rating question, “how much do you like this apartment”? Apartments were scored by respondents on a 7-point bipolar scale ranging from “like a lot” to “dislike a lot”. 7-point scales are more sensitive than 5-point (Cummins & Gullone, 2000). The scoring was set-up for parametric analysis, testing mean scores to find effects (refer to the statement of analysis, in the final section of this chapter). Apartment features included alternatives according to the design for attributes and levels (refer to the methodology chapter).

Procedure Step 2

Second Ranking Task:

The initial ranking task was repeated after the experimental task to understand whether the features that were most important to respondents have changed after evaluating the attributes in apartment alternatives. The task was exactly the same as the initial task which enabled the researcher to compare their performance before and after the experimental task.

Final Evaluation of a Pair of Apartments:

After the second ranking task, the respondents were asked to evaluate one more pair of apartments. A pair was chosen from the four pairs presented in the experimental task. The purpose of this was to test for any change in preferences after the second ranking task. Although this task was in the research instrument, it is beyond the scope of the studies and therefore not analysed in the thesis.

Procedure Step 3

Recall of Treatment Groups:

Procedure step three involved asking respondents to recall their psychological distance treatment group, both the spatial element (Sydney or Melbourne) and the temporal element (1 year or 2 months). It was expected that the treatment groups assigned to respondents would influence attribute preferences and would also interact with representation format to affect the scoring of apartment alternatives and choice of apartment.

Memory recall was assessed for the spatial element of the psychological distance treatment by asking "At the beginning of the survey, we asked you to imagine you are renting an apartment in a city in Australia. Can you recall which city that was? (Please write the city below)". This was cross checked with the group respondents were assigned to. Re-call was also assessed for the temporal element of the psychological distance treatment. Respondents were asked "We also asked you to imagine moving in a specific time-frame. Can you recall what that was? (Please write the timeframe below)" They were also asked whether they recalled what they wrote in the "how" or "why" task, asking "Can you recall that you stated three reasons WHY or three ways HOW you wanted to move to a new apartment? (Please write down one of your answers)". Their answers were also cross-checked against the treatment group assigned to each respondent.

Procedure Step 4

Scale

Step 4 of the procedure for study 2 was a self-administered scale which measured processing style (SOP). This scale was also used in study 1 however it was not correctly administered in that study because the researcher failed to include all of the items in the measure. The scale consisted of 22 items with a four-point bi-polar scale. The SOP is included as Appendix 1.

Procedure Step 5

Demographic Questions

Step 5 of the procedure consisted of demographic questions, which were identical to those administered in study 1, and included as Appendix 18: Demographic questions. In summary, the demographic questions asked respondents to indicate their age group, their gender, their living situation (renting, sharing etc.), their home country and the amount of time they have lived in Australia.

Data Analysis

This section describes the data storage, the data cleaning and data processing, and concludes with a statement of analysis where the analysis procedures are described ahead of the results chapters.

Data storage

Respondent responses were collected using online survey software Qualtrics.

Data Cleaning

The data were examined and found to contain some inconsistent or repeated responses, out of range responses, test responses and blanks cells. Qualtrics' "forced response" was activated for most questions, which prevented respondents from continuing to the next page until all questions were answered. Where respondents did not write what was asked of them, cases were not removed from the entire study, but only where they affected specific analyses. For example, where responses to the construal manipulation task were not consistent with what the survey asked respondents to write, their cases were excluded from hypothesis testing concerning construal mindset. However, where too much data were missing, particularly in the experiments, entire cases were removed. 27 problem cases were removed for study 1 and 16 cases were removed for the second study 2.

Data Processing

Analysis of the pre-tests and studies were performed using IBM SPSS Statistics version 23, using downloaded data from survey software Qualtrics.

Statement of Analysis

Four statistical procedures were performed to prepare the data for analysis and to test the hypotheses. They were descriptive analysis, factor analysis, MANOVA, and mixed-effects models.

A summary of all the analyses is shown in Table 12 and discussed in the sections to follow. The reliability and factor analysis are included as Appendix 23.

Table 12: Summary of Analyses Used in the Research

Study	Task / measure	Analysis name	Hypothesis Tested	Purpose / question
1 & 2	Demographic questions	Descriptive statistics	1-6	How can the sample be described?
1 & 2	Processing style	Reliability and factor analysis	5	Does the measure work on the sample?
1	Learning Style	Reliability and factor analysis	5	Does the measure work on the sample?
1	REI	Reliability and factor analysis	5	Does the measure work on the sample?
2	Behavioural Identification Form	Reliability and validity	6	Does the measure work on the sample?
2	Ranking task	MANOVA	6	What is the rank order of attributes?
1 & 2	Rating of apartments	Mixed-effect model	1-6	How do respondents score each apartment alternative?

Descriptive analysis:

Descriptive analysis was used in both studies to show the demographic patterns of respondents and to produce a profile of their characteristics, enabling the researcher to describe the typical respondent.

Factor analysis:

Reliability testing and confirmatory factor analysis was used to establish the reliability and the validity of the measures employed by the research (SBLSQ, SOP, and REI). The main question that this analysis answers is whether the underlying structure of the scales as reported in the literature, are consistent with the research samples contained in this thesis (Pallant, 2013). The analyses involved submitting the measures to a three-part process of data reduction involving the assessment of the suitability of the data for factor analysis, data extraction and factor rotation. Factor analysis is reported in Appendix 23.

MANOVA:

Study 2 uses a 2x2 two-way between-subjects factorial multivariate analysis of variance (MANOVA) design to investigate differences in mean between concrete and abstract construal attributes in a task in which respondents were asked to prioritize apartment features (ranking task). Although MANOVA assumes that interval data is used, it is used as a proxy in this case as the data for the ranking task is not interval. The data from this task was used to examine the main effects of apartment features (attributes) and interaction effects of psychological distance and the how/why construal manipulation task with apartment features. A comparison of medians of rent, commute time, gym, dining and sunlight (all dependent variables) revealed how each of them are positioned, within the two construal groups. This analysis is reported in chapter 8 (study 2). A MANOVA was also performed to capture the 25 dependent variable items for the BIF scale, to compare the concrete and abstract means for each item and then use the results as a manipulation check. Analysis of the BIF measure, is reported in Tables 24 and 25.

Mixed-effects models:

A linear mixed-effects regression model was chosen to model the preference data in both studies where the independent and dependent variable is continuous. The "mixed" component denotes the mixing of random and fixed effects. The subjects are the random effects and the fixed effects are factors that have characteristics that are repeatable and usually contain a small number of levels (such as cognitive processing style).

According to MathWorks (2017, Ref R2017b), the standard format of a linear mixed-effects model is:

$$y = \underbrace{X\beta}_{\text{fixed}} + \underbrace{Zb}_{\text{random}} + \underbrace{\varepsilon}_{\text{error}}$$

where,

- **y** is the n-by-1 response vector, and n is the number of observations.
- **X** is an n-by-p fixed-effects design matrix.
- β is a p-by-1 fixed-effects vector.
- **Z** is an n-by-q random-effects design matrix.
- **b** is a q-by-1 random-effects vector.
- ε is the n-by-1 observation error vector.

The reason why this model was chosen is because it can handle the mixed effect characteristics of preference data well. For example, they can handle repeated measures, within-subjects as well as between-subjects variables. They can also handle missing data and unbalanced designs where the amounts of data in the conditions are not equal (Verbeke & Molenberghs, 2000). Further, they measure interactions between any combination of discrete or continuous variables (McCulloch & Searle, 2000).

The dependent variable in the mixed-effects models (for both studies) constitutes rating scores for each individual, for each apartment. The between-subjects independent variables entered into the model were for study 1: representation format, user-needs; attribute training; attribute familiarity. Study 2 independent variables were: representation format; cognitive processing style; and construal mindset.

Within-subject factors entered into the model, for study 1 were presence of dining space and layout orientation and for study 2: rent price; commute time; presence of gym nearby; presence of dining space; and layout orientation. Mixed models are used to analyse study one and study two in Chapters 7 and 8.

Chapter Summary

This chapter commenced with the positioning of the research then described the sample, instrumentation, data collection procedures and ended with a statement of analysis where all the analyses used in the thesis were described and justified.

7. STUDY ONE (REPRESENTATION EXPERIMENT)

Introduction

The research methodology and the design used to test the conceptual framework and hypotheses were described in chapters 5 and 6. This current chapter focuses on: the operationalisation of the study design; the specific procedures used to test hypotheses; and the results of the data analyses. Hypotheses 1, 2, 3, and 4 were tested in this chapter and collectively they made up study 1. This study examined whether laypersons were better able to articulate preferences for apartment layout features based on floor plan formats compared to text formats because the floor plans helped them to better imagine apartment layout attributes, which in turn helped the experiment to be more realistic. It also examined whether user-needs, attribute training, and attribute familiarity influenced preference articulation on floor plan representations.

Research Objectives and Hypotheses

The main objective of the research was to understand whether floor plan representations assist a lay-person in the visualisation of building layout attributes. This was established by comparing articulation of preferences for layout attributes on floor plan representations (in experimental conditions) *and* text representations (Louviere et al., 1987; Vriens et al., 1998) Floor plans were expected to out-perform text-because floor plans are, by their nature able to explain spatial configuration of layouts in terms of shape and position , so it is expected the precision of the estimates will increase (lower error variance). Language, on the other hand, is limited to specifying relationships more abstractly (Hayward and Tarr, 1995). This research compared the utility of given features for the two types of representation (floor plan and text) and examined whether the features were perceived to be more prominent to individuals when they are presented graphically in floor plans, as compared to when the features are presented in written format (Jansen et al.; 2009, Louviere et al., 1987; Orzechowski et al., 2005, 2012; Vriens et al., 1998).

This research used SP methods to investigate this question. The logic applied to the main objective of the research is that: if the features on which individuals are asked to focus in floor plan representation are found to be more prominent to those individuals than they are in a written format, then this will mean that individuals are more sensitive to variations in level, which means that they attribute greater importance to the feature, which in turn shows a greater understanding of the features in the floor plan representation compared to the text format. Thus the current chapter hypothesises firstly, that;

(H1) Apartment layout attributes represented by floor plans, will be more important in preference tasks than content-equivalent verbal descriptions.

The purpose of comparing the two stimuli in experimental conditions was to understand whether preference articulation for layout attributes in floor plan formats becomes more similar to text format in certain conditions, or whether those conditions increased attribute sensitivity in floor plans suggesting they were more realistic stimuli for layout preferences or superior to text in marketing messages. This research hypothesises that the *legibility* and subsequent *visualisation* of floor plan representations depends on *user-needs,* an important variable because individual's attribute trade-off behaviour depends on their particular user-needs (Vischer, 1985), and so the current study examines whether: 1) respondents were more sensitive to layout attributes when they were related to their user-needs; and 2) whether their user-needs related preferences were better articulated on floor plan representations because of focussing on those needs. It is therefore hypothesised that;

(H2) Where apartment layout attributes are represented by floor plans and user-needs are aligned with specific attributes, the attribute related to the user-need increases in importance in preference tasks.

It also hypothesised that *training* individuals about the nature of layout attributes will assist with their floor plan *visualisation* (Orzechowski et al., 2012). What individuals notice about buildings depends on their training (Montello, 2014). Furthermore it was established that experts and laypeople pay attention to different layout attributes (Montello, 2014). However, it is not yet known whether training laypeople about a particular attribute assists them to focus on that attribute, and whether this focus will help them to know what to look for on floorplans, and therefore improve articulation of their preferences on floor plan representations. To test this, this thesis hypothesises that:

(H3) Where apartment layout attributes are represented by floor plans and attribute training aligned with specific attributes, these attributes will increase in importance in preference tasks.

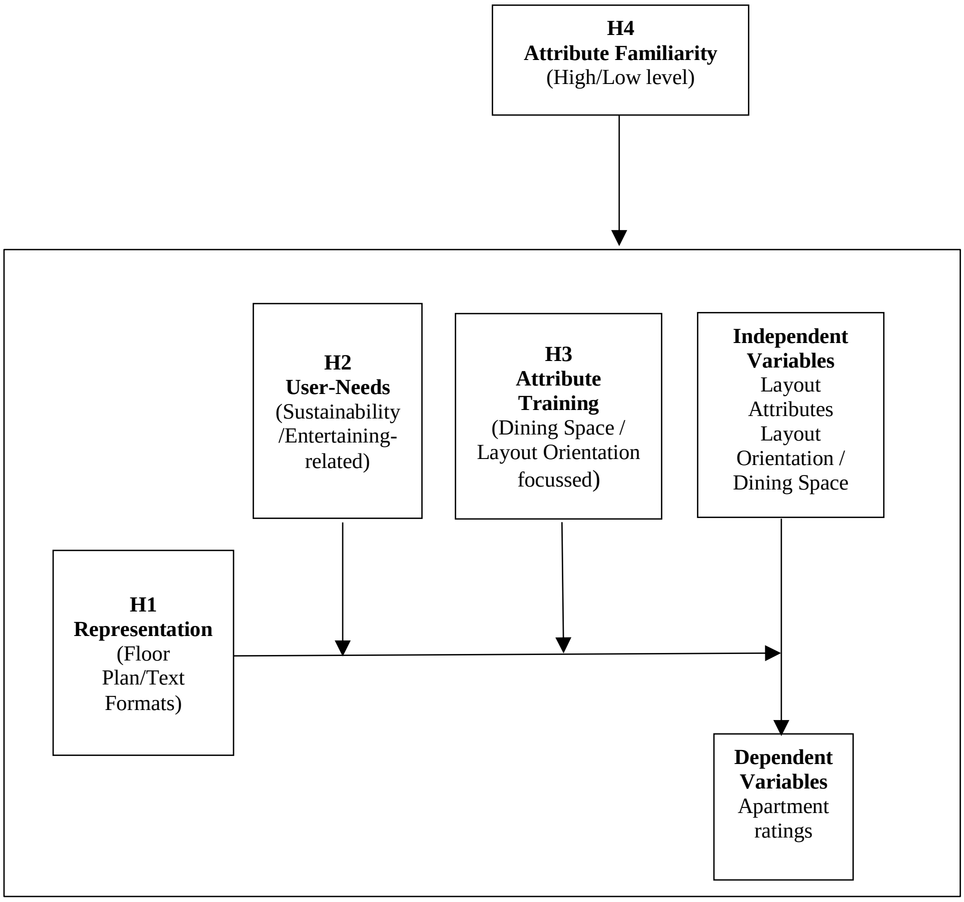
Another important variable to *legibility* of floor plan representations is *attribute familiarity* (Day et al., 2012; Orzechowski et al., 2012). Individuals familiar with layout attributes (due to having inspected multiple building layouts previously) are deemed to have more familiar with layout attributes than the rest of the sample. It is proposed that a person's familiarity with building layout attributes affects whether or not they are able to better articulate their preferences on floor plan representations compared with text representations. Being familiar with the attributes, they may know what to look for in plans - in fact they may be somewhat familiar with floor plans. To see if this is supported, this thesis hypothesises that:

(H4) Attribute familiarity moderates preferences for apartment layout attributes such that the more familiar individuals are with layout attributes and representations the more they gain in importance.

In summary, the objective of study 1 is to examine whether individuals who are able to read floor plans are able to articulate their preferences for layout attributes on floor plans such that: 1) floor plans help people to imagine layout attributes; and 2) when comparing formats for apartment layout representation, the floor plan format will outperform the written format in preference articulation because floor plans are by nature able to explain spatial configuration of layouts whereas the written format is limited to describing only abstract spatial relationships. The study objectives are further, from the perspective of the lay-person, to test whether: focussing on a particular user-need; undertaking training about a particular attribute; and having a high level of attribute familiarity will result in improved legibility of floor plans because due to the factors outlined above individuals will know what to look for on the floor plans.

This chapter focusses on testing the effect of attribute representations on preference articulation, including moderation testing of user-needs, training, and attribute familiarity. The model below demonstrates the relationships in the study however, more detail about the conditions and direction of the moderating variables is described in the next section.

Figure 11: Research Model for study 1



Representations, user-needs, and training were manipulated in a 2 x 2 x 2 between-subjects design, and they were analysed using a mixed-effects model in SPSS together with the attribute familiarity attribute. All of the variables (as shown in the model above) were tested to moderate representation and evaluations of layout attributes dining space and sunlight.

Dependent and Independent Variables

There were a number of dependent variables in the study, shown in Table 13.

Table 13: Dependent Variables

	Dependent variable	Scale
DV 1	How much do you like this apartment?	5-point interval scale: Dislike extremely, dislike very much, neither like nor dislike, like very much, like extremely.
DV 2	Would you be interested in inspecting this apartment?	3-point nominal scale: Yes, maybe, no.
DV 3	If sustainability-related user-needs: How well can the apartment accommodate drying clothes on a clothes airer:	5-point interval scale: Poor, fair, good, very good, excellent.
	Or if entertaining-related user-needs: How well does the apartment accommodate dinner parties for 6?	
DV 4	If sustainability-related user-needs: What chance does the apartment have at being naturally warm in winter?	5-point interval scale: Poor, fair, good, very good, excellent.
	Or if entertaining-related user-needs: How well does the apartment accommodate having friends for sleepovers?	
DV 5	How well does the apartment accommodate a compact laundry?	5-point interval scale: Poor, fair, good, very good, excellent.
DV 6	How well does the apartment accommodate a separate foyer?	5-point interval scale: Poor, fair, good, very good, excellent,
DV 7	Given your needs, how much do you like this apartment?	5-point interval scale: Dislike extremely, dislike very much, neither like nor dislike, like very much, like extremely.
DV 8	Given your needs, would you be interested in inspecting this apartment?	3-point nominal scale: Yes, maybe, no.

The main dependent variables, from which respondents indicated their overall preferences for each apartment alternative were indicated on the final two dependent variables on the table above. Respondents were asked on a 5-point bipolar interval rating scale, ranging from “dislike extremely” on the left pole to “like extremely” on the right pole of the scale, to consider their user-needs and indicate how much apartment alternatives were liked.

The purpose of the remaining six dependent variables was to prime respondents into thinking about and considering their assigned user-needs when considering how they would rate apartment alternatives.

All of the dependent variables were presented to respondents as evaluation questions, together with the apartment alternatives, requiring them to score four apartment alternatives twice, as explained in the methodology chapter.

The independent variables were all between-subjects variables, apart from the apartment attributes, and are defined as follows and further described in the next section:

1) Layout attributes – Layout attributes refer to the features by which each apartment alternative is described in the experiment. There were two attributes used in this sunlight and dining space; each was varied over two levels.

2) Representation format – Representation format refers to the medium of the apartment stimuli in the experiment and is a manipulated variable. Participants were organised into one of two representations: text, and floor plan.

3) User-needs – User-needs refers to the particular focus of the respondents’ layout-related needs, in the experiment and is a manipulated variable. Respondents were assigned to one of the following two conditions: entertaining-related; or sustainability-related.

4) Training – Training is a manipulated variable, referring to the particular training focus in the experiment. Respondents were either trained about the nature of the dining space attribute, or the sunlight attribute.

5) Attribute familiarity – Attribute familiarity refers to level of familiarity with the experimental attributes due to prior experience with inspecting property layouts. There are two levels: high level (those who have familiarity); and low level (those who do not have familiarity).

Method (Sample, Design and Procedure)

Eight hundred and forty-five undergraduate (marketing) students (47 % male) participated in the study. The students were recruited from Marketing Research classes and they received partial course credit for participating. Table 14 exhibits the respondents' demographic information.

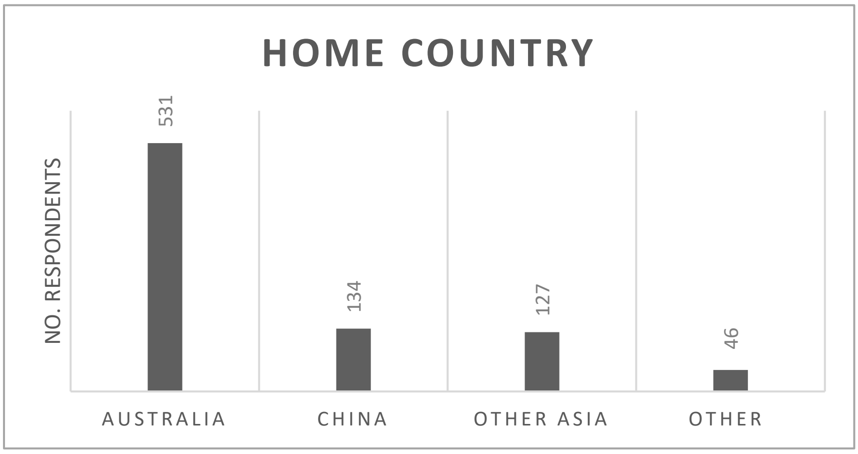
Table 14: Respondents' Demographics

Demographic Variable	Categories	Frequency N=845	Percentage
Gender	Male	392	46.4
	Female	448	53.0
	Missing	5	0.6
Age	18-20	668	79.0
	21-23	156	18.5
	24-26	9	1.1
	Over 26	7	0.8
	Missing	5	0.6
Home Country	Australia	531	62.9
	China	134	15.8
	Other Asia	127	15.0
	Other	46	5.4
	Missing	7	.8
Hemisphere of origin	Northern	280	33.1
	Southern	561	66.4
	Missing	4	0.5
Years in Australia	Less than 1	121	14.3
	1-3	104	12.3

	3-5	36	4.3
	Over 5	99	11.7
	All my their life	480	56.8
	Missing	5	.6
Living situation	Renting	209	24.9
	Owner	33	3.9
	Share House	57	6.7
	With parents /family	523	61.9
	Other	18	2.1
	Missing	5	.6

Home Country is an important variable to this research because, as will be explained further in the thesis, an apartment's desirable orientation to the sun is different for the northern and southern hemisphere. As Table 14 shows, around a third of respondents came from the northern hemisphere, most from Asia. The bar chart below (Figure 12) shows also that the Home Country ratio of the sample was around half from Australia and the remaining from abroad. It also illustrated that most non-Australians were from Asia.

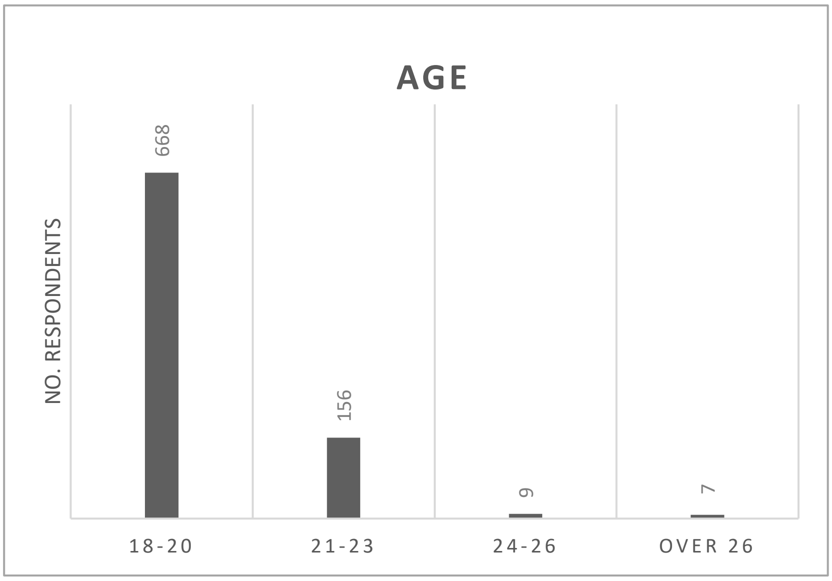
Figure 12: Home Country



*Note graph does not include missing data

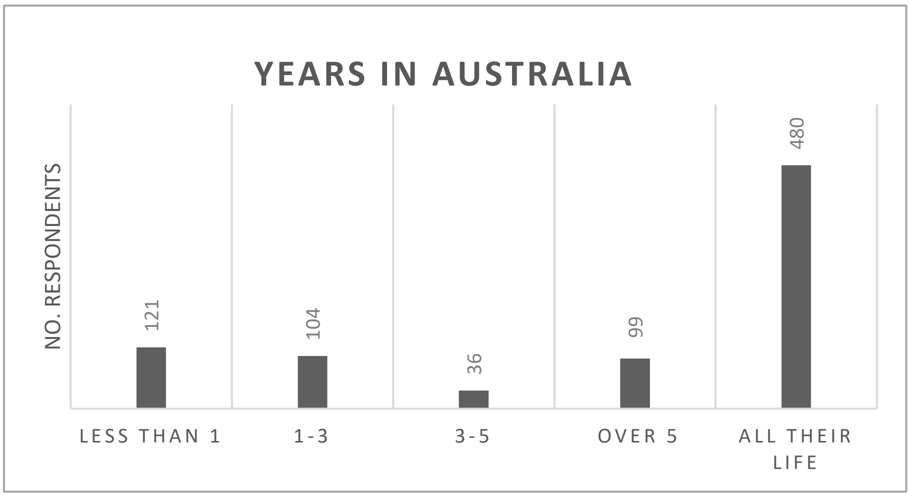
Age was also important to this study because a respondent's age could indicate how limited their experience with layout attributes is, affecting the generalizability of the results. As can be seen in Figure 13, most respondents (80%) were in the 18-20 age category.

Figure 13: Age



The number of years that respondents have lived in Australia is of importance to the study as it may influence their understanding of the English language and the type of representation formats that they are used to. These factors could influence the survey results. Figure 14 indicates that around 57% have been living in Australia all their life.

Figure 14: Years in Australia



*Note graph does not include missing data

Living situation is also important to this study. If respondents were living with their parents or other family, it's unlikely they will have much familiarity with layout attributes. However, if respondents were renting, they would have gone through the process of looking for property (online, contacting agents etc.) and inspecting property to choose one that suits their needs and hence be more familiar with layout attributes. As can be seen in Figure 15, 523 respondents live with parents or family (62%) and less than 30% are renting or own their own home. This will be challenging for the studies - especially when testing hypotheses about (layout) attribute familiarity and understanding the attributes (which effects all hypotheses).

Figure 15: Living Situation

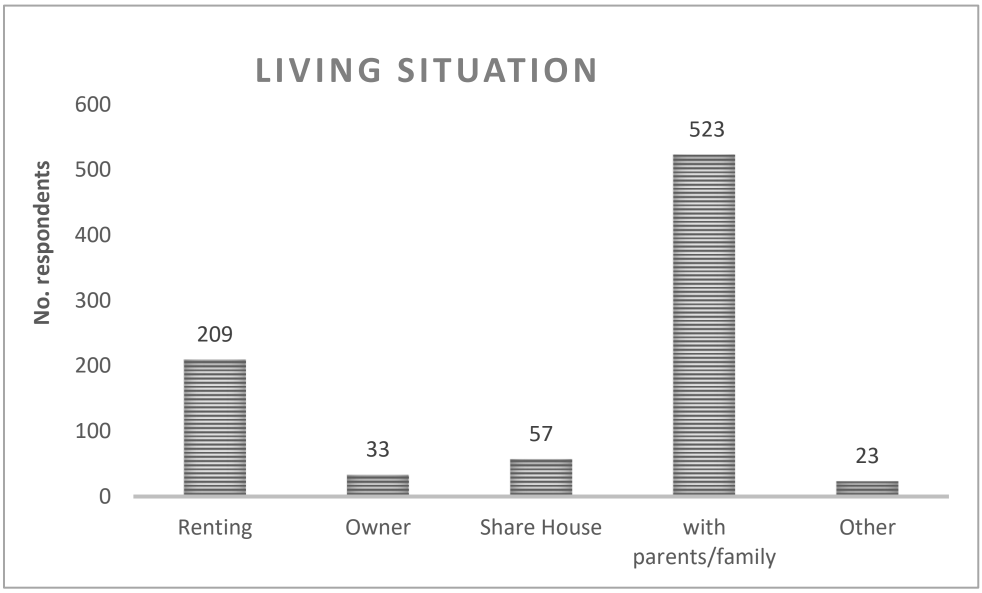


Table 15 exhibits the respondents' answers about their property browsing behaviour. Less than half of respondents performed any kind of property searching - which is unsurprising as 79% of respondents were twenty years old or under and 62% lived with their parents of other family.

Table 15: Respondents' Property Browsing Behaviour

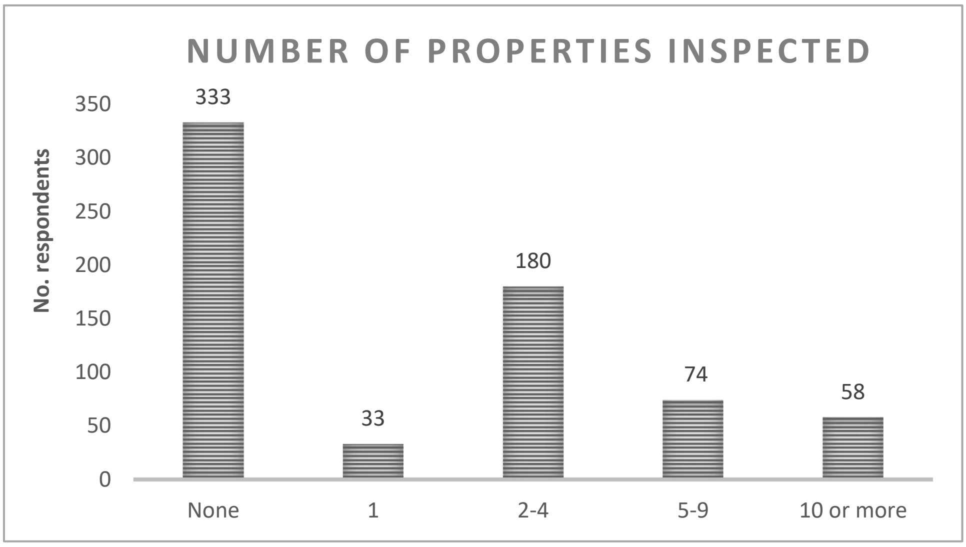
Variable	**Categories**	**Frequency N=845**	**Percentage**
Performed searches	Yes	444	52.6
	No	400	47.3
	Missing	1	0.1
Performed online searches	Yes	431	51
	No	13	1.5

	Missing	401	0.5
Number property inspections	None	333	39.4
	1	33	3.9
	2-4	180	21.3
	5-9	74	8.7
	10 or more	58	6.9
	missing	167	19.8
Search methods	Manually	354	62
Portals searched (not mutually exclusive)	Alerts online	77	13.6
	Advertise online	81	14.3
	Other	56	9.8
	Real estate.com	296	40.7
Portals searched (not mutually exclusive)	Domain	185	25.4
	Other portals	99	13.6
	Gumtree	79	10.9
	Social media	59	8.1
	None	9	1.2

One of the most important questions asked of respondents concerned the number of inspections they have attended. This was linked to their living situation.

Figure 16 shows that 336 (54%) have inspected no properties, or only the one they are living in. Although 46% have inspected property, the category of between 2-4 properties makes up about 58% of that figure which will affect the attribute familiarity variable but also general familiarity with layout attributes, which could affect the results of both experiments.

Figure 16: Number of Properties Inspected



*Note graph does not include missing data

After giving informed consent respondents were seated in individual booths in the Behavioural Laboratory located at Monash Business School and given an online survey. They were then randomly assigned to one each of three experimental conditions. Firstly, they were assigned to either the floor plan format, the text format, or the combined floor plan and text format (the latter was not analysed). Secondly, they were assigned to either the entertaining-related user-needs condition or the sustainability-related user-needs condition. Finally, they were randomly assigned to no training, or one of two trainings focussed on the nature of attributes (either dining space training or layout orientation training). Table 16 shows the respondents' distribution for each of the three experimental factors.

Table 16: Distribution of Respondents and Conditions[2]

Representation format	User-needs focus		Training focus		
	Entertaining-related	Sustainability-related	Dining Space	Layout Orientation	No Training
Text	172	175	170	165	0
Floor plan	168	167	172	175	0
Text and floor plan	81	82	0	0	163
Total	845		845		

The procedures are now summarised from the methodology chapter.

Procedure Step 1

The research instrument commenced with a set of instructions: "We are interested in people's decision-making process when renting apartments". A scenario was given to all respondents to prime respondents into imagining the setting in which the experiment was predicated (Figure 4).

[2] The third condition (text and floor plan) was not added to the data collection initially and so in not included in most of the hypothesis tests in study 1. With these removed, the effective sample for study 1 consisted of 672 respondents only.

At this time, respondents were split into two randomly selected manipulation groups in the condition representation format. Approximately half of the respondents were given information by text and the remaining were shown by floor plans. Appendix 9 contains examples of all text formats and Appendix 10 – examples of all floor plans. Appendix 9: Apartment alternatives presented in text format

Respondents were also split into two randomly selected user-needs treatment groups - “sustainability” and the “entertaining”. They were asked to imagine that they had specific needs related to either one or the other. An example can be viewed in the research instrument for study one, Appendix 21.

It was explained that four apartments would be presented for evaluation. Respondents were asked to consider each apartment alternative, and to evaluate its ability to accommodate their user-needs. The four apartments were presented to respondents individually. The apartments are included as Appendix 9 for text formats and Appendix 10 for floor plan formats.

Once the four apartments were presented to respondents another manipulation, attribute training was introduced for two groups. Group assignment was randomised so that in some cases, respondents were given training about the layout attribute and others about dining space. The attribute training is included as Appendix 3, 4, 5, and 6. After training, a further 4 apartments were presented to respondents for evaluation. These were the same apartments as prior to the instruction manipulation so that the researcher could test for a significant difference pre-manipulation to post-manipulation. The instruction manipulation sheets used floor plans and text depending on whether the respondent was in the floor plan or text format condition.

Procedure Step 2

After the experimental task, respondents were asked to do a matching task. They were split into two groups, depending on whether they were in the floor plan or the text group. They were asked to match a text description to a floor plan where they were in the floor plan group, and a text description to a floor plan where they were in the text group. The purpose of this task was to analyse how well respondents understood both types of stimuli presentation and how that affected their preferences. (Refer Figures 5 and 6 in methodology chapter). The apartments were randomised to control for order effect and respondents were forced to provide only one response.

Procedure Step 3

From there, respondents were asked to answer some questions about their property browsing behaviour (included as Appendix 17) and this was followed by questions about the respondent (included as Appendix 18).

The demographic questions asked respondents to indicate their age group, their gender, their living situation (renting, sharing etc.), their home country, and the amount of time they had lived in Australia. The questions are included in an example of the research instrument in Appendix 21.

Procedure Step 4

The final task for respondents was a self-administered scale which measured cognitive processing style scales. The first scale consisted of the Santa Barbara Learning Style Questionnaire (SBLSQ) (Appendix 1). After achieving poor validity in factor analysis, a further two measures were added to the survey. The second scale was the Style of Processing (SOP) scale was introduced. The SOP is included as Appendix 2.

Survey completion time - floor plan vs. text

Before hypothesis testing to examine differences in respondent evaluation scores of floor plan and text conditions, the time taken to complete the two survey versions was compared as a difference in time could indicate that one of the conditions was more easily read than the other, which in turn, could offer insights about the legibility of floor plans. Respondents spent around 26 minutes completing the survey, with those in the floor plan condition requiring more time than those in the text condition. An independent samples t-test was conducted to compare the time recorded for the text format ($M = 25.40$, $SD = 7.54$), and floor plan format ($M = 27.31$, $SD = 11.19$, $t (680) = 2.62$, $p =. 009$). The test shows that there is a significant difference in time taken to complete the two survey versions such that respondents took longer to complete the floor plan version than the text version by approximately two minutes. This could indicate that interpretation of floor plan information is not quickly processed as is the case for other visual representations such as images (Jansen et al., 2009) however it remains to be seen in the following sections whether floor plan representations enable respondents to better visualise layout attributes and better articulate their preferences, despite being more time consuming to read than text.

For the third group, text and floor plan, time taken to complete surveys was not recorded so it is not known whether text accompanying the floor plan reduced interpretation time, but it was expected that the time fell somewhere in the middle of the two conditions.

Results

Pre-testing

Study one pre-test was administered to 118 respondents. Two attributes were chosen for the pre-test, dining space and layout orientation, and respondents were asked to consider these attributes before evaluating apartments. The pre-test is reported in Appendix 13.

Testing the Hypothesis

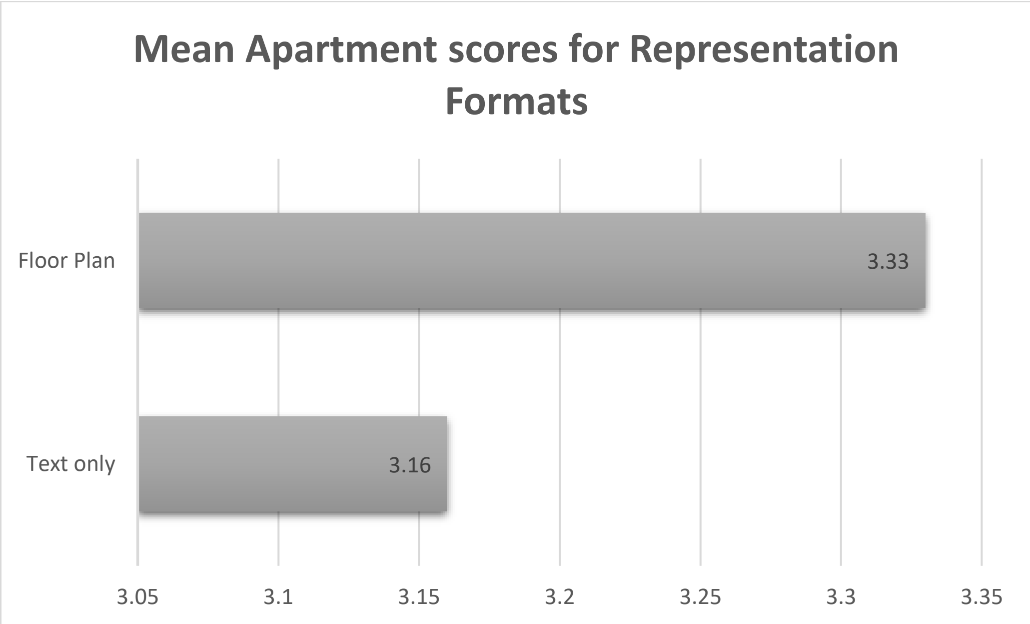
This section tests hypotheses 1, 2, 3, and 4.

Hypothesis 1 – Representations

Hypothesis 1 was tested by analysing the results of a rating task. There was one overall rating question and four others, two of which were fixed and another two which varied. The latter two were dependent variables but they also helped to strengthen the overall rating task. To analyse the four scores of each respondent of apartment evaluations, a repeated measures mixed-effects model analysis was conducted in statistics program SPSS testing random and fixed effects. The dependent variables constituted apartment preference rating scores (also called the overall rating) from four apartment alternatives. The between-subjects independent variables entered into the model was representation type. Within subject factors, the two layout attribute variables, were dining space and layout orientation.

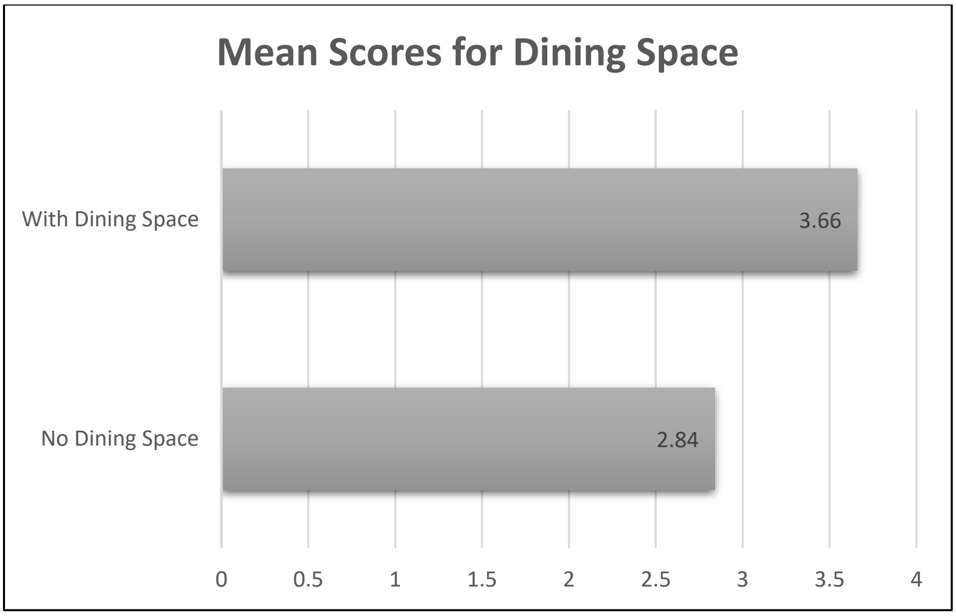
The mean overall rating scores for representation format levels were as follows: text only (low level) M=3.16, floor plan with text (middle level) M=3.26 and floor plan (high level) M=3.33. The difference between the representation format means were statistically significant (F (2, 1057.75) = 10.08, p = .000) but the difference between the formats is in fact small (from M=3.16 – M=3.33). Although the effects aren't large, they show that mean scores have a larger range where layout attributes are presented on apartments with non-spatial information presented in a written format. The text with floor plan is not used in this or many of the analyses. Figure 17: Means scores for *apartment* in different Representation Formats shows the difference in apartment score for text compared with floor plan.

Figure 17: Means scores for apartment in different Representation Formats



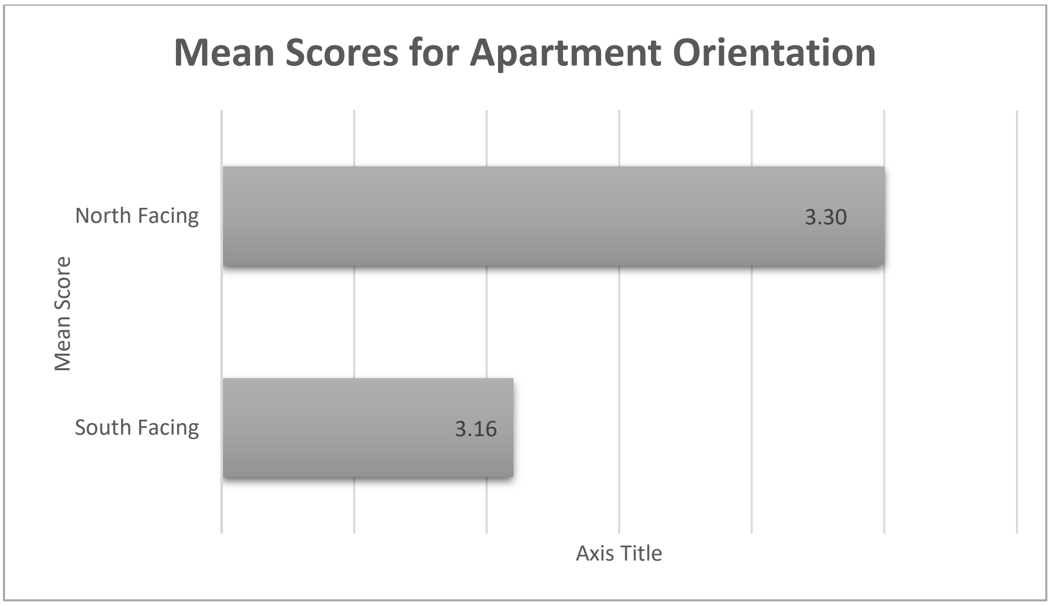
When attribute dining space was tested in the model, the mean score for no dining space (low level) was M=2.84 and with dining space (high level) was M=3.66. The means were significantly different (F (1, 2509.72) = 1165.19, p = .000) and in the right direction as shown in Figure 18.

Figure 18: Mean Scores for Dining Space



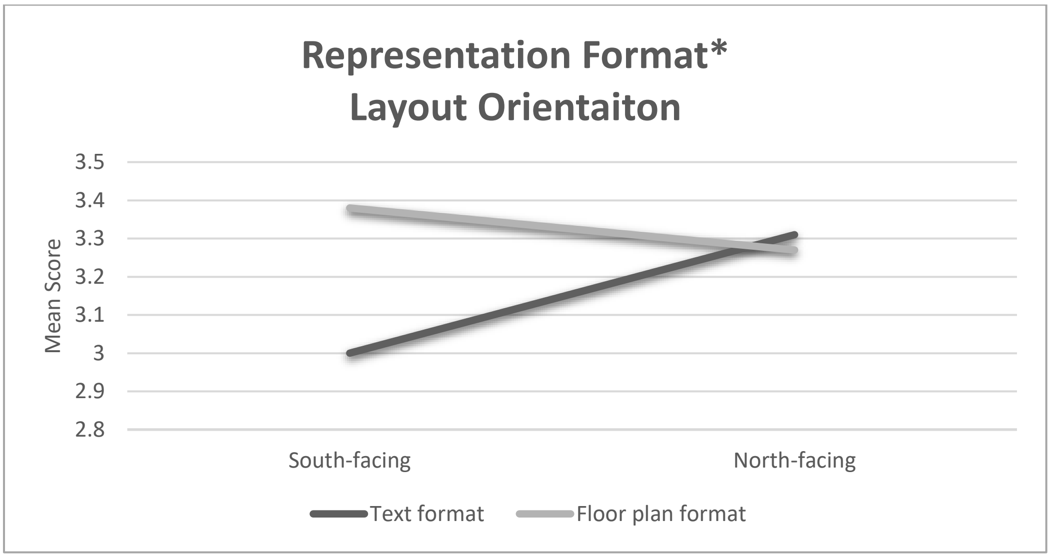
When attribute layout orientation was tested in the model, the mean score for south-facing (low level) was M=3.16 and north-facing (high level) was M= 3.30. The means were significantly different (F (1, 3367.76) = 16.21, p = .000). This is presented in Figure 19.

Figure 19: Mean Scores for Apartment Orientation



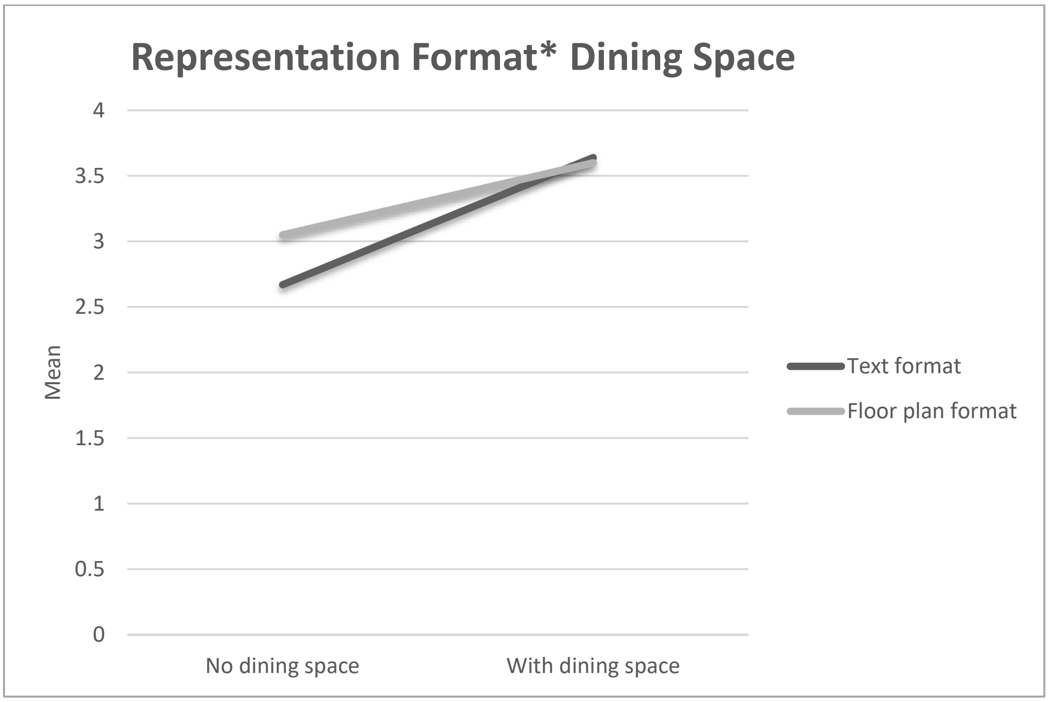
When representation format was tested for an interaction effect with attribute layout orientation in the model, in the text condition, the south-facing layouts (low level) scored a mean of M=3.00 and north-facing layouts (high level) scored M=3.31. In the floor plan condition, south-facing layouts (low level) scored a mean of M=3.38 and north-facing layouts (high level) scored M=3.27. Although the means for the interaction were significantly different for the interaction effect between representation format and layout orientation (F (2, 3367.76) = 24.97, p = .000), the difference was small and the direction was not as expected as the floor plan format scored more for the south-facing layout than the north-facing. The effect was larger for the text condition and overall contrary to expectations for this interaction effect. Refer Figure 20.

Figure 20: Representation Format*Layout Orientation



When representation format was tested for interaction with attribute dining space in the model, the mean score for the text condition in the layouts with no dining space (low level) scored a mean of M=2.67 and in layouts with dining space (high level) scored M=3.64. This was similar in the floor plan condition, where no dining space layouts (low level) scored a mean of M=3.05 and layouts with dining space (high level) scored M=3.60; the interaction means were also significantly different (F (2, 2509.76) = 37.48, p = .000). As Figure 21 indicates, the text format has a larger range of mean scores that the floor plan format.

Figure 21: Representation*Dining space



It was decided to also test representation format on the ancillary dependent variables which were included in the research instrument to prime respondents into thinking about the attributes and to assist with making the task realistic. The ancillary dependent variables are respondent scores for 1) how well the apartment could accommodate a dinner party for 6; 2) how well does the apartment accommodate having friends for sleepovers; 3) how well clothes will dry indoor on a clothes airer; and, 4) what chance does the apartment have at being naturally warm in winter. The representation format effect on each of these scores is included in this thesis, as it is the representation format is the key variable tested thought the thesis.

It was expected that the scores would not only effect and reinforce the manipulation itself but also could act as a manipulation check for the main rating score, indicated by similar scoring. The mean rating scores of the ancillary dependent variable questions for representation format levels were as follows:

1) For rating of how well the apartment could accommodate a dinner party for 6, there were no significant difference between mean scores. It was expected that dining space would score significantly higher than no dining space (With dining space M=2.73, on dining space M=2.73). The results show that the manipulation check of the dinner for 6 dependent variable did not work for this sample however that does not mean the manipulation did not work.

2) For rating of how well does the apartment accommodate having friends for sleepovers, there were no significant difference between mean scores (M= 2.67 for no dining space and 2.62 for with dining space). It was expected that dining space would score significantly higher than no dining space but the leap from dining space to additional space to accommodate friends for sleepovers may have been too big for the respondents. The results show however that the manipulation check of the dinner for 6 dependent variable did not work for this sample however it does not mean the manipulation did not work.

3) For rating of how well clothes will dry indoor on a clothes airer, significant difference in means were found for layout orientation (northern orientation M=2.80 and southern orientation M=2.41). The difference between the means was statistically significant ($F(1, 1687.94) = 59.67$, $p = .000$). The overall rating scores were higher than for this dependent variable (northern orientation M= 3.30 and southern orientation M= 3.19) however the differences were also significant and the

directions supported each other so for this dependent variable the manipulation check worked for this sample.

4) For rating of what chance does the apartment have at being naturally warm in winter, significant effects were found for layout orientation, and the interaction between representation format and layout orientation. For layout orientation, northern orientation scored M=3.24 and southern orientation scored M=2.23, showing that it was clearer to respondents on the floor plans whether or not the apartment would be warmer in winter. The difference between the means were statistically significant (F (1, 1668.32) = 383.23, p = .000). As previously established, the overall rating scores were higher (northern orientation M= 3.30 and southern orientation M= 3.19), although only marginally. Also, the difference between rating scores was much higher for the dependent variable "what chance does this apartment have at being naturally warm in winter" than the overall rating score. Once again, the differences were significant and the directions supported each other so for this dependent variable the manipulation check worked for this sample.

Hypothesis 2 – User-needs

Hypothesis 2 testing involved examination of the interaction effect of user-needs and representation format on layout evaluations, using a 2 X 2 between subjects design with factors user-needs (sustainability-related and entertaining-related) and representation format (floor plan, text and both). This effect was tested by adding it as a between-subjects variable to the repeated measures mixed-effects model analysis used to test hypothesis 1. The objective of hypothesis 2 was to test whether focussing a particular user-need improves floor plan legibility by examining whether 1) respondents were more sensitive to layout attributes when they were related to their user-needs; and, 2) whether their user-needs related preferences were better articulated on floor plan representations because of focussing on those needs.

The first step of testing for this effect, involved examining the interaction effects of user-needs and representation format, illustrated in Table 17.

Table 17: Effects Table[3]

Conditions	Df	Error	F	Sig.
User-needs	1	1035.04	4.2	.041
User-needs * Representation format	4	1035.14	5.25	.000
User-needs * Representation format * layout orientation	6	3354.32	21.18	.000
User-needs * Representation format * Dining Space	6	2476.36	269.45	.000

The mean scores for user-needs levels were as follows: entertaining-related needs 3.21, and sustainability-needs 3.28. Additionally, the interaction effect of user-needs and representation format is statistically significant (F (4, 1035.14) = 5.25, p=.000).

The expectation of the model however was that the layout attributes would be assigned greater utility by respondents when they matched their assigned user-needs. The following interaction was therefore tested: user-needs x representation format and layout attributes. Significant effects were found for both layout orientation (F (6, 3354.32) = 21.18, p=.000) and dining space (F (6, 2476.36) = 269.45, p=.000).

[3] This table does not include the third representation condition (floor plan and text combined)

More sensitivity was expected to be shown to variations in the level of the layout attribute that will be related to respondents' assigned user-needs, such that 1) in the floor plan group, where respondents user-needs are sustainability-related, they will show more sensitivity to variations in level in the layout orientation attribute; and 2) in the floor plan representation group, where respondents user-needs are entertaining-related, they will show more sensitivity to variations in level in the dining space attribute. The Table of Means below, Table 18, contains the effect of the conditions on the means for each attribute level.

Table 18: Table of Means[4]

User-needs (condition)	Representation (condition)	Attributes	Mean	Mean Difference	SD
Sustainability-related	Floor plan	North-facing	3.29	-0.14	.047
		South-facing	3.43		.047
		With dining space	3.48	0.24	.042
		No dining space	3.24		.048
	Text	North-facing	3.44	0.52	.046
		South-facing	2.92		.046
		With dining space	3.57	0.77*	.041
		No dining space	2.80		.047
Entertaining-related	Floor plan	North-facing	3.26	-0.06	.047
		South-facing	3.32		.047
		With dining space	3.73	0.88*	.042
		No dining space	2.85		.048
	Text	North-facing	3.17	0.08	.047

[4] This table does not include the third representation condition (floor plan and text combined)

		South-facing	3.09		.047
		With dining space	3.71	1.16*	.041
		No dining space	2.55		.047

* indicates that means are significantly different (at p<.05)

Differences in mean are reported as follows, firstly, in the floor plan group, where respondent's user-needs were sustainability-related, the sensitivity to changes in level of the layout orientation attribute were lower and not in the direction that was expected (north-facing M=3.29, south-facing M=3.43) than the sensitivity to the dining space attribute (with dining space M=3.48, no dining space, M=3.24). In the case of the former, north-facing apartments are expected to be more desirable than south-facing as Melbourne is in the southern hemisphere northern sun provides direct sunlight and natural warmth in winter. Secondly, in the floor plan representation group, where respondents user-needs were entertaining-related, the sensitivity to changes in the dining space attribute (with dining space M=3.73, no dining space, M=2.85) has a greater effect on the floor plan than the text condition, which was an expected effect. The large difference in means (dining space attribute) supports Hypothesis 2.

Figure 22 illustrates the difference in the floor plan mean scores for layout orientation in the entertaining and the sustainability needs conditions. It clearly shows that where residents are in sustainability condition, they score the apartments for layout orientation as expected. When they are not focused on sustainability needs the scores behave differently, indicating the importance of user-needs when evaluating floor plans.

Figure 22: User-needs*Layout Orientation in Floor Plan Format

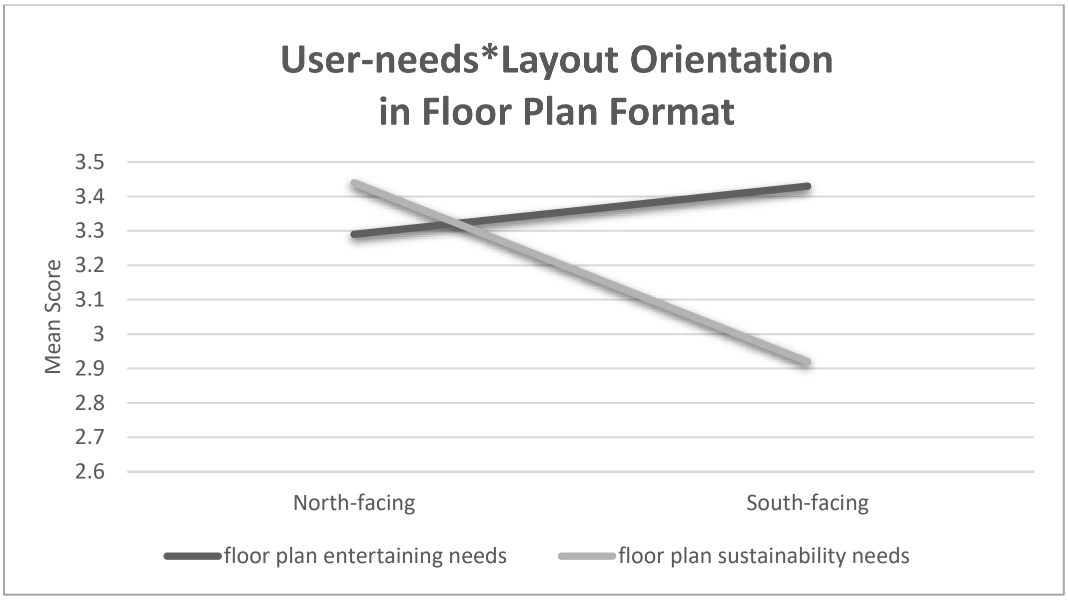


Figure 23 illustrates the difference in the entertaining condition, in the text format between dining space and no dining space. Once again, when focussing on entertaining user-needs, the apartments are scored higher when a dining space in included. This indicates the importance of user-needs when evaluating floor plans.

Figure 23: User-Needs*Layout Orientation in Text Format

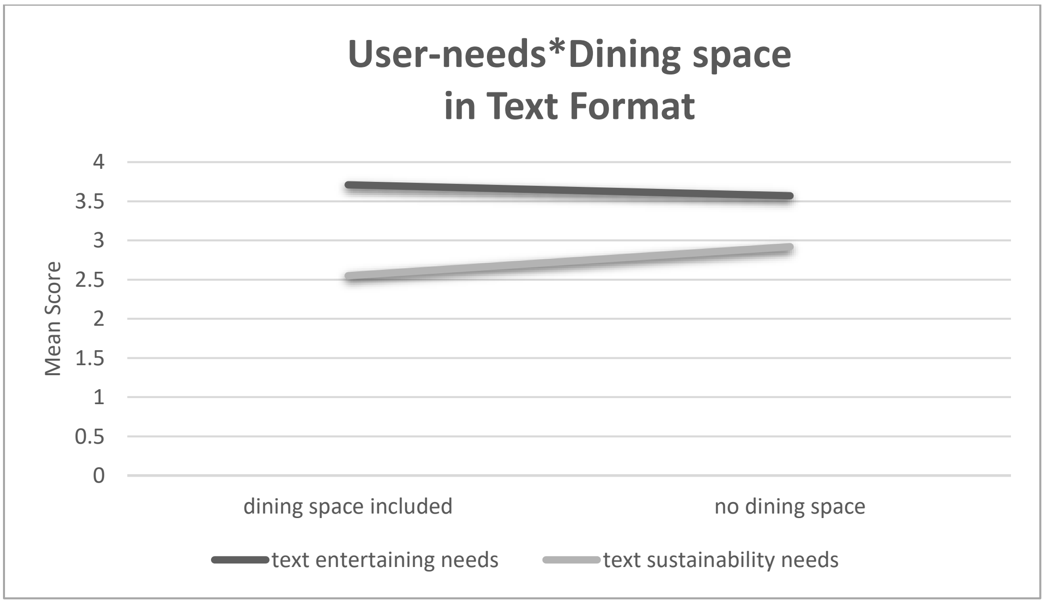


Figure 24 shows the difference between dining space in text and floor plan formats, illustrating that that floor plans are scored higher for dining space in the entertaining condition have the greater ranges in the case of the dining space attribute.

Figure 24: Entertaining User-needs*Representation Format* Dining Space

Hypothesis 3 – Attribute Training

Hypothesis 3 testing involved examination of the interaction effect of training type, user-needs and representation format on layout evaluations, using a 2 X 2 X 2 between subjects design with factors training type (layout orientation and dining space), user-needs (sustainability-related and entertaining-related) and representation format (floor plan and text). This effect was tested by adding training type as a between-subjects variable to the repeated measures mixed-effects model analysis used to test hypotheses 1 and 2. The data collected before and after training were used for this analysis. The objective of hypothesis 3 was to test whether focussing attribute training on a particular attribute improves floor plan legibility by examining whether 1) respondents were more sensitive to layout attributes when they were trained about the nature of the attributes and, 2) whether their attribute training related preferences were better articulated on floor plan representations because of knowing more about their assigned attribute. Further, the objective was to test whether the training indeed trained respondents about attributes, indicated by increased sensitivity to attributes (in particular in the floor plan condition) after training compared with before the training.

Testing for this interaction effect involved firstly conducting a paired-samples t-test to evaluate the impact of attribute training on respondents' apartment layout scores. There was no statistically significant difference in layout scores from time 1 (before training; M= 3.13, SD=3.50) to time 2 (after training; M=3.05, SD=4.45), t(2727)=.99, p=.324 indicating that there was no significant overall impact of training on respondents scores. The next step involved adding the time 1 scores (before training) and time 2 scores (after training) to the mixed-effects model together with the attribute training variable and relevant interactions.

Table 19: Effects Table[5]

Effects	*Df*	*Error*	*F*	*Sig.*
Time1-Time 2	1	2626.46	.00	.969
Attribute Training	1	1382.22	.66	.417
Time1-Time 2* Attribute Training	1	2626.46	.070	.792
Time1-Time 2* Attribute Training * *Representation format	4	1811.05	6.50	.000

[5] This table includes the third representation condition (floor plan and text combined)

Time1-Time 2* Attribute Training* Representation format * layout orientation	8	5282.64	21.65	.000
Time1-Time 2* Attribute Training* Representation format * dining space	8	4381.62	209.87	.000

The effects table, Table 19, shows there was no significant main effect for time1-time (F (1, 2626.46) = .00, p = .969), as earlier shown by the paired-samples t-test. This is contrary to expectations as the knowledge gained from attribute training was expected to increase sensitivity to the attribute scores particularly for the floor plan representations. Also, as expected, the main effect of attribute training was not significant across the two levels (1, 1382.22) = .66, p = .417), as shown in the t-test.

The expectation of the model however was that there would be an increase in the range of scores from time1 to time2, as it was hypothesised that respondents' sensitivity to variations in level of the dining space (layout orientation) attribute will be greater *after* they have learned about the nature of the dining space (layout orientation) attribute, compared to *before* the training.

Also, the layout attributes would be assigned greater utility by respondents when they matched the attribute training which they undertook. The following interaction was therefore tested: time1time2 x attribute training x representation format and layout attributes. Significant effects were found for interacting these variables with attributes layout orientation (F (8, 5282.64) = 21.65, p=.000) and dining space (F (8, 4381.62) = 209.87, p=.000).

More sensitivity was expected to be shown to variations in level of the layout attribute that will be related to respondents' assigned attribute training type, such that

1) in the floor plan group, where respondents attribute training type was layout orientation, they will show more sensitivity to variations in level in the layout orientation attribute after the training; and 2) in the floor plan representation group, where respondents' attribute training type was dining space, they will show more sensitivity to variations in level in the dining space attribute after the training.

The Table of Means, Table 20, below contains the effect of the conditions on the means for each attribute level.

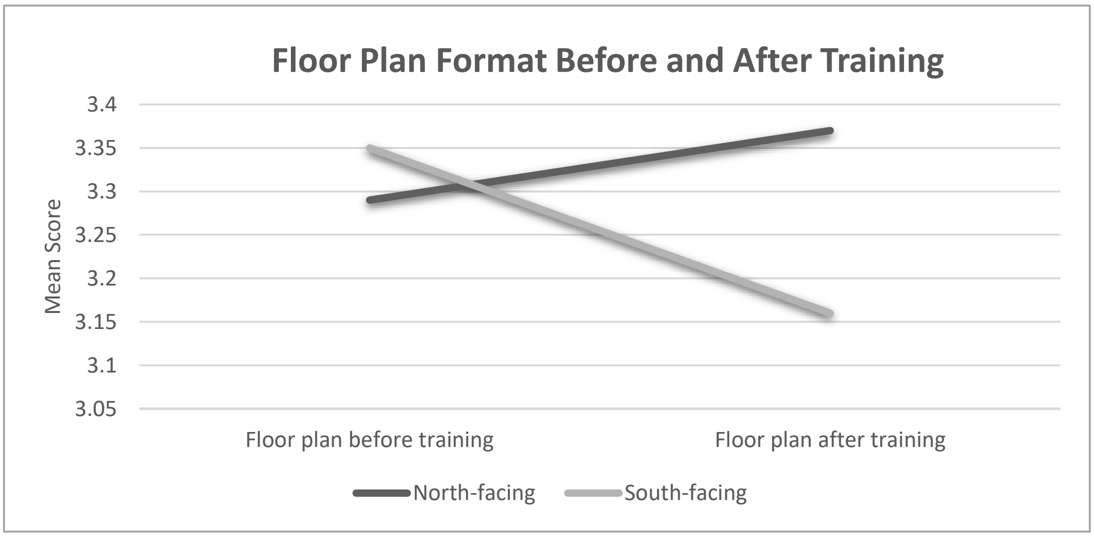
Table 20: Table of Means

Att. Training	Rep	Attributes	M /T1	Diff /T1	SD/ T1	M /T2	Diff /T2	SD/ T2
LO	FP	North-facing	3.29	-0.06*	.05	3.37	0.21*	.05
		South-facing	3.35		.05	3.16		.05
		With dining space	3.61	0.58	.04	3.51	0.5	.04
		No dining space	3.03		.05	3.01		.05
	T	North-facing	3.29	0.31*	.05	3.45	0.49*	.05
		South-facing	2.98		.05	2.96		.05
		With dining space	3.63	0.99	.04	3.62	0.83	.04
		No dining space	2.64		.05	2.79		.05
DS	FP	North-facing	3.26	-0.15	.05	3.27	-0.07	.05
		South-facing	3.41		.05	3.34		.05
		With dining space	3.60	0.54	.04	3.56	0.51	.04
		No dining space	3.06		.05	3.05		.05
	T	North-facing	3.33	0.3	.05	3.28	0.17	.05
		South-facing	3.03		.05	3.11		.05
		With dining space	3.65	0.95	.04	3.61	0.84	.04
		No dining space	2.70		.05	2.77		.05

* indicates that means are significantly different (at p<.05)

As can be seen from Table 20, there were differences in mean between levels of orientation layout prior to and post attribute training. When comparing time 1 and time 2 scores, the following is reported. Firstly, in the layout orientation attribute training group, the sensitivity to changes in level of the layout orientation attribute was increased between time 1 (north-facing M=3.29, south-facing M=3.35) and time 2 (north-facing M=3.37, south-facing M=3.16). Although the difference in mean for time 1 was not in the expected direction, this was corrected after training, indicating that relevant attribute training improved floor plan legibility – the means for text format in the layout orientation attribute training group supports this. This effect is illustrated in Figure 25.

Figure 25: Before and After Training (for orientation attribute) within Floor Plan Format condition.

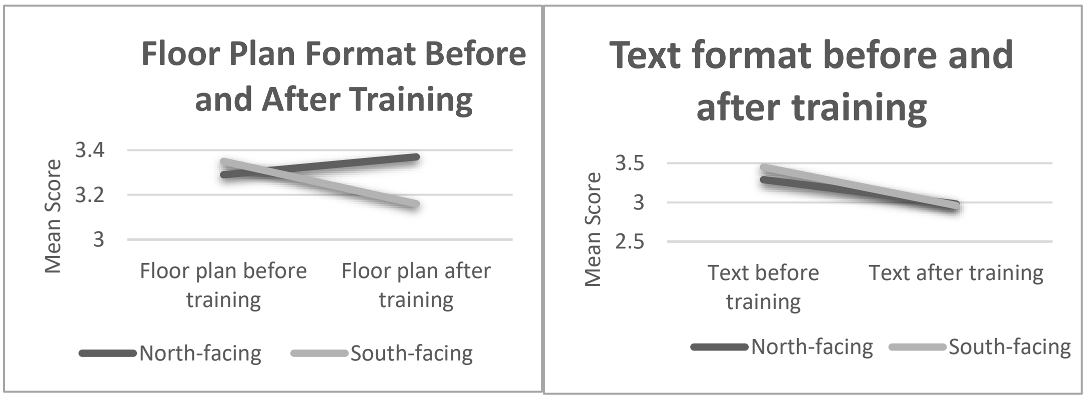


Conversely, in the dining space attribute training group, the dining space attribute did not perform better in time 2, in either representation format, indicating that attribute training for this attribute did not help respondents improve their attribute knowledge nor improve floor plan legibility. However it did show that the two representation formats agreed on the score for dining space after training. Table 22 shows this effect in mean scoring for dining space attribute, in the dining space training condition and the floor plan condition.

Figure 26: Before and After Training (for dining space attribute) within Floor Plan condition

A significant three-way interaction exists when representation formats are compared for before and after training and for layout orientations.

Figure 27: Representation Format*Before and After Training*Layout Attributes



As can be seen in Figure 27, the north-facing mean score increases significantly as expected after training whist the south facing score decreases. Additionally, the text condition is much the same in the before and the after training condition. In floor plan condition (north-facing M=3.29, south-facing M=3.35) and in the text condition (north-facing M=3.37, south-facing M=3.16).

In the user-needs analysis (Hypothesis 2), testing revealed no significant interaction effect of user-needs on the layout attribute in the floor plan representation format condition, however it was decided to test this effect again, when testing hypothesis 3, in the time 2 condition, with the expectation that respondents would be better able to articulate preferences for layout orientation on floor plan representations and focussing on their user-needs after training about the layout attribute.

Analysis showed that before attribute training, the layout orientation attribute was not scored in the expected direction (north-facing M=3.30, south-facing M=3.36), and there was no significant effect of the sustainability user-needs group on the layout attribute, however, after undertaking training about the attribute, a significant effect was found (T1/T2 x attribute training x user-needs x layout orientation, F (8, 5275.71) = 10.86, p=.000). The effect of the sustainability user-needs manipulation as well as the attribute training manipulation did assist respondents to better articulate their preferences on floor plans (north-facing M=3.41, south-facing M=3.06).

Post training, respondents were asked how useful they found the training information. 12.2% found the training very useful; 52.3% found it useful; 29.6% found it neither useful nor useless; 4.7 % found it useless; and 1.2% found it very useless. As noted in the previous sentence the results indicated that at least 64% of the respondents found the training useful. When splitting these findings into the two training groups that respondents were randomly assigned to (layout orientation and dining space), respondents in the layout orientation group indicated that the training was more useful than those in the dining space group. This manipulation check supported the findings of the experiment.

Additional to these results, it is worth noting by following up with a second experiment post training, respondents could have acquired attribute familiarity by undertaking the experiment and this could have made them more sensitive to the attributes when the experiment was repeated. Thus, the effects found between the experiment and the repeat of the experiment could have occurred with or without the attribute training.

Hypothesis 4 – Attribute familiarity

The attribute familiarity variable was used to differentiate respondents who were familiar with the layout attributes in the study and those who were not. The variable consisted of two levels, less familiar and more familiar. It was expected that those respondents more familiar with the attributes in the study will be better able to articulate their preferences on in the floor plan format than those less familiar.

The first step involved preparing the variable for testing hypothesis 4. This involved analysing the number of properties respondents had inspected over the past 2 years. Although there were 167 cases missing from this survey question, the remaining cases showed that 39.4% of respondents had never inspected any properties, 3.9% had inspected only 1, 21.3% had inspected between 2 and 4, 8.8% had inspected between 5 and 9 and 6.9% had inspected 10 or more properties. As can be seen from Table 14 only 16% of the sample had attended more than 5 property inspections in two years, so respondents are generally expected to have low level familiarity with layout attributes, which could be a factor of their experiences based in part, on age. Where individuals have observed 5 property inspections or more, it would be expected that they would be more familiar with the attributes in the study. Given the sample is mostly students, observation of 5 or more properties is only a small subset.

Testing hypothesis 4 was performed by repeating the analysis for hypotheses 1 and 2 testing and adding the attribute familiarity variable to the model as part of the between-subjects design. However the model showed no significant main effect for attribute familiarity (F (1, 2337.88) = .452, p=.50). Although there were interaction effects found for representation format x layout orientation (F (5, 4675.20) = .23.67, p=.000), and representation format x dining space (F (1, 4319.53) = 777.47, p=.000). There was some evidence that attribute familiarity improved sensitivity to attributes however this was in only the text condition and only for the layout orientation (attribute training* representation format* layout orientation), such that those with low attribute familiarity scored M=3.2 for north-facing, and M=3.03 for south-facing, a small effect. Those with high level attribute familiarity scored north-facing M=3.37, south-facing M=3.02, significantly larger. However no increase in sensitivity to attributes was found in the floor plan condition within these interactions which could indicate that attribute familiarity did not improve floor plan legibility.

Discussion

Respondents scored attributes more sensitively on text formats compared with floor plan formats, with attribute dining space scoring less sensitively in the floor plan format (although the direction was correct, showing some legibility) and attribute layout orientation did not score in the expected direction, showing poor legibility for apartment orientation. Hypothesis 1 posited that the attributes would be judged more sensitively on the floor plan format, so *Hypothesis 1 is not supported in this study.* SP methods enabled comparison between stimuli mediums of text and floor plan for apartment layout attributes. In the case of finding similar attribute mean scores, Louviere et al. (1987) advises scholars it is more realistic for the respondents to be presented with products in a visual format, for there is no need to spend the time or money continuing studies that compare the visual format to the verbal. Following this logic, the results for hypothesis 1 do not enable future studies to use floor plans alone with validity, when measuring preferences for people untrained in reading floor plans. However with more research into which floor plan attributes individuals do not understand and why, it could be possible for future studies to measure layout attributes with floor plans unaccompanied by text (unless non-spatial attributes are included in the study). The results of hypothesis 1 contributed to the method by showing that text format was scored more sensitively than floor plans for "dining space" however only by M=0.72 and the floor plan format, although scoring less sensitively, did score similarly and in the right direction for dining space. The result of floor plan evaluations of "layout orientation" also contributed to the method but not in the expected way. Whilst the text format scored the south-facing much lower than north-facing, as expected, the floor plan format result was just the opposite, a large range or mean score but in the wrong direction. The results of the floor plan version shows that "layout orientation" is not understood or not properly considered in the experiment. It suggests the importance of understanding layout attributes in SP experiments, which ever format is evaluated. The analysis of hypothesis 1 also showed that as a main effect, floor plans were scored higher than text formats (Figure 17). When testing for moderation of representation on "dining space" (Figure 18) it scored more sensitively on the floor plan format than the text format. However, considering that one of the two attributes was not understood or considered properly, and showed mean sensitivity in the wrong direction, the result of floor plans scoring higher could be due to the picture superiority effect (Childers & Houston, 1984; Paivio, 1978). SP methods enabled the researcher understand that "orientation layout" was not understood or not considered in the expected way (rather than not important) because it showed poor legibility in the case of the floor plan formats compared with the text formats.

This method allowed multiple conditions to be tested together in the one model, which enabled testing of interaction effects between the factors. After representation was added to the model, *user-needs* was included also. Attribute "dining space" (but not layout orientation) became more important to respondents when user-needs were manipulated. Respondents in the floor plan condition showed increased sensitivity to dining space when they were in the entertaining-related needs condition as expected. *So hypothesis 2 is supported, but only for attribute "dining space"*. When user-needs, layout orientation and floor plan format were interacted (Figure 22), the sustainability needs condition showed a large attribute range in the expected direction whereas the entertaining needs condition did not show this effect. However when user-needs, dining space and text format were interacted, refer (Figure 23) text format scored higher than floor plan format however it showed very little attribute range. The floor plan format however scored a little lower but showed a greater importance. Focussing respondents on particular needs appeared to improve preference articulation on the floor plan format. The contribution to SP methods for hypothesis 2 is that it is not possible to know what people are judging when you ask them to rate a product but by inducing hypothetical user-needs, rating the intended attributes improves rating, shown by improved importance of the attributes.

A further factor was added to the preference model, again to allow for testing of interaction effects, *attribute training*. Interacting floor plan format, layout orientation and before and after training showed a big change both in range of mean scores and direction, compared with text formats *supporting hypothesis 3*. Specifically, the orientation layout attribute showed a significant sensitivity of changes in level comparing Time 1 and Time 2 in the floor plan condition and further, a three-way interaction comparing the layout orientation with ding space showed that the latter remained the same before and after training. This is a significant contribution to SP methods because it indicates that, assuming respondents understand and are trained in housing layout related attributes, this format could be helpful in future similar studies of this nature.

SP methods also allow for individual differences to be tested in the same model as manipulated conditions. Attribute familiarity was added to the preference model and showed increased importance of the dining space attribute (but not layout orientation importance), for respondents in the case of floor plan formats where respondents were familiar with layout attributes and in the entertaining-related user-needs condition. However, no increase in sensitivity to attributes was found in the floor plan condition when attribute familiarity was interacted with representation format and attribute training. This shows that attribute familiarity was evident in the text condition but it did not translate to a better understanding of floor plans, contrary to what was expected. The sample showed that even those familiar with inspecting houses, the layout orientation attribute was not well understood. Generally though, there was very little attribute familiarity with 80% of the sample having inspected four or less properties in the past two years. The contribution of this testing shows that sampling is important when testing housing attribute familiarity; this sample of which 80% were 18-20 year olds, 62% living with their parents (or other family). *Therefore hypothesis 4 is not supported.*

Chapter Summary

The study 1 chapter commenced with a description of the variables used in the study. This was followed by a short method section summarising the relevant sample, design and procedure sections of the methodology chapter. This was followed by results and a discussion.

8. STUDY TWO (CONSTRUAL EXPERIMENT)

Introduction

This chapter focuses on: the operationalisation of the study design; the specific procedures used to test hypothesis five and six; and the results of the data analyses. Hypothesis five tests whether individual differences in cognitive processing affect product appraisal. Hypothesis six examines whether one's construal level indirectly affects product appraisal depending on the type of visualisation used to describe products.

Research Objective and Hypothesis

The SOP was included with this study because it was incorrectly applied in study one and therefore could not be properly analysed. As study 5 is outlined in study 1, it is not further summarised here (refer Appendix 23) however the hypothesis is stated:

(H5) Where apartment layout attributes are represented by floor plans and individuals have a visual cognitive processing style, their preference articulation of layout attributes will be increased.

A review of the marketing literature reveals that product appraisal is: 1) impacted by construal (Trope et al., 2007); and 2) moderated by product representation (Zhao et al., 2014), the latter tested in the first study of this thesis. Study two combined these two variables to further understand decision-making with regards to the procurement (buying or renting) of real-estate. Specifically, it examined whether construal moderated appraisals of real estate acquisition depending on how the product was represented to consumers. It was expected that people evaluating floor plan representations of apartments (vs. text) would award higher scores if they were in the low construal-level mindset (vs. high) because floor plans contain detailed information about real-estate. Individuals were more likely to need detailed information to assist with decision-making about renting or buying real estate when they were in a psychologically proximal mindset.

There are several inter-related dimensions of psychological distance: temporal; spatial; social; and probabilistic distance (Liberman et al., 2007; Trope & Liberman, 2010, 2011; Trope et al., 2007).

It is known from the real-estate literature that both temporal and spatial factors impact product perception and appraisal, (Ardila, 2016; Einstein, 2009; Zhuge, Shao, Gao, Dong, & Zhang, 2016). Further, the literature reveals that, in the context of marketing, the perceptions of products vary depending on the consumers' distal or proximal psychological distance to those products (Dhar & Kim, 2007; Fiedler, 2007). Study 2 therefore used the dimensions of temporal and spatial psychological distance to test whether construal moderated apartment evaluations indirectly through representation format.

Zhao et al. (2014) found that when marketers use visualization to describe products, the appraisal score of a detailed text description (concrete condition) versus a very general text description (abstract condition) became matched to the construal perspective of consumers. However only temporal psychological distance was manipulated in this study and only text was used as a visualisation aid. The current study therefore extended the work of Zhao et al. (2014) by manipulating spatial and temporal psychological distance. In addition, the study explored the construal effect on verbal and visual representations of product ratings.

Many researchers have examined the effect of visual and verbal marketing messages on consumer behaviour in the context of construal level theory (Chang & Lee, 2009; Dhar & Kim, 2007; Hernández-García, González-González, Jiménez-Zarco, & Chaparro-Peláez, 2015).

Some researchers such as Rossiter (1982), have found that visual messages have a are more effective in influencing attitudes and behaviour than verbal messages. Evidence from the literature about general advertising justifies relatively more focus on visual messages than on verbal, for example, the picture superiority effect discussed in (Childers & Houston, 1984; Paivio, 1978). However, other researchers have found that visual messages do not always produce effective results due to (amongst other constructs) when the individual identifies with a verbal information processing style (Childers et al., 1985; Thompson, 2006; Wyer, 2008).

The construal literature in business and marketing has thus far, to this author's knowledge, not utilised floor plans when manipulating product representations and construal. However, there are several examples that manipulate pictures and words, for example, (Amit, Algom, & Trope, 2009; Bar-Anan et al., 2007). The current study seeks to test whether construal mindset shows differences in attribute importance between construal level and representation format. Differences will help to explain why (if at all) people in different mindsets read floor plans differently. Although floor plans and pictures both contain contextual information additional to the product descriptions usually contained in text, it is not known whether floor plans are more difficult to read than pictures (O'Neill, 1991) as they are expert tools that laypeople don't usually easily understand (as they do with pictures).

When looking at the type of visual representations that trigger greater choice or preference-share of consumer evaluations of products, there is a growing body of literature such as Lee et al., (2016) that have attempted to classify representations as concrete or abstract. Lee et al., (2016) found that shapes and colours moderate product appraisal. Higher appraisal scores were found for people in low-level construal that appraised products represented by colour, and higher scores were found for people in high-level construal where products are represented by shapes. This study seeks to contribute to this growing body of research by classifying floor plans (by the researcher), as generally either concrete or abstract representations by this difference in scoring.

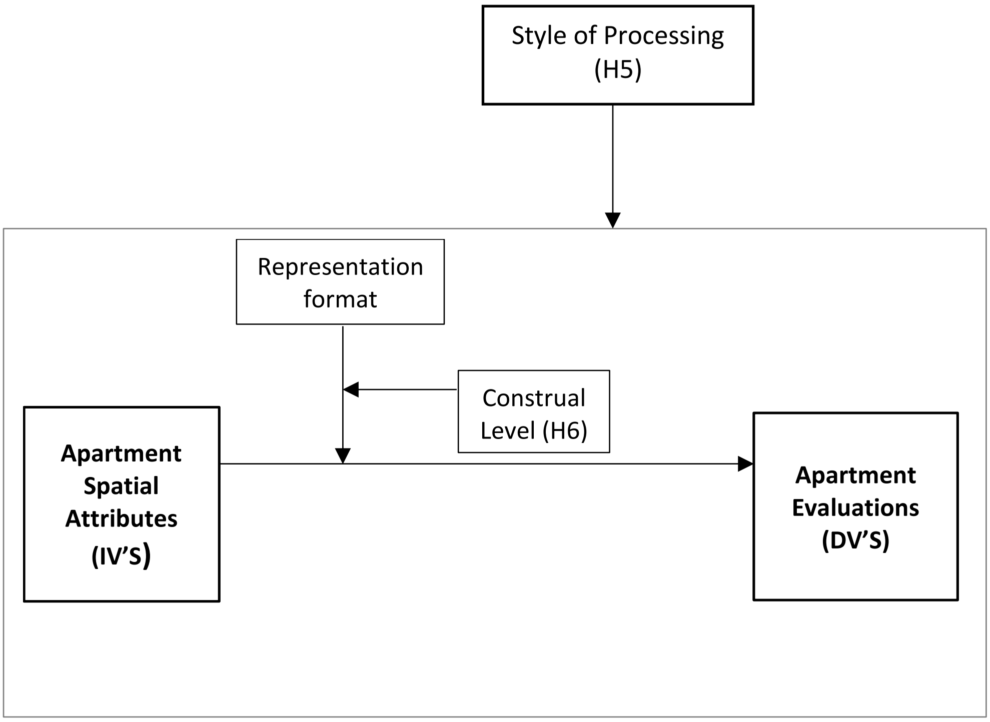
The two styles of representation examined so far in this thesis are text and floor plans. The floor plans contained graphical descriptions of attributes related to the study and other spatially related attributes, for example walls, room sizes, symbols and so on (Zhu et al., 2014). By contrast, the text descriptions only describe the attributes related to the study.

As has been established from the literature, when people were in a concrete (vs. abstract) state of construal, they were focusing on the present in great detail and were therefore less likely to focus on the secondary features of products or the gist of the of the product (Fujita, Trope, et al., 2006). This logic was applied when formulating the type of visualisation used in hypothesis six. Since floor plans can contain detailed information they assist more in situations where the product is psychologically proximal. By comparison, it was assumed that text descriptions assist more in situations that were more distal. The figure below explains that representation format moderates the evaluations (dependent variables) of the apartment attributes (independent variables), as established in the first study. It further shows that construal level moderates representation format which is the focus of study 2.

H6: Construal level moderates the impact of representation format on apartment evaluations such that when apartment information is represented by floor plans (vs. text), layout attributes will be more important in stated preference tasks when their mental construal is concrete (abstract).

The research model below shows the types of variables and the relationships being examined in this study: Representation format moderated evaluations of apartment attributes; and construal mindset moderated representation format.

Figure 28: Research Model for study 2



Dependent and Independent Variables

The researcher tested construal level and representation format, and observed respondent scores for apartment alternatives in a 2 x 3 between-subjects design. Respondents were put into one of two psychological distance conditions; one of two construal mindset tasks; and one of three visualisation conditions.

The dependent variable involved each respondent considering and scoring eight apartment alternatives from a 16-alternative fractional factorial design as explained in the methodology chapter. The 16-alternative design was then halved and reduced to eight alternatives per-person. Randomly, either alternatives 1-8 or 9-16 were presented to respondents to decrease load and time taken to undertake the survey. Respondents indicated how much they like each apartment, selecting from a 7-point bipolar scale, ranging from “like a lot” on the left pole to “dislike a lot” on the right pole of the scale.

The independent variables were all between-subjects variables and are defined as follows:

1) Apartment attributes – Attributes refer to the features by which each apartment alternative was described in the experiment. There were five attributes used in this study, rent, sunlight, dining, gym, and commute time; each was varied over two levels. The two layout attributes from study one were also utilised in the second study and a further three attributes that were not layout attributes, and were not able to be described on the floor plan format were chosen using an affordance-based housing preference approach that (Coolen, 2015) focussed on user-needs.

2) Representations – This refers to the style of the representation of the apartment stimuli. Participants were organised into one of three groups: text only; floor plan with limited text; and a middle level - floor plan with text.

3) Construal manipulation – This refers to the mental construal of respondents. Respondents were organised into two groups, either high-level (also referred to as abstract) or low-level (also referred to as concrete). The construal manipulation consisted of a spatial and temporal component, two levels of each Sydney 1 year and Melbourne 2 months. The former construal referred to a distal place and time and the latter a proximal place and time. Further, respondents were primed with a construal mindset task which was manipulated. They were either given a “how” (low-level construal) (low level construal) task or a “why” task (high level construal). This task was designed to further strengthen the abstract (concrete) mindset of respondents (Freitas et al., 2004).

Method (Sample, Design and Procedure)

Two hundred and seventy-one undergraduate (marketing) students (40.2 % male) participated in the study. On the first day of data collection there were some technical issues and therefore not all students completed. The completion rate was 96%. The students were recruited from Marketing Research classes and they received partial course credit for participating.

Table 21 exhibits the respondents’ demographic information.

Table 21: Respondents' Demographics

Demographic Variable	Categories	Frequency N=260	Percentage
Gender	Male	106	40.8
	Female	154	59.2
Age	18-20	177	68.1
	21-23	76	29.2
	24-26	5	1.9
	Over 26	2	0.8
Home Country	Australia	160	61.5
	China	34	13.1
	Other Asia	44	16.9
	Other	22	8.5

After giving informed consent, the respondents were seated in individual booths in the Behavioural Laboratory located at Monash Business School and given an online survey. They were then randomly assigned to one each of three experimental conditions. Firstly, they were assigned to either Sydney 1 year (combined spatial and temporal abstract level manipulation) or Melbourne 2 months (combined spatial and temporal concrete level manipulation). The relatively unequal numbers in the groups is due to technical difficulties on the first day in the lab. Secondly, they were assigned to either the "why" (abstract level manipulation) or the "how" (concrete level manipulation) construal mindset task. As explained in the methodology chapter, the construal mindset task is designed to further engage respondents in abstract (concrete) construal. Finally, they were randomly assigned to one of three representation formats: text only; text and floor plan; or floor plan with limited text. Table 22 shows the respondents' distribution for each of the three experimental factors.

Table 22: Distribution of Respondents amongst Conditions

Presentation Style	**Construal Mindset**	**Psychological Distance**	
		Abstract - Sydney 1 year	**Concrete - Melbourne 2 months**
Text only	**Why**	19	22
	How	21	23
Floor plan and text	**Why**	20	28
	How	21	17
Floor plan and limited text	**Why**	19	22
	How	21	26

Procedure Step One

Scenarios

Respondents were randomly exposed to one of two scenarios which represented either a proximal situation in terms of psychological distance or a distal situation in terms of location. Afterward, they were given a set of instructions (Figure 29).

Figure 29: Instructions Apartment Options

You will soon be presented with eight apartment options. Each one varies in whether it has a dining room, whether it gets direct sunlight, whether it has a gym nearby, whether it has a commute time of 5 minutes or 15 minutes and whether the rent is closer to $350 or closer to $400 per week.

But before you evaluate the apartments, we would like to understand, which of the features is the first one you would be interested in?

The opening scenario of the experiment for study 2 asked respondents to imagine they were moving house because they have graduated and found a job and they want to live near their workplace., respondents were asked to imagine they were preparing a list of features that were important to them, familiarising them with the features before the ranking and experimental tasks.

Figure 30 – Scenario Presented to Respondents in Sydney 1 Year Condition

> *For this study, we are interested in people's decision-making process when renting apartments.*
>
> *Please imagine the following:*
>
> *You have done well in your studies and are close to graduating. You have been looking for jobs and now have presently been offered an exciting graduate position with a company located in the central business district of* ***Sydney****. The position commences in* ***1 year****.*
>
> *You are thinking about the sort of home you want in* ***Sydney****. Even though it is* ***a year*** *away, imagine you are already browsing on-line for apartments.*
>
> <u>*You make a list of the things important to you:*</u>
> *1 bedroom apartment style living*
> *Designated dining space*
> *Sunlight*
> *Rent range $350-$450 p/w*
> *Live short commute from work*
> *Fitness*

After this, respondents were instructed that they would be evaluating apartments:

Figure 31: Evaluation Instructions (for the Sydney 1 year version)

> *You will now be presented with four pairs of apartments that will be available within the next* ***1 year in Sydney.***
>
> *For each apartment option, please evaluate the features and consider whether you would be interested in living in it.*

Ranking task

Prior to evaluating apartments respondents were asked rank apartment attributes. All five apartment features were listed in a fixed order identical to the order presented in the experimental task. When respondents clicked on one of the features, the remaining four were presented in the following screen. Respondents were again directed to indicate the first feature they would be interested in. Again, after selecting a feature, the remaining three features appeared in the following screen. This was repeated until respondents selected a feature from the final two.

For the duration of the online survey, the construal manipulation was assumed to continue such that a respondent did not cease the mindset nor change from one mindset to another. After the respondents were asked to rate 8 apartment profiles (four pairs of two) they were again presented with the ranking task in the same format and content as the pre-experimental ranking task.

This study examined the main effects of apartment features and interaction effects of psychological distance and construal thought exercises with apartment features. A comparison of medians of rent, commute time, gym, dining and sunlight was expected to reveal how each was positioned within the two construal groups. A 2x2 two-way between-subjects factorial design (MANOVA) was then employed with two independent variables, each with two levels. The independent variables were the: construal conditions; psychological distance (abstract or concrete); and construal thought manipulation (abstract or concrete). The five apartment features: rent, commute time; gym; dining; and sunlight were included in the model separately so that the model could handle all the attributes. The results are presented in the results section of this chapter.

Construal manipulation task

Following the opening scenario, respondents were given the construal manipulation consisting of a "why" (abstract level manipulation, Figure 32) and "how" (concrete level manipulation Figure 33) activity mindset task. They were randomised via the survey platform "Qualtrics" so that respondents either received the "why" task or the "how" task and the two groups were evenly populated. In the task, respondents were asked to write why (how) they would move from their current accommodation to the city in the timeframe assigned to them. After writing a response they were asked twice more to provide a reason why (how). As explained in the methodology chapter, this was an adaption from Freitas et al., (2004) and was successfully used in the literature (for example, Agrawal & Wan, 2009; Fujita, Henderson, Eng, Trope, & Liberman, 2006; Ng, 2012).

The task involved designing a succession of "why" or "how" questions to help respondents to think in an increasingly concrete (abstract) manner for the purpose of strengthening the effect of their mindset condition. Respondents were later asked (after the experimental task) to recall their reasons and their allocated city and timeframe to check their mindset condition did continue throughout the experiment. An example of the construal manipulation task is presented below for Sydney 1 year In Appendix 7 (abstract) all combinations of cities and timeframes were included.

Figure 32: Construal Manipulation Task for Condition "Why"

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three ways ***WHY*** *you would move from your current accommodation to a new apartment in* ***Sydney*** *in* ***1 year***

WHY (1)

WHY (2)

WHY (3)

Figure 33: Construal Manipulation Task for Condition "How"

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three ways HOW you would move from your current accommodation to a new apartment in ***Sydney*** *in* ***1 year***

HOW (1)

HOW (2)

HOW (3)

Experimental Task

The next section was the experiment. Respondents were randomly divided into three representation format groups: text only; text and floor plan; and floor plan with limited text. The style that includes limited text with floor plans varies the dining room and orientation attributes using floor plans as they are layout attributes and are able to be presented graphically (Figures 8, 9 and 10). All the representation groups are presented in the methodology chapter. Table 23 shows 2 categorical intensities (levels) for each attribute in the study.

Table 23: Categorical intensities of Apartment Attributes

	Low intensity	High intensity
Attribute 1	No dining space	Dining space included
Attribute 2	No direct sunlight	All-day direct sunlight
Attribute 3	Rent $400 per week	Rent price $350 per week
Attribute 4	15 min commute to work on train	5 min commute to work on train
Attribute 5	No gym nearby	Gym nearby

Figures 8, 9 and 10 show one versions of each representation in the experiment. All versions are presented in Appendices 24, 25 and 26. The representation formats show combinations of the attributes below.

Procedure Step Two

In this section another ranking task was administered, identical to the former ranking task which enabled the researcher to compare their performance before and after the experimental task.

Procedure Step 3

Recall of Treatment Groups:

Procedure step three involved asking respondents to recall their psychological distance treatment group, both the spatial element (Sydney or Melbourne) and the temporal element (1 year or 2 months). It was expected that the treatment groups assigned to respondents would influence attribute preferences and would also interact with representation format to affect the scoring of apartment alternatives. Respondent answers were also cross-checked against the treatment group assigned to each respondent.

Procedure Step Four

After the experiment, respondents completed a 22-item Style of Processing (SOP) scale about their preferred style of thinking (Childers, Houston, and Heckler, 1985). The SOP was included with this study because it was incorrectly applied in study one and therefore could not be properly analysed. The scale was introduced to respondents as shown in Figure 34: Explaining Style of Processing Scale in the Survey. The SOP scale is included as Appendix 2.

Figure 34: Explaining Style of Processing Scale in the Survey

Research shows that people differ in how they use words and pictures. This information will help us to understand how your preferred way of information processing influenced your apartment evaluations.

Further explanation of the relevance of SOP to study two, and its preparation for hypothesis testing is included as: Discussion and Analysis of measures in Study 1. The SOP was tested in hypothesis 5 on the sample and the results are found in the results section below.

Procedure Step Five

At the end of the survey, respondents answered demographic questions about their age, gender, and home-country. This information was included as it may help to explain some of the results. For example, respondents whose home country is in the northern hemisphere may expect that south-facing apartments are more desirable than north-facing ones.

Survey Completion Time

Respondents spent around 14 minutes completing the survey with those allocated to the floor plan condition requiring more time than those allocated to the text condition. Comparing the time taken to complete the survey could offer insights about the legibility of floor plans for different treatment groups. A "t-test" was run to test the difference in mean between the text only stimuli and the stimuli that presented floor plans. The difference was not found to be significant (Text: $M = 792.30$, $SD=255.90$, Floor plan: $M = 840.12$, $SD=292.96$, $t(285) = -1.290$, $p = .175$). Because of this a one-way between-groups ANOVA test was conducted to separate the three groups: text only (group 1); floor plan with full text (group 2); and floor plan with limited text (group 3). Respondents took an average of: 13 minutes 20 seconds (group 1; $SD=255.90$); 13 minutes and 61 seconds (group 2; $SD=279.12$); and 14 minutes and 38 seconds (group 3; $SD=305.79$). Unlike study one survey completion times, the differences were not significant ($F(2, 257) = 1.40$, $p = .247$). Appendix 22 contains the full survey including all of the conditions as well as the SOP scale.

Results

Results BIF Scale

Before undertaking the study, a pre-test was conducted to test the stimuli and to run a construal manipulation check, called the Behavioural Identification Form (BIF; Vallacher and Wegner, 1989), in a choice and preference study. The measure is described in the methodology chapter and is included as Appendix 8.

The inclusion of the BIF is explained in the background chapters and the scenarios and variables are described in the methodology chapter. It was prepared for hypothesis testing but not included as a manipulation check in the final results chapter because it could not successfully assess the effectiveness of the construal level manipulation in the pre-test. Pre-testing for study 2 Appendix 19 contains the complete pretesting for Study 2.

The scenarios and variables used in study two are described in the methodology chapter. In summary, the representation format consisted of two levels, for the main study because no significant interaction effects were found between construal level and representation format apart from when interacted with attribute rent price.

The BIF is a 25-item dichotomous questionnaire that recorded individual differences in construal level (concrete or abstract) that respondents identified with. This data was converted into a construal level index for each person and was used to evaluate the effectiveness of construal level manipulation. The (BIF) index described activities in an abstract way and in a concrete way, and the task asked respondents to indicate which description they could most identify with. Respondents who identified with the lower level concrete description were scored 1 and those who identified with the higher level abstract description were scored 2. A construal level index was calculated for each respondent by adding up the scores and then dividing by the number of items in the questionnaire (25). The higher the index, the more the abstract the identification. The results of the overall items and individual items are presented in Table 24.

However they are not included as a manipulation check in the final study because they could not successfully assess the effectiveness of the construal level manipulation in the pre-test. For the same reason, the results of the pre-test are not reported here.

Table 24: Manipulation check results

	Item	Abstract (mean)	Concrete (mean)	Comparison of scores	Sig
	All items (total)				.96
1	Eating	1.79	1.68	0.11	.32
2	Brushing teeth	1.79	1.74	0.05	.63
3	Resisting temptation	1.29	1.29	0.00	.98
4	Having cavity filled	1.54	1.26	0.28	.03
5	Talking to a child	1.46	1.50	-0.04	.76
6	Locking a door	1.71	1.79	-0.08	.46
7	Greeting someone	1.62	1.56	0.06	.62
8	Cleaning the house	1.38	1.32	0.06	.69
9	Washing the clothes	1.54	1.50	0.04	.76
10	Making a list	1.75	1.76	-0.01	.90
11	Reading	1.71	1.53	0.18	.18
12	Joining the army	1.62	1.71	-0.09	.53

13	Picking and apple	1.62	1.65	-0.03	.87
14	Chopping down a tree	1.75	1.74	0.01	.87
15	Measuring room for carpeting	1.79	1.71	0.08	.90
16	Painting a room	1.71	1.62	0.09	.47
17	Paying the rent	1.42	1.44	-0.02	.48
18	Caring for houseplants	1.58	1.65	-0.07	.86
19	Voting	1.50	1.47	0.03	.63
20	Climbing a tree	1.83	1.76	0.07	.83
21	Filling out a personality test	1.75	1.53	0.22	.53
22	Taking a test	1.62	1.53	0.09	.09
23	Growing a garden	1.67	1.53	0.14	.48
24	Travelling by car	1.87	1.88	-0.01	.30
25	Pushing a doorbell	1.67	1.65	.02	.93

*$p<.05$

The abstract and concrete scores for individual test items are not significantly different (except for 'having a cavity filled' ($p=0.03$); $F(25, 32) = .51$, $p = .96$. Based on the findings that there were few significant differences in mean between concrete and abstract conditions for the 25 BIF items, the manipulation check does not support the findings of the construal level manipulation.

The items from the BIF scale were summed up for each respondent and then divided by 25 (25 items) resulting in a construal level index (Table 25) for each respondent. A one-way ANOVA was then analysed with the abstract and concrete conditions, with no significant differences found for this sample, as can be seen in Table 25. Respondents in the abstract level condition (move to Sydney in 1 year) did not identify with the higher level abstract identification ($M=15.78$, $SD = 3.84$), and respondents in the concrete level condition (move to Melbourne in 1 month) did not identify with the lower-level concrete identification (M = 15.43, SD = 5.30). This indicates that the construal level index did not work for this sample.

Table 25: Construal Level Index

	Mean	Std. Deviation	Std. Error
Sydney Why (Abstract)	15.78	3.84	.55
Melbourne How (concrete)	15.43	5.03	.70

Results Ranking Task

The ranking results are presented in Table 26 and indicate the rank of each attribute as well as the preference share is a percentage out of 100 for each condition.

Table 26: Median Rank for Construal Manipulation

	Pre-Experimental task		Post –Experimental task	
Apartment Features	Psychological Distance (abstract)	Psychological Distance (concrete)	Psychological Distance (abstract)	Psychological Distance (concrete)
Price	1st (47.9%)	1st (53.2%)	1st (45.5%)	1st (49.6%)
Commute Time	2nd (41.3%)	2nd (37.4%)	2nd (40.5%)	2nd (40.3%)
Gym	5th (2.5 %)	5th (50.4 %)	5th (51.2 %)	5th (50.4 %)
Dining	3rd (28.1%)	4th (37.4%)	3rd (32.2%)	3rd (25.2%)
Sunlight	4th (31.4%)	3rd (30.2%)	4th (27.3%)	4th (31.7%)

Looking at the median scores in Table 26 it is clear that there is barely any variation on the median score between the conditions, and therefore there is little difference between the two ranking task results (ranking task pre-experiment and ranking task post-experiment). Importantly, the abstract and concrete groups were exactly the same at prioritising the apartment attributes. There was one exception and that was the difference between the concrete abstract scores for dining and layout orientation in the pre-experimental ranking task but there was only a small difference. Respondents clearly indicated that in all conditions price was the first feature they were interested in knowing about when considering whether or not to rent a new apartment. This was followed by: commute time; dining; sunlight; and gym. As the ranking tasks included before and after the experiment were the same, comparing their results could be manipulation check for the experimental task.

Results Experimentation Task

This section tests hypotheses 5 and 6. Hypothesis 5 was attempted in Study 1 but was unsuccessful due to technical issues. It is therefore repeated in study 2. The scale is included as Appendix 2 and is prepared for hypothesis testing in Appendix 23.

Results Hypothesis 5 - SOP scale

Replicating the steps taken by Childers et al., (1985) the reliability and validity of the SOP scale was calculated and reported (Nunnally & Bernstein, 1994) in Appendix 23**:** Discussion and Analysis of measures in Study 1. This involved generating Chronbach's alpha values for the overall SOP measure followed by the verbal and visual sub-scale factors. Then the SOP measure was submitted to a confirmatory factor analysis coefficient alpha, exploratory factor analysis, and confirmatory factor analysis - followed by an assessment of the validity. After totalling the scale scores for each respondent they were split into three equal groups: highly verbal; highly visual; and neither verbal nor visual, as explained in Appendix 23. A mixed-model tested for interaction of representation formats (Text only, text and floor plan and text and limited floor plan) psychological distance (Sydney 1 year and Melbourne 2 months) and processing style. A significant interaction was not found for the interaction of representation format and processing style ($F(4, 698.6) = .50$, $p = .74$), however a three-way interaction was found for representation format, psychological distance and processing style ($F(2, 698.6) = 2.04$, $p = .058$). Since no interaction was found for representation style and the cognitive style of processing this hypothesis in not carried.

Results Hypothesis 6 - Preference Rating

To analyse the eight scores of each respondent of apartment evaluations, a repeated measures mixed-model analysis was conducted in statistics program SPSS testing random and fixed effects. The dependent variables constituted apartment preference rating scores from 16 apartment alternatives. The between-subjects independent variables entered into the model were: psychological distance; construal mindset; and representation format. Within subject factors, the five apartment attribute variables, (entered into the model separately) were: rent price; commute time; gym; dining; and sunlight.

Missing responses, and respondents that did not follow the construal manipulation task instructions were not included in analysing the effect of construal on the dependent variables. The construal manipulation was considered successful where abstract – induced respondents (vs. concrete induced) responded with relevant answers to the abstract (vs. concrete) construal manipulation tasks. Responses that indicated a reinforcement of the abstract condition were coded +1 and those that indicated a reinforcement of the concrete condition were coded -1. Those who were in a hybrid category, such as the abstract psychological distance level and the "how" thought exercise were coded 0 because reinforcement of the construal manipulation was not present. The 7-point scale was inadvertently reversed for study 2, so a lower level on the scale indicates a higher mean preference score.

The model was unable to include all variables at once so the effect sizes were calculated first with between-subjects' variables: representation format; construal mindset; and psychological distance.

The mean scores for representation format levels were as follows: text only (low level) M=4.41; text and floor plan (middle level) M=4.93; and floor plan with limited text (high level) 5.27. The difference between the representation format means were statistically significant ($F\ (2, 723.19) = 43.73$, $p = .000$).

The mean preference scores for construal mindset levels were as follows: how task (proximal) M=4.79; and why task (distal) M=4.95. The differences between the construal mindset means was statistically significant ($F\ (1, 723.19) = 4.21$, $p = .040$). This shows that preference share was higher for the why task than the how.

The mean scores for psychological distance levels (move to Sydney in 1 year vs move to Melbourne in 2 months) were as follows: concrete psychological distance rated M=4.82; and abstract psychological distance rated M=4.92. The difference was found to be not statistically significant ($F\ (1, 723.19) = 1.67$, $p = .196$).

The attributes were then included in the model one at a time as the mixed model analysis would not allow all of the attributes to be included at once. When attribute rent was tested in the model, the mean scores for $350 per week was M=4.97 on the rating scale and M=4.77 for $400 per week. The difference was statistically significant ($F\ (1, 2007.7) = 7.96$, $p = .005$) but the effect was not large. As shown in the tests of fixed effects, Table 27, no significant interaction effects were found between: rent; independent variables representation format; psychological distance; and construal mindset.

Table 27: Tests of Fixed Effects – Rent

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	723.193	16443.900	.000
Qr_rent	1	2007.657	7.956	.005
PresentStyle	2	723.193	43.732	.000
PsychDist	1	723.193	1.673	.196
WhyHow	1	723.193	4.213	.040

When attribute gym was tested in the model, the mean scores for gym nearby ($M=4.93$) and no gym nearby ($M=4.93$) were not significantly different (F (1, 1088.78) = 2.66, $p = .103$). No significant interaction effects were found between gym, representation format, psychological distance and construal mindset (Table 28).

Table 28: Tests of Fixed Effects – Gym

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	720.909	16337.372	.000
PresentStyle	2	720.910	43.432	.000
WhyHow	1	720.909	4.194	.041

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

When attribute commute-time was tested in the model, (Table 29) the mean score for 5 minutes was M=5.02 and 15 minutes (high-level) was M=4.72. The means were significantly different (F (1, 1079.44) = 15.30, p = .000). No significant interaction effects were found between: commute-time; representation format; psychological distance; and construal.

Table 29: Tests of Fixed Effects – Commute-Time

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	718.113	16765.369	.000
Qr_com	1	1079.443	15.299	.000
PresentStyle	2	718.113	44.560	.000
WhyHow	1	718.113	4.291	.039

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

When attribute sunlight was tested in the model, (Table 30) the mean score for South-facing was M=4.90 and north-facing (high-level) was M=4.84. The means were not significantly different (F (1, 1600.38) = .481, p = .488). No significant interaction effects were found between: sunlight; representation format; psychological distance; and construal.

Table 30: Tests of Fixed Effects – Layout Orientation

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	714.361	16237.649	.000
PresentStyle * Qr_sun	2	1600.378	2.440	.088
PresentStyle	2	714.363	43.203	.000
WhyHow	1	714.361	4.153	.042

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

When attribute dining space was tested in the model, the mean score for with dining space, Table 31 was M=4.94 and no dining space was M=4.80. The means were significantly different (F (1, 785.82) = 4.23, p = .040). No significant interaction effects were found between: sunlight; representation format; psychological distance; and construal.

Table 31: Tests of Fixed Effects – Dining Space

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	722.931	16340.393	.000
Qr_din	1	785.823	4.227	.040
WhyHow * Qr_din	1	785.823	4.507	.034
PresentStyle * PsychDist * WhyHow * Qr_din	2	785.823	2.514	.082
PresentStyle	2	722.931	43.442	.000
WhyHow	1	722.931	4.195	.041

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

Comparing the difference between means for each attribute in the model, the relative importance of the attributes is: 1) Commute time; 2) Rent; 3) Dining space; 4) Sunlight; and 5) Gym. The same comparison in the first ranking task revealed different results with the relative importance of the attributes being: 1) Commute time 2) Rent; 3) Sunlight; 4) Gym; and 5) Dining space. The two tasks supported one another in so far as commute time and rent were most important to them. Comparing the tasks, the three remaining attributes did not have the same rank. However, as established, the construal manipulation had no effect and we cannot reject the null hypothesis.

Results for Smaller Sample

As the results did not show the effects expected, the data was reviewed for respondents who did not recall their psychological distance group. They were asked: “At the beginning of the survey, we asked you to imagine you are renting an apartment in a city in Australia. Can you recall which city that was?” Further they were asked “We also asked you to imagine moving in a specific time-frame. Can you recall what that was?” Out of 260 respondents, 248 recalled the city (95%); 219 respondents recalled the timeframe (84%). They were also asked if they recalled their construal mindset manipulation group at this time. Out of 260 respondents, 172 recalled the construal mindset manipulation check (how / why task) (56%). It was decided to remove the cases that could not recall the timeframe, the relevant city, and their manipulation check task, leaving 146 respondents. This was done as the measures suggested the manipulation did not work for these cases. Although the expected effects were not achieved, some of them were marginally significant, which indicates that the research instrument did work somewhat better when the cases discussed above were removed.

When attribute layout orientation was tested in the model, the mean score for south-facing (low-level) was M=4.79 and north-facing (high-level) was M=4.87[6]. The means were not significantly different ($F (1, 858.56) = .591$, $p = .442$). This was much the same as the original analysis. No significant interaction effects were found between: sunlight; representation format; psychological distance; and construal. However marginal effects were found for representation format * psychological distance and representation format * why/how, refer Table 32.

[6] As the scale was not in the correct direction in the survey the lower mean score is actually the better mean

As can be seen by both means tables below (Tables 32 and 33), when both representation formats are combined and presented to respondents, a large effect on the rating scale was found, however this combination of formats did not confirm the hypothesis. In Table 32, in the text only condition, it was expected that the abstract condition will score lower than the concrete and this was the case. Further, in the floor plan condition, it was expected that the concrete condition would score lower than the abstract and this was the case.

Table 32: Means Table – Representation Format * Psychological Distance (Orientation)

Representation Format	Psychological distance	Mean	Std. error
T ONLY	Abstract	4.370	.096
	Concrete	4.449	.090
T + FP	Abstract	5.074	.095
	Concrete	4.781	.093
FP + limited text	Abstract	5.311	.096
	Concrete	5.230	.088

In Table 33 it was expected that the abstract condition would score lower than the concrete condition for representation format text, as it did. Further, the floor plan representation format was expected to have a lower mean in the concrete condition and it did.[7]

[7] As the scale was not in the correct direction in the survey the lower mean score is actually the better mean

Table 33: Means Table – Representation Format * How/Why (Orientation)

Representation Format	HowWhy	Mean	Std. error
T ONLY	abstract	4.413	.095
	concrete	4.406	.092
T + FP	abstract	5.074	.089
	concrete	4.782	.099
FP + limited text	abstract	5.356	.095
	concrete	5.185	.089

Table 34 shows the table of mixed effects for layout orientation.

Table 34: Tests of Fixed Effects – Layout Orientation

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	403.871	9006.314	.000
PresentStyle	2	403.873	22.250	.000
PresentStyle * PsychDist	2	403.873	2.598	.076
PresentStyle * WhyHow	2	403.873	2.519	.082

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

When attribute rent was tested in the model, the mean scores for $400 per week (was M=4.89 on the rating scale and M=4.79 for $350 per week.[8] The difference was not statistically significant (F (1, 936.90) = .858, p = .355). As shown in the tests of fixed effects, (Table 36) no significant interaction effects were found between: rent; independent variables representation format; psychological distance; and construal

[8]On the scale that was used, a lower score meant a more attractive apartment (see page 108)

mindset. However marginal effects were found for representation format * psychological distance and representation format * Why/How.

In the Table 35 it was expected that the abstract condition would score lower than the concrete condition for representation format text. It did not but the scores are much the same. However, the floor plan representation format was expected to have a lower mean in the concrete condition and it did.

Table 35: Means Table – Representation Format * How/Why Priming (Rent)

Representation Format	HowWhy	Mean	Std. error
T ONLY	Abstract	4.412	.095
	Concrete	4.407	.091
T + FP	Abstract	5.074	.089
	Concrete	4.782	.099
FP + limited text	Abstract	5.356	.095
	Concrete	5.185	.089

Table 36 shows the test of mixed effects for Rent.

Table 36: Tests of Fixed Effects – Rent

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	402.524	9021.901	.000
PresentStyle	2	402.524	22.277	.000
WhyHow	1	402.524	3.800	.052
PresentStyle * PsychDist	2	402.524	2.614	.074
PresentStyle * WhyHow	2	402.524	2.532	.081

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

When attribute dining space was tested in the model, the mean score for no dining was M=4.93 and with dining was M=4.74.[9] Although the means do not show much difference in the rating scale, they are significantly different (F (1, 430.31) = 3.96, p = .047). A significant effect was found for Why/How*dining (F (1, 430.31) = 4.074, p = .044) and marginal effects were found for representation format * psychological distance and representation format * Why/How and Why/How*dining as show on the table of fixed effects.

In Table 37 it was expected that the abstract condition would score lower than the concrete condition for representation format text, this was the case. The floor plan representation format was expected to have a lower mean in the concrete condition and it did.

Table 37: Means Table – Representation Format * How/Why Priming (Dining)

Representation Format	HowWhy	Mean	Std. error
T ONLY	Abstract	4.412	.095
	Concrete	4.407	.092
T + FP	Abstract	5.074	.089
	Concrete	4.782	.099
FP + limited text	Abstract	5.356	.095
	Concrete	5.185	.089

Table 38 shows the test of mixed effects for Dining Space

[9] On the scale that was used, a lower score meant a more attractive apartment (see page 108)

Table 38: Tests of Fixed Effects – Dining

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	409.943	9102.091	.000
WhyHow * Qr_din	1	430.311	4.074	.044
PresentStyle	2	409.943	22.462	.000
WhyHow	1	409.943	3.834	.051
PresentStyle * PsychDist	2	409.943	2.635	.073
PresentStyle * WhyHow	2	409.943	2.551	.079

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

When attribute commute-time was tested in the model, the mean score for 15 minutes (low-level) was M=4.80 and 5 minutes (high-level) was M=4.81[10]. The means were not significantly different (F (1, 825.77) = .300, p = .584). No significant interaction effects were found between: commute-time; representation format; psychological distance; and construal as shown in Table 39. However marginal effects were found for representation format * psychological distance and representation format * Why/How and Why/How*dining.

Table 39: Tests of Fixed Effects – Commute-Time

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	397.655	8966.283	.000
PresentStyle	2	397.654	22.123	.000
WhyHow	1	397.655	3.774	.053
PresentStyle * PsychDist	2	397.654	2.583	.077
PresentStyle * WhyHow	2	397.654	2.521	.082

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

[10] On the scale that was used, a lower score meant a more attractive apartment (see page 108)

When attribute gym was tested in the model, (the mean score for gym not nearby (low-level) was M=4.85 and gym nearby (high-level) was M=4.82.The means were not significantly different (F (1, 813.94) = .077, p = .782) and the scores were almost equal. Significant interaction effects however were found between gym* representation format and representation format * psychological distance.

Table 40: Tests of Fixed Effects – Gym

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	407.065	9081.713	.000
PresentStyle * Qr_gym	2	814.110	5.338	.005
PresentStyle	2	407.066	22.425	.000
WhyHow	1	407.065	3.826	.051
PresentStyle * PsychDist	2	407.066	2.624	.074
PresentStyle * WhyHow	2	407.066	2.549	.079

**note only significant effects are shown in table, Dependent Variable: overall rating score.*

Discussion

The main experiment results for study 2 indicated that there was a significant main effect for rent such that respondents scored apartments with a lower rental price more highly. There was also a significant main effect for commute time and dining. 5 minutes commute-time scored higher than 15 minutes. No dining room scored significantly lower than the attribute with dining room. There was no significant difference in means between the levels for attribute gym and attribute sunlight. No significant interaction effects were found between the attributes: representation format; psychological distance; and construal.

Although not essential to the core argument of the thesis, the following main effects were found. Representation format had a large main effect with floor plans appraised more highly than text. As stated in the background chapter, this was an expected result. No main effect was found for psychological distance however, the construal mindset task revealed that the why condition (distal) scored apartments higher than the how condition (proximal).

In summary, the preference model was able to include construal mindset and presentation by using the SOP. Although the scale did not work for this sample, once again the contribution to the method was that sampling was an important issue when measuring cognitive processing style. Hypothesis 5 is therefore not carried. Construal level (using the experimental conditions construal mindset, and psychological distance), was unsuccessful in manipulating apartment scores within the representation format condition. Although representation format as a main effect had a huge effect on the model, all interaction effects were not significant. Hypothesis six is therefore not carried. The reason for the failure is not conclusive however several reasons are offered in the conclusion chapter. This was further discussed in the final chapter.

Chapter Summary

This chapter focused on: the operationalisation of the study design; the specific procedures used to test hypothesis five and six; and the results of the data analyses. The next chapter draws conclusions and discusses implications.

9. CONCLUSIONS AND IMPLICATIONS

Introduction

This chapter discusses the findings from studies 1 and 2, (hypotheses 1-6) and their implications and then progresses to discuss the limitations of the research, suggesting future studies that may strengthen and/or support the research in the areas of housing, environmental psychology and marketing.

General Discussion

It has been established in the literature that by imagining products either mentally, or through external representations, people are better able to understand them (Scaife & Rogers, 1996). In the context of the built environment, researchers have found that visualisation assists with preference articulation (Orzechowski et al., 2005, 2012). Despite searching the literature, no peer reviewed studies were found to show whether consumers find floor plans to be legible and visualisable tools (Vriens et al., 1998).

Imagining building layout attributes in floor plan representations was hypothesised to be moderated by: *user-needs; training; attribute familiarity; cognitive processes; and construal mindset* (Montello, 2014). Research was undertaken to posit that understanding floor plans depends on *user-needs* (Vischer, 1985), and *attribute familiarity* (Day et al., 2012; Orzechowski et al., 2012). It also posited that *training* individuals about the nature of layout attributes would assist with floor plan *visualisation* (Orzechowski et al., 2012). Further, it was posited that legibility and visualisation of floor plans would be greater for individuals who are *visual cognitive* *processors* (Childers et al., 1985), and, in a *concrete construal mindset* (Trope et al., 2007; Zhao et al., 2014). Hypotheses testing is reported below.

Hypothesis 1 stated that representation of layout attributes in a floor plan format will be more important in stated preference experiments than content-equivalent verbal descriptions. The preference task was expected to reveal that attributes featured on floor plans would have a greater range of utility estimates than the same attributes featured on text formats. The purpose of floor plans is to explain spatial configuration of layouts in terms of shape and position (de las Heras et al., 2014), whereas language is limited to specifying spatial relationships more abstractly (Hayward & Tarr, 1995). Representation format had a large effect on layout attribute importance, however, contrary to the expected outcome, attributes were not appraised more sensitively on floor plan formats compared to text formats. Floor plans demonstrated some sensitivity in the expected direction for attribute dining space, indicating some level of legibility. However, the floor plan format showed very little sensitivity to the layout orientation attribute and furthermore, the results were not in the expected direction, with south-facing layouts scoring slightly higher than north-facing layouts, showing poor legibility of floor plans by the respondents. Therefore, the preference task does not support hypothesis 1, as it showed that regardless of the ability of floor plans to describe layout information better than text, untrained individuals do not find floor plan formats to be as comprehensible as text formats. Although the hypothesis is not supported, it did show that floor plans and text formats had a similar utility estimate for attribute dining space, which could indicate0 that when layout attributes are further understood by laypersons, future studies that measure preferences with floor plan formats could be valid.

Hypothesis 2 states that layout attributes represented by floor plans will be more important in preference tasks when attributes are evaluated with a focus on user-needs. It was expected that user-needs would interact with representation format such that more sensitivity would be shown to variations in the level of the attribute that related to the assigned user-need theme. In the floor plan group, where respondents' user-needs are sustainability-related, it was expected that they would show more sensitivity to variations in level to the sunlight attribute and that they would be more interested in inspecting apartments with a north-facing orientation attribute compared to apartments with a dining space attribute. Also, in the floor plan representation group, where respondents' user-needs were entertaining-related, it was expected that they would show more sensitivity to variations in level of the dining space attribute and that they would be more interested in inspecting apartments with a dining space compared with a north-facing layout orientation. The preference task analyses confirms that *user-needs* significantly affect utility estimates of apartment layout attributes when they are represented by floor plans. A larger difference in means for changes in level of dining space was found where respondents were assigned to the user-needs category of entertaining-related needs compared to where they were assigned to the sustainability-related needs category, within the floor plan condition. This hypothesis is supported and it also shows that although floor plans and text formats had a similar utility estimate for attribute dining space (in the entertaining condition), the layout orientation attribute did not. This strengthens that argument that when layout attributes are understood, future studies measuring layout preferences with floor plan formats could be a valid format to use.

Hypothesis 3 states that, after training individuals about the nature of layout attributes, the attributes would become more important in preference tasks, and that the difference in attribute importance between floor plan and text formatted representations would diminish when compared to the situation before training. It was expected that utility scores would demonstrate an increased understanding of changes in attribute level, by scoring the attributes more sensitively and in the expected direction for that enhanced utility. Respondents were expected to be focussed on the attribute they learned about and that visualisation by them of that attribute using a floor plan would therefore show sensitive articulation of their preferences. Specifically, it was expected that where respondents are in the floor plan representation group, with entertaining-related needs, their sensitivity to variations in level of the dining space attribute will be greater after they have learned about the nature of the attribute compared to before their training. Where respondents were in the floor plan representation group, with sustainability-related needs, it was expected that their sensitivity to variations in level of the layout orientation attribute would be greater after they had learned about the nature of the attribute compared to before they had received training about that attribute. Analysis of preference task showed that in the floor plan format condition, respondents who were subjected to layout orientation-related training showed a large difference in sensitivity to the orientation attribute before they received training in that attribute compared with after training. A significant three-way interaction exists when representation formats are compared for before and after training and for layout orientations compared with text. The latter showed almost no difference before and after training (Figure 27).

This difference in sensitivity was echoed in the responses obtained when testing the text format condition. These findings demonstrated that attribute training did in fact work for layout orientation. Perhaps dining space was easily understood on floor plan formats and no improvement in sensitivity through training in the attribute was necessary – as evidenced by the fact that there was no increase in importance of the ranking of the attribute after the respondents received attribute training. Once again, this supports the argument that if people understand layout attributes, the utility estimates will be similar for the floor plan and text formats. Establishing which layout attributes are challenging to comprehend and training people about such attributes also supports that floor plans could be a valid format to use in SP methods.

Post training, respondents were asked how useful they found the training information and at least 64% of the respondents found the training useful. When splitting these findings into the two training groups that respondents were randomly assigned to (layout orientation and dining space), respondents in the layout orientation group indicated that the training was more useful than those in the dining space group. This manipulation check supported the findings of the experiment. Attribute training could also have occurred from repeating the same experiment post training. Thus, the effects found between the experiment and the repeat of the experiment could have occurred with or without the attribute training.

Hypothesis 4 states that attribute familiarity moderated preference for apartment layout attributes such that the more familiar individuals were with inspecting property, the greater the importance of the layout attributes would be on floor plan representations. It was expected that in the floor plan format condition, respondents with more attribute familiarity, would be more sensitive to variations in level of the dining attribute and the layout orientation attribute. The preference task did not support this expectation.

Determining the legibility of floor plans by measuring preference articulation for layout attributes and then comparing them against preference articulation for text formats was not successful in showing that floor plans were preferred over text as the latter out-performed the former in each of the analyses. It was clear from comparing results for floor plan and text representations, that untrained people find floor plan formats less legible than text formats when evaluating apartment layouts, regardless of user-needs, attribute training and attribute familiarity.

Hypothesis 5 states that cognitive style moderated consumer preferences for spatial attributes such that the more visual an individual is, the greater the importance of the layout attributes on floor plan representations would be to them. It was expected that those with a visual cognitive style of processing that were also in the floor plan representation group would be more sensitive to variations in attribute levels (compared with those, with the same cognitive style, in the text representation group). A significant interaction was not found for representation format and cognitive processing style in the preference task, which indicated that regardless of whether individuals were verbal or visual learners, floor plans can be difficult to read for untrained individuals.

Hypothesis 6 states that construal level moderates the impact of representation format on apartment evaluations such that when apartment information is represented by floor plans (text), respondent evaluations will be higher when their mental construal is concrete (abstract). In Study 2 construal level (using experimental conditions: construal mindset; and psychological distance) was unsuccessful in manipulating apartment scores within the representation format condition. Although representation format as a main effect had a huge effect in the model, no interaction effects were significant. Several points can be made to comment on this failure.

Firstly, the manipulation may have worked but subsequently a trigger could have caused a switch in construal level as it has been established in the literature that construal mindset can be influenced by very subtle cues (Hansen & Melzner, 2014).

This could have been mitigated by measuring respondents' construal as a trait rather than assigning them to an induced condition (Hong & Lee, 2010; Lermer, Streicher, Sachs, Raue, & Frey, 2015). This would involve determining respondents' mental construal level at the commencement of the survey and again at the conclusion by asking them which level they identify with, using the BIF or some other manipulation check. Unfortunately, this study only applied the BIF measure at the conclusion of the experimental task, so it was not possible to analyse construal as a trait. However future studies could address this issue.

Thirdly, the BIF manipulation check failed in the pre-test. Failure to find a significant difference between manipulated construal levels for apartment evaluations should therefore be unsurprising. Similar to the comment made in the second point, the BIF results could have been used to measure construal as an individual trait and compared with manipulated construal (Lermer et al., 2015). It could have been posited that an individual's construal mindset trait at the time of the survey overrules the induced (or manipulated) construal mindset. This could also be addressed in future studies.

Fourthly, the floor plans used in this study were largely made up of the plan of an outside envelope together with internal walls that make a shape out of each room, presented in black and white. As discussed in the literature review, the findings of Lee et al. (2016) revealed that people in low level construal appraise products more highly when colour representation was used rather than shapes. Further construal studies using the same scenarios as the current study could instead of using black and white floor plans and text, manipulate apartment representation by comparing floor plans that present information in black and white shapes together with those that use colour representations. In addition, different representational techniques could be used in future studies that are more popular, technologically relevant, and provide more information (and require less translation) than floor plans do such as: graphic art; virtual reality; photography; architectural visualisations and renderings that use colour, lighting, framing, composition, and angles to together create more meaningful information for the interpreter of those representations.

Fifthly, the construal manipulations were checked after the experiment (for psychological distance and construal mindset) which revealed that only 60% (N=114) of respondents properly recalled their construal groups. This indicated that for 40% (N=146) the psychological distance manipulation did not work for this sample. The calculation of number of respondents required for this study to be meaningful was established to be 240 respondents and the study achieved 260.

Finally, the scenario of respondents imagining that they have graduated and received a job offer could be too abstract to for the respondents to imagine which may have had the impact of putting most respondents into the abstract construal level, resulting in the failure of the construal manipulation.

Contributions

This thesis makes methodological contributions to the housing literature; to a lesser degree to the marketing literature; and also to SP methods. It also contributes to the real estate industry. The main contribution of this research was that it compared text and floor plan formats in SP tasks in a housing context and found that respondents' preferences were similar for certain conditions and for certain attributes.

An important benefit of SP methods is that they enable the researcher to use visual representations as experimental stimuli. In some instances, visual representation has been found to make the task more realistic and enhance external validity where choices depend strongly on the inspection of products (Loosschilder, 1997; Vriens et al., 1998). This research contributed to that literature by investigating the utility of using floor plans as experimental stimuli.

SP methods elicit preferences from respondents by tasking them with scenarios that require them to trade-off attributes. This enables the researcher to understand which attributes were found to be more important relative to the others. This research contributed to an understanding of the importance of layout attributes to the housing literature. Further, it found related conditions that increased the importance of the attributes.

When new visual formats are introduced to the literature in SP methods, it is recommended by scholars that the importance of attributes in the new visual format be compared to the importance of attributes in the traditional text-based format. If the results are similar, Louviere (1987) suggests that the visual format should be used instead of verbal formats as it has been established that visual formats can be more realistic (therefore increasing the precision of estimates and lowering error variance) in SP experiments than verbal formats (Loosschilder, 1997; Vriens et al., 1998). Further, the time and expense of comparing the formats when they have been found to consistently achieve similar results is deemed not necessary. However, if the recorded importance or attributes in the visual and verbal versions are not reliably similar, as was the case with this research, then other questions and explanations need to be explored about the visual format before it can be used as a valid and reliable format in preference studies. In this research, the dining space attribute was similar when comparing floor plan and text formats for each hypothesis test (1-3) however the layout orientation attribute was different when comparing floor plan and text formats, apart from the 'after attribute training' condition when the results became similar. Floor plans have been used in SP experiments before (Gao et al., 2013), no studies however have compared their attribute importance with text-based formats. Based on this, this paper has made further contributions to the SP method. Although similar attribute utility results were sought in this and many other method-focussed peer-reviewed studies, in industries, such as advertising, increased rating and sensitivity of floor plans and other visual formats compared to text could be the desired intention of such studies.

Scholars are sceptics when it comes to the ability of verbal experimentation representations of spatial attributes to realistically represent settings. This research's purpose was to study this area by comparing floor plan and text stimuli when rating layout attributes. The expectation was that similar ratings for the two formats would may achieved where laypersons found floor plans comprehensible, which would be a contribution to SP methods as explained above. Although this was not the outcome for both attributes, the research enabled preference testing of an appropriate visual representation of a housing product. Although the results show that some of the hypotheses were only carried on one attribute, they indicate that it is a suitable visual format for this type of study. The research contributes to the discussion of the inadequacy of verbal representations when considering consumer choices about the design and styling of products (Hagtvedt & Patrick, 2014, Jaeger et al., 2001; Page & Rosenbaum, 1992; Srinivasan et al., 1997; Yang & Lynn, 2014).

The research also contributes to the discussion that non-verbal representations have received less attention than verbal formats in the literature and it agrees that the issues pertaining to pictorial and prototype stimuli representations are, as a result, less resolved in the literature (Jaeger et al., 2001).

Preferences were measured for housing products in different representation formats. SP Methods is the usual vehicle for these types of studies. Measuring preferences in a real-estate context, as was done in this paper, is also relatively new to literature comparing preferences of apartment layouts. In addition, some insight into why untrained people find apartment layout features difficult to appraise using floor plan representations (for example because they do not understand the nature or significance of layout orientation) was also explored in this paper which has made both a managerial and method contribution to the literature.

The thesis contributes to the housing literature by its finding that the importance of floor plan formatted attributes were less than text formatted attributes. This result was unexpected. Possible reasons for the result were the nature of the particular attributes being evaluated and the lack of attribute familiarity. The research confirmed that features of products are assigned greater importance by individuals depending on how marketing messages are represented, an important marketing insight.

The thesis also provides insights into the proposition that the legibility of floorplans is related to specific user-needs; attribute familiarity; attribute training; the user's visual processing style; and whether or not the user is in a concrete construal mindset.

From a managerial perspective, the paper's findings regarding temporal construal offers a possible reason as to why buyers of off-the-plan apartments experience shock when they realise their apartment is nothing like they imagined it to be when they bought it years earlier (McIntyre, 2013; Williams, 2015, October 14). When examining detailed documents such as floorplans and specification documents, individuals' abstract mindset may hinder their ability to imagine something in the more distant future. Conversely, people browsing for property in the immediate or near future are likely to be in a state of low-level or concrete construal. However, construal effects were not found in this research, so this point is yet to be examined in future research.

A practical contribution to the real-estate industry provided by this research is that inclusion of floor plans in property marketing affects property rating (refer Figure 17). Although there are many industry reports, blogs, articles, experiences, and anecdotal claims that this is so, this doctoral research contributes an empirical insight to the real estate industry that interest in property is increased when floor plans are provided – in both rental and purchase markets. Although the industry provides floor plans for buyers for almost all property advertised on property portals, this is not the case with rental property, which the industry could find insightful.

Limitations

There were several limitations that have influenced the research. They have been grouped into 7 points: 1) methodological limitations; 2) SP validity; 3) hypotheses expectations; 4) design limitations; 5) respondent understanding of SP tasks; 6) eliciting preferences; and 7) over reliance of user-needs.

Methodological (general)

There were a number of methodological limitations in this study. SP methods traditionally utilise text descriptions of products alternatives. However, in the case of spatial information about products, they may not be able to adequately explain alternatives because language is limited in its ability to describe spatial relationships Hayward and Tarr (1995). Yet visual representations are limited in that they can bias perceptions (Crilly et al., 2004; Lurie & Mason, 2007) by focussing attention where it is not intended (Jansen, 2009). The floor plan is limited to only the spatial attributes as explained in the methodology chapter (apartment's size and orientation to the sun).

The methodological purpose of comparing visual and verbal representations in preference tasks was to test whether preference scores were the same or at least similar. This is because traditional verbal formats have been found to be reliable and in many cases of acceptable external validity, internal validity, and predictive validity. So, visual formats that achieve similar preference scores are also assumed to be content-equivalent.

Although SP methods allow for visual and graphical formats to be used in experimental stimuli, outcomes are not the same for different mediums for example see Louviere, et al.(1987) and Vriens et al. (1998). There is no clear answer from the literature to explain the inconsistencies. This thesis acknowledges that no insights were found to this problem.

A further limitation is that although visual presentation can help respondents to understand attributes, sometimes additional information is provided inadvertently, some of which may not be relevant to the measurement task. This could cause visual information to be processed differently to verbal formats and individuals could be affected by an inherent preference for one over the other (Jansen et al., 2009).

The bigger picture reason in SP methods for comparing formats and finding them to be equal in preference articulation, is to find representation formats that help particular products to appear more realistic to respondents when they are articulating their preferences. Virtual reality does not apparently influence preference mean scores for attribute levels compared to text format (Orzechowski et al., 2005) yet photographs do (Jansen et al., 2009). The current study compared text (verbal) with floor plans (visual), however the question of whether the two representational formats were adequately content equivalent was of paramount importance to the study as difference could cause bias. However in industry, such as marketing, and specific to this research, real-estate, bias by using non-verbal messages is an important tool to increase product preferences and thereby increase interest in property (Vriens et al., 1998).

An ongoing debated limitation of SP methods is that it may not reflect actual choice behaviour, in other words, what respondents claim they would do in a hypothetical situation, they may not actually do if the situation were real (Louviere, 1974). The two studies in this thesis were motivated by a similar problem, the questioning in the literature about the validity of SP methods and, in particular, the question of whether individuals could properly comprehend spatial attributes in the typically verbal SP format, and whether individuals were able to truly articulate responses that relate the hypothetical preferences to preferences in real markets.

Predictive Validity

The current study did not test external or predictive validity. However, internal validity was tested by attempting to minimise error (randomisation of order of repeated measures).

External validity was a limitation of the study as generalisation of the findings from the sample of students was not adequate.

Expert vs. Lay

The study was also limited in that it did not expand testing of expert versus lay perceptions (or preferences) and familiarity of products. The hypotheses tested laypersons' preferences. A focus group with experts could have assisted with the selection of attributes and the floor plan styles.

Other Contexts

Testing of floor plan products in other contexts such as emergency plans, shopping centre maps, navigation and wayfinding in buildings and google indoor maps could have contributed insights to each of these contexts.

Construal

There were a few hypotheses expectations that did not work for this sample. The expected interaction of construal mindset and representation format did not work as expected, although when cases were removed that clearly did not engage with construal, these factors became marginal effects. The literature does suggest that language is an abstract format in terms of construal, see for example, Hayward and Tarr, (1995), yet study 2 did not find this. It was assumed that construal mindset influences the perception of visual formats by showing increased importance to floor plans when in a concrete mindset. However, the construal study did not work, and one of the limitations of this study could have been that the sample, after many cases needed to be removed because they did not fit with the required data for some of the questions, the resulting number of respondents was too small to provide reliable results.

In the Study 2, perhaps the construal mindset did not remain salient due to the high level of focus required to undertake the preference task. Also, by not manipulating user-needs in property in the construal experiments, perhaps the respondents did not have a theme/need to focus on and therefore the construal mindset was varied, negatively impacting on the results.

Fractional factorial design

Study 2 had many more possible alternatives for respondents to consider by virtue of its designed compared to Study 1, limiting its ability to analyse some effects. Study 1 used only two attributes with two levels, and so only four alternatives were required to be rated. However, study 2 had 5 attributes with two levels each, resulting in many more alternatives for respondents to consider, so a fractional factorial design was applied to reduce the cognitive load and maintain the attention of the respondent. Fractional factorial designs enable the testing of studies designed with a large number of alternatives by limiting the number of those alternatives presented to respondents by selection of a subset (fraction) of the full set of combinations of the attribute levels. However, it's utility as a research design is limited by the very fact that not all combinations are able to be tested.

Lack of peer-reviewed literature

Whilst the floor plan format would be expected to outperform the written format in preference articulation because floor plans are by nature explain spatial configuration of layouts, it was also expected that where floor plans were comprehensible to the layperson, they would perform similarly to the written format. The lack of literature on perceived legibility of floor plans is a limitation to the research. Another limitation was that there was very little literature found that used floor plans to elicit preferences. Scholarly papers have not as yet researched evaluations of floor plan representation from the perspective of non-experts, with the exception of Gao et al., (2013).

Limited Understanding

Some respondents don't understand or relate to SP tasks. This could be a sampling issue, and therefore the topic of the study needs to be suitable for the respondent cohort. Scholars are concerned that if respondents don't understand profiles of the attributes being tested then the experimental results could be lacking in validity. Some respondents found the construal thought exercises difficult to grasp because the instruction was too open. This was indicated when they asked the research assistants in the laboratory for additional guidance whilst undertaking the computer based survey. This may have affected the desired outcome that the two conditions interacted by agreeing with the direction of the difference between the two construal levels. With limited understanding of layout attributes respondents were likely to yield different utility ranges (visual vs. verbal) in rating experimental alternatives.

When individuals are able to visualise the attributes as they are intended to be visualised (Vriens et al., 1998) the individual will better be able to engage with the hypothetical task as if it was a real situation. Examples concerned with the problem that profiles and attributes might not be fully understood which presents the problem that respondents may find the experimental tasks unrealistic and so the experimental results could lack external validity. By improving floor plans that are used in marketing material for lay-persons, the laypeople will have a better understanding of properties, and consequently an opportunity to make more informed decisions about whether to inspect the property and whether to buy or rent it. Perhaps a more exploratory approach into how individuals use floor plans could have helped this thesis to understand not just what the preferences were but also why.

Individual decision-making

There are many limitations when eliciting preferences from individuals. This research found that individual differences such as processing style do not influence preference scores, neither did attribute familiarity although that could be explained by the young and inexperienced population that made up the sample. The research did not measure the preferences of family types despite these being found in the literature to be a determinant of housing preferences (Gao et al., 2013) (Molin, Oppewal, & Timmermans, 2001) and residential groups (Molin et al., 2002). This research tests preferences for individual decision-making rather than preferences of a group. Some attempts have been made to design web-based tools that assist untrained end-users to customise architect designs (Stouffs et al., 2013) however these tools are made for user groups, and although they were encumbered by limitations that include conflicts between individual needs and differences in design knowledge amongst the groups, it is important to highlight that the context of choosing property is often combined with the attribute preferences of other interested parties.

Expert Preferences

Another limitation was testing user-needs of attribute layouts when the users selected do not understand design factors. This was a study that did not include expert preferences and in this sense, it was limited due to it not drawing its sample from the whole population which resulted in it not being a balanced study. Also, it did not examine user-needs from the perspective of those who will not be the end user. Vischer (2008) found that to assess the quality of the built environment based solely on what users tell us they need, given that they may not be direct users and that other important determinants such as design factors may be unknown, could be inappropriate.

Content Equivalence of Representation Formats

Jansen et al. (2009) says that a possible explanation for their results is that although visual presentation can help respondents to understand attributes, sometimes additional information is provided inadvertently, some of which may not be relevant to the measurement task. Another two explanations offered by Jansen et al., 2009 are that visual information is processed differently to verbal and individuals could be affected by an inherent preference for one over the other.

Future Studies

Future studies could address each of the limitations discussed in the previous section: further methodological contributions; predictive validity; expert preferences and comparing expert versus lay preferences; group decision-making; other contexts that use floor maps; further SP studies interacting construal and representation format; further contributions to SP methods with floor plan formats; and, sampling more suited to the survey.

Future studies could also measure spatial ability (Montello, 2014) as another important individual difference that may affect the importance of layout attributes. This study did not measure spatial ability as a predictor of housing preferences using floor plan formats. However, some of the literature reviewed found that visual people were usually also spatial people (Rourke & Finlayson, 1978).

This study did not examine gender as a predictor of housing preferences using floor plans. It was noted that some literature found that males perform better in spatial tasks than females (Kass, Ahlers, & Dugger, 1998), and this could be addressed in an extension of this study in future research.

The construal experiment could be re-worked in future studies to find whether mental construal influences rental property decisions. Although no peer-reviewed research has been found to support this claim, construal has been found to effect decisions related to other products. For example product decisions are: 1) impacted by construal (Trope et al., 2007); 2) impacted by information processing (Thompson, 2006); and 3) moderated by product representation (Zhao et al., 2014). In addition, the construal experiment could be repeated in future research in the context of tourism accommodation, particularly holiday apartments as this may be less abstract for respondents to imagine than the scenario used in this paper.

Future studies could attempt to link preference tasks that utilise floor plan formats in the context of housing to floor plan legibility. The premise for this future research could be that if people are able to mentally imagine building layouts using floor plan representations, they will better understand the layout attributes and therefore they will be better able to articulate their preferences (on floor plans) for those attributes. The key to such a study would be to examine other ways (than attribute training) of helping individuals to engage with layout attributes on floor plan formats. This could include such methods as tasking drawing and the sketching of architectural ideas that reveal the schematic spatial thinking of the author (Suwa & Tversky, 1997; Tversky, 2002).

Finally, future studies could apply the same comparison used in this paper (text and floor plan formats) to different contexts such as: navigation and way-finding instructions like those found on maps for fire exit information and hospital layout information (Løvs, 1998); spatial instructional teaching material such as diagrams; "you are here" maps in shopping centres (Dogu & Erkip, 2000; Klippel et al., 2006); plans; photographs; 2d & 3D drawing software; and virtual reality software for students of engineering, medicine, geography, architecture, and many trades (Sorby & Baartmans, 2000).

Summary of hypotheses and results

Hypothesis 1 states that: *Apartment layout attributes represented by floor plans, will be more important in preference tasks than content-equivalent verbal descriptions.* It was expected that floor plan attributes would score higher because they are better able to explain spatial relationships than verbal formats, and the attributes tested in the hypothesis were layout attributes, and so spatial by nature. This hypothesis was not carried because neither layout attributes' attribute range was higher in the floor plan condition than the text.

Hypothesis 2 states that: *Where apartment layout attributes are represented by floor plans and user-needs are aligned with specific attributes, the attribute related to the user-need increase in importance in preference tasks.* It was expected that where individuals were assigned a particular user-need, that the related layout attribute would be more important and would therefore show a greater range of categorical intensities for that particular attribute. The hypothesis was carried but only for the attribute dining space.

Hypothesis 3 states that: *Where apartment layout attributes are represented by floor plans and attribute training aligned with specific attributes, these attributes will increase in importance in preference tasks.* It was expected that after training individuals about layout attributes, their utility scores will demonstrate a greater range than before training. For attribute dining space, there was no difference in importance between before and after training. However for attribute layout orientation, a large difference in importance between before and after occurred. This showed that the training was effective. Hypothesis 3 is carried but only for the layout orientation attribute.

Hypothesis 4 states that: *Attribute familiarity moderates preferences for apartment layout attributes such that the more familiar individuals are with layout attributes and representations the more they gain in importance.* It was expected that individuals that inspected multiple properties would be more familiar with layout attributes. However very few of the sample had inspected multiple properties and this hypothesis was therefore not carried.

Hypothesis 5 states that: *Where apartment layout attributes are represented by floor plans and individuals have a visual cognitive processing style, their preference* *articulation of layout attributes will be increased.* It was expected that visual processors would show greater sensitivity to layout attributes on floor plans than text formats however most of the sample indicated that they were visual processors and the testing was not successful, and the hypothesis was not carried.

Hypothesis 6 states that: *Construal level moderates the impact of representation format on apartment evaluations such that when individuals are in a concrete mindset and apartment information is represented by floor plans (vs. text) the importance of layout attributes will be higher than for individuals in an abstract mindset.* It was expected that when describing spatial information, the detailed nature of floor plans compared with the abstract nature of written language would match respondents in the concrete construal mindset. However this experiment was not successful and the hypothesis is therefore not carried.

Conclusion

This thesis provides new insights and contributions to method and industry on the importance of the utility estimate of layout attributes using floor plan representations as experimental stimuli for housing preference modelling research. It was found that untrained individuals found the floor plan representation of the layout orientation attribute to have very different utility estimates to the text format, however after attribute training, the utility estimates were similar. As for dining space, utility estimates were similar for floor plan and text formats before and after attribute training. As for layout orientation, it was shown that many respondents' home-country was in the northern hemisphere, which could have influenced their rating of north-facing apartment in the opposite direction than expected. After training respondents about the orientation of apartments in Melbourne, this finding was changed and the utility estimate of layout orientation became more similar to the text format, which was the expected outcome. However, it was found when user-needs, and attribute training were tested as moderators of representation format, attribute utility estimates were similar for both formats however floor plan formats had a smaller (but not significant) range than text formats. Therefore, this research shows that floor plans as SP stimuli could be suitable and valid with more research for evaluating apartment layout preferences.

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Appendix 1: The Santa Barbara Learning Style Questionnaire (SBLSQ)

Questions to test your preferred learning style: please TICK only one box for each question

1. I prefer to learn visually.

☐	☐	☐	☐	☐	☐	☐
3	**2**	**1**	**0**	**-1**	**-2**	**-3**
Strongly agree	Moderately agree	Slightly agree	Neither agree or disagree	Slightly disagree	Moderately disagree	Strongly disagree

2. I prefer to learn verbally.

☐	☐	☐	☐	☐	☐	☐
3	**2**	**1**	**0**	**-1**	**-2**	**-3**
Strongly agree	Moderately agree	Slightly agree	Neither agree or disagree	Slightly disagree	Moderately disagree	Strongly disagree

3. I am a visual learner.

☐	☐	☐	☐	☐	☐	☐
3	**2**	**1**	**0**	**-1**	**-2**	**-3**
Strongly agree	Moderately agree	Slightly agree	Neither agree or disagree	Slightly disagree	Moderately disagree	Strongly disagree

4. I am a verbal learner.

☐	☐	☐	☐	☐	☐	☐
3	**2**	**1**	**0**	**-1**	**-2**	**-3**
Strongly agree	Moderately agree	Slightly agree	Neither agree or disagree	Slightly disagree	Moderately disagree	Strongly disagree

5. I am good at learning from labelled pictures, illustrations, graphs, maps, and animations.

☐	☐	☐	☐	☐	☐	☐
3	**2**	**1**	**0**	**-1**	**-2**	**-3**
Strongly agree	Moderately agree	Slightly agree	Neither agree or disagree	Slightly disagree	Moderately disagree	Strongly disagree

6. I am good at learning from printed text.

☐	☐	☐	☐	☐	☐	☐
3	**2**	**1**	**0**	**-1**	**-2**	**-3**
Strongly agree	Moderately agree	Slightly agree	Neither agree or disagree	Slightly disagree	Moderately disagree	Strongly disagree

Appendix 2: Style of Processing Scale (SOP)

	Item	Responce			
		Always True	Usually True	Usually False	Always False
1	I enjoy doing work that requires the use of words (W)	1	2	3	4
2*	There are some special times in my life that I like to relieve by mentally “picturing” just how everything looked (P)	1	2	3	4
3*	I can never seem to find the right word when I need it (W)	1	2	3	4
4	I do a lot of reading (W)	1	2	3	4
5*	When I’m trying to learn something new, I’d rather watch a demonstration than read how to do it (P)	1	2	3	4
6*	I think I often use words in the wrong way (W)	1	2	3	4
7	I enjoy learning new words (W)	1	2	3	4
8*	I like to picture how I could fix up my apartment or a room if I could buy anything I wanted (P)	1	2	3	4
9	I often make written notes to myself (W)	1	2	3	4
10*	I like to daydream (P)	1	2	3	4
11*	I generally prefer to use a diagram rather than a written set of instructions (P)	1	2	3	4
12*	I like to doodle (P)	1	2	3	4
13*	I find it helps to think in terms of mental pictures when doing many things (P)	1	2	3	4
14*	After I meet someone for the first time, I can usually remember what they look like but not much about them (P)	1	2	3	4
15	I like to think of synonyms for words (W)	1	2	3	4
16*	When I have forgotten something I frequently try to form a mental “picture” to remember it (P)	1	2	3	4
17	I like learning new words (W)	1	2	3	4
18	I prefer to read instructions about how to do something rather than have someone show me (P)	1	2	3	4
19*	I prefer activities that don’t required a lot of reading (W)	1	2	3	4
20	I seldom daydream (P)	1	2	3	4
21*	I spend very little time trying to increase my vocabulary (W)	1	2	3	4
22*	My thinking often consists of mental “pictures” or images (P)	1	2	3	4
W = verbal items, P = visual items, *items reversed for scoring					

Appendix 3: Attribute Training 1

This training was presented to the entertaining user-needs group and the text format group

Understanding Property Descriptions

Property is commonly marketed to consumers by describing features and benefits with text, symbols, photographs and floorplans.

In this survey you are being presented with text descriptions of apartments. When searching for property online, it is important that you understand property descriptions in order that you can evaluate them and decide whether or not to attend an inspection.

Descriptions such as the description of an apartment given below, communicate the important characteristics of the apartment such as the rooms and layout, **the space available for activities** and the position in relation to the sun.

Assessing whether or not the apartment has enough space for your needs can be done where descriptions indicate sizes and shapes of rooms and the way in which they relate to each other.

For example, in the apartment below, the living and kitchen space is described as rectangular, almost 6 meters by 3.5 meters. It is also described as open plan, meaning the kitchen and living spaces are adjoined and not separated by a wall. A compact kitchen could take up 2 by 3.5 meters, leaving another 4 x 3.5 metres for a compact the living room that can accommodate a lounge setting. **If, for example, you are looking for an apartment that can accommodate dinner parties you will realise that this apartment is not big enough**. The kitchen and living spaces do not have room for additional activities.

Example Apartment Description
Total floor space 50 square meters
5.9m x 3.5m open plan living & kitchen
Built-in robe in bedroom
Large windows but no direct sun
No dining space
Compact laundry in cupboard

Appendix 4: Attribute Training 2

This training was presented to the entertaining user-needs group and the floor plan format group

Understanding Property Descriptions

Property is commonly marketed to consumers by describing features and benefits with text, symbols, photographs and floorplans.

In this survey you are being presented with visual descriptions of apartments in the form of floorplans. When searching for property online, it is important that you understand floorplans in order that you can evaluate properties and decide whether or not to attend an inspection.

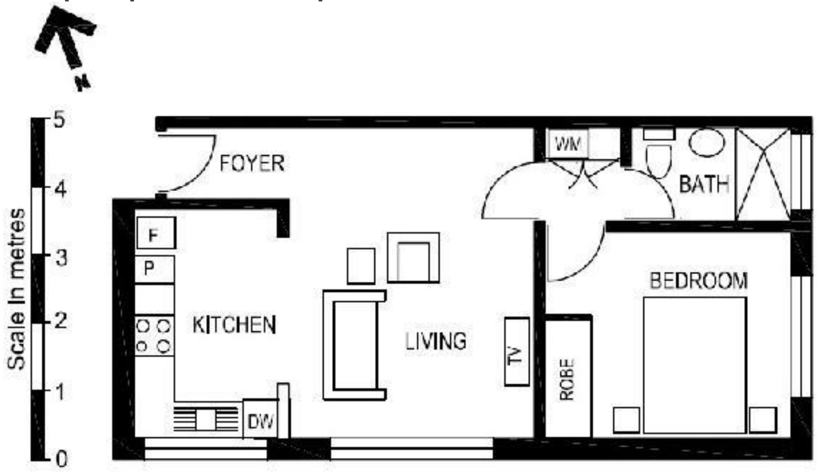
Floorplans, such as the floorplan of an apartment shown below, are two dimensional diagrams that communicate the important characteristics of property such as the layout, the position in relation to the sun and the **space available for activities.**

Assessing whether or not the apartment has enough space for your needs can be done with the assistance of the scale and by considering the shapes of rooms and the way in which they relate to each other.

The scale is usually adjacent to the plan and can assist with determining approximate room sizes. When furniture is shown such as lounge settings, one can use the scale to ensure there is around a meter of travel space around and between activities.

The floorplan shown below indicates that the living and kitchen space are adjoined and not separated by a wall, also called open-plan. Furniture and fit out indicate that living and kitchen activities are accommodated by this plan. **If, for example, you are looking for an apartment to accommodate dinner parties you will realise by using the scale and taking the clues from the furniture, that this apartment is not big enough.**

Example Apartment Floorplan



Appendix 5: Attribute Training 3

This training was presented to the sustainability user-needs group and the text format group

Understanding Property Descriptions

Property is commonly marketed to consumers by describing features and benefits with text, symbols, photographs and floorplans.

In this survey you are being presented with text descriptions of apartments. When searching for property online, it is important that you understand property descriptions in order that you can evaluate them and decide whether or not to attend an inspection.

Descriptions such as the description of an apartment given below, communicate the important characteristics of the apartment such as the rooms and layout, the space available for activities and **the position in relation to the sun.**

Knowing the direction of north can assist in checking whether direct sunlight will penetrate any of the window openings on the outside walls of the apartment. Other clues about the relationship of property to the sun can be found in text descriptions such as "north facing" or "sunny aspect".

The description of the apartment described below (large windows but no direct sun) indicates that the apartment is positioned poorly in relation to north. None of the windows are penetrated by direct sun and so this apartment would not receive any direct sunlight and would not be naturally warm in winter. This could have the drawback of feeling cold and dark and heating bills would be higher than apartments facing north.

Example Apartment Description
Total floor space 50 square meters
5.9m x 3.5m open plan living & kitchen
Built-in robe in bedroom
Large windows but no direct sun
No dining space
Compact laundry in cupboard

Appendix 6: Attribute Training 4

This training was presented to the sustainability user-needs group and the floor plan format group

Understanding Property Descriptions

Property is commonly marketed to consumers by describing features and benefits with text, symbols, photographs and floorplans.

In this survey you are being presented with visual descriptions of apartments in the form of floorplans. When searching for property online, it is important that you understand floorplans in order that you can evaluate properties and decide whether or not to attend an inspection.

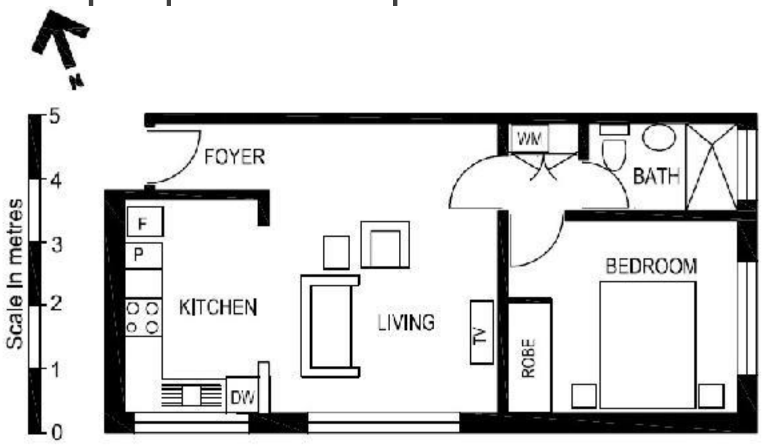
Floorplans, such as the floorplan of an apartment shown below, are two dimensional diagrams that communicate the important characteristics of property such as the layout, the space available for activities and the position in relation to the sun.

When assessing the position of property in relation to the sun, check the direction of the North Point adjacent to the floorplan. North indicates roughly the direction of the sun at midday. The sun rises to the east of north and sets to the west of north.

Knowing the direction of north can assist in checking whether direct sunlight will penetrate any of the window openings on the outside walls of the apartment. **If the windows of the apartment are located to the east or west of north and/or directly north, this tells you that the apartment is well positioned in relation to North.**

The floorplan shown below indicates that the apartment is positioned poorly in relation to north. None of the windows are penetrated by direct sun and so this apartment would not receive any direct sunlight and would not be naturally warm in winter. This could have the drawback of feeling cold and dark and heating bills would be higher than apartments facing north.

Example Apartment Floorplan



Appendix 7: Construal mindset tasks

1. Construal manipulation task WHY with Sydney 1 year (abstract psychological distance).

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three reasons **WHY** you would move from your current accommodation to a new apartment in **Sydney** in **1 year**

Construal Mindset Task for Condition "Why" and Sydney 1 year

WHY (1)	
WHY (1)	
WHY (1)	

. . . .

2. Construal manipulation task WHY with Melbourne 2 months (concrete psychological distance).

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three reasons **WHY** you would move from your current accommodation to a new apartment in **Melbourne** in **2 months.**

Construal Mindset Task for Condition "Why" and Melbourne 2 months

WHY (1)	
WHY (1)	
WHY (1)	

....

3. Construal manipulation task WHY with Sydney 1 year (abstract psychological distance).

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three reasons **HOW** you would move from your current accommodation to a new apartment in **Sydney** in **1 year**

Construal Mindset Task for Condition "How" and Sydney 1year

HOW (1)	
HOW (1)	
HOW (1)	

....

4. Construal manipulation task HOW with Melbourne 2 months (concrete psychological distance).

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three reasons **HOW** you would move from your current accommodation to a new apartment in **Melbourne** in **2 months**

Construal Mindset Task for Condition "How" and Melbourne 2 months

HOW (1)

HOW (1)

HOW (1)

Appendix 8: Behavioural Identification Form

Table of BIF items:

Activity / Behaviour	Description
Eating	Chewing and swallowing Getting nutrition
Tooth brushing	Moving a brush around one's mouth Preventing tooth decay
Resisting temptation	Saying "no" Showing moral courage
Having cavity filled	Going to the dentist Protecting your teeth
Talking to a child	Using simple words Teaching a child something
Locking a door	Putting a key in the lock Securing the house
Greeting someone	Saying hello Showing friendliness
Cleaning the house	Vacuuming the floor Showing one's cleanliness
Washing clothes	Putting clothes into the machine Removing odours from clothes
Making a list	Writing things down Getting organised
Reading	Following lines of print Gaining knowledge
Joining the army	Signing up Helping the nation's defence
Picking an apple	Pulling an apple off a branch Getting something to eat
Chopping down a tree	Wielding an axe Getting firewood
Measuring room for carpeting	Using a yardstick Getting ready to remodel
Painting a room	Applying brush strokes Making the room look fresh
Paying the rent	Writing a cheque Maintaining a place to live

Caring for houseplants	Watering plants Making the room look nice
Voting	Making a ballot Influencing the election
Climbing a tree	Holding on to branches Getting a good view
Filling out a personality test	Answering questions Revealing what you like
Taking a test	Answering questions Showing one's knowledge
Growing a garden	Planting seeds Growing fresh vegetables
Travelling by car	Following a map Seeing countryside
Pushing a doorbell	Moving a finger See if someone's home

Appendix 9: Apartment alternatives presented in text format

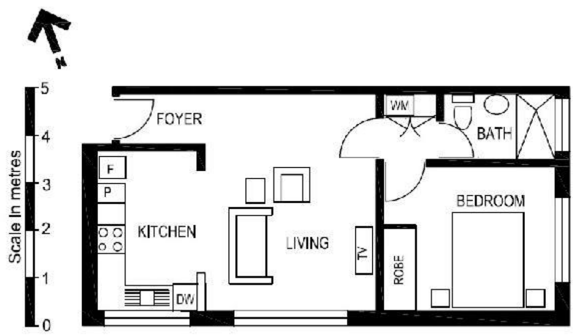
Apartment 1
Total floor space 60square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows and all-day direct sun
Dining space seats 6
Compact laundry in cupboard

Apartment 2
Total floor space 50 square meters
5.9m x 3.5m open plan living and kitchen
Built-in robe in bedroom
Large windows and all-day direct sun
No dining space
Compact laundry in cupboard

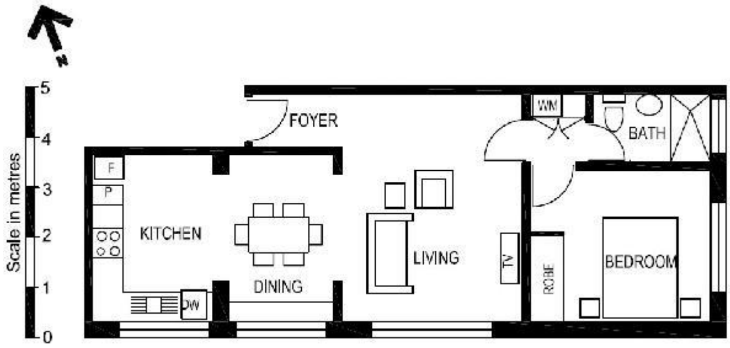
Apartment 3
Total floor space 50 square metres
5.9m x 3.5m open plan living and kitchen
Built-in robe in bedroom
Large windows but no direct sun
No dining space
Compact laundry in cupboard

Apartment 4
Total floor space 60 square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows but no direct sun
Dining space seats 6
Compact laundry in cupboard

Appendix 10: Apartment alternatives presented in floor plan format

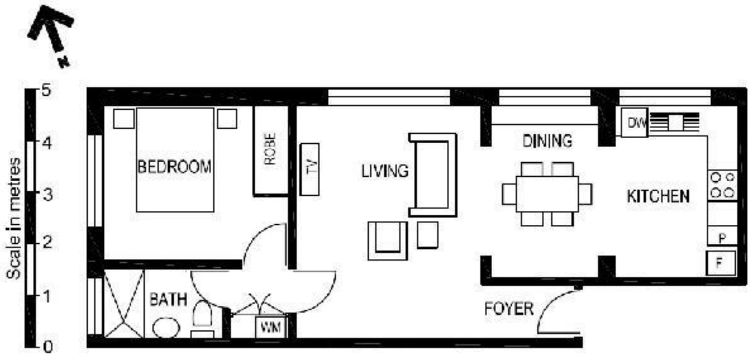


Floorplan 1



Floorplan 2

Floorplan 3



Floorplan 4

Appendix 11: Human Ethics Certificate of Approval

MONASH University

Monash University Human Research Ethics Committee (MUHREC)
Research Office

Human Ethics Certificate of Approval

Date:	**15 August 2013**	
Project Number:	**CF13/2329 – 2013001230**	
Project Title:	**User Perceptions of Property Floorplans**	
Chief Investigator:	**Prof Harmen Oppewal**	
Approved:	**From: 15 August 2013**	**To: 15 August 2018**

Terms of approval

1. The Chief investigator is responsible for ensuring that permission letters are obtained, if relevant, and a copy forwarded to MUHREC before any data collection can occur at the specified organisation. **Failure to provide permission letters to MUHREC before data collection commences is in breach of the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research**.
2. Approval is only valid whilst you hold a position at Monash University.
3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must contain your project number.
6. **Amendments to the approved project (including changes in personnel):** Requires the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC.
   Substantial variations may require a new application.
7. **Future correspondence:** Please quote the project number and project title above in any further correspondence.
8. **Annual reports:** Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.
9. **Final report:** A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.

10. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.
11. **Retention and storage of data:** The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

[redacted]

Professor Nip Thomson

Chair, MUHREC

cc: Dr Jan Brace-Govan, Ms Jacqueline Baker

Postal – Monash University, Vic 3800, Australia
[redacted]
ABN 12 377 614 012 CRICOS Provider #00008C

Appendix 12: Explanatory Statement

Project: "User Perceptions of Property Floorplans"

Dear participant,
My name is Jacqueline Baker. I am a PhD student working under the supervision of Professor Oppewal and Associate Professor Brace-Govan in the Department of Marketing. This study is part of my thesis project and you are invited to participate. Please read this Explanatory Statement in full before deciding whether or not to take part in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed below.

The aim/purpose of the research
The aim of this research is to provide insights into the role of floor plans in the intention to rent residential property; examining in particular how inherent and experienced-based abilities affect the way in which individuals understand visual representations of architectural layouts in the form of two dimensional floor-plans.

Possible benefits
This research finding will contribute towards gaining a better understanding of how floor plans can assist with online marketing of property. Outcomes may help designers of real estate portals and property sellers to better utilise floor plans in online marketing and more generally, may assist with visually representing products to the target market.

What does the research involve?
You will participate in a simulated choice and preference task involving the evaluation of residential property as well as undertaking a cognitive test, filling in a behaviour identification form and answering some questions. Consenting to participate in the project and withdrawing from the research. Being part of this study is voluntary and you are under no obligation to complete tasks. However, once you have done your tasks in the lab you cannot withdraw your answers from the study as they will be anonymous.

How much time will the research take?
These tasks will take between 10 and 15 minutes to complete.

Inconvenience/discomfort
We do not anticipate that the completion of the questionnaires will cause any discomfort.

Participation reward
By partaking in this research you will be receive credit towards your unit in accordance with the rules of the Department of Marketing subject pool.

Confidentiality

Your responses will be kept anonymous. All data collected will not be shared with anyone besides the researchers involved in conducting this research.

Storage of data
Data will be stored without any identifying personal information, although the eye-tracking data will be inherently linked to individual participants. Data collected will be securely stored in accordance with Monash University regulations for 5 years. A report of the study may be submitted for publication, but individual participants will not be identifiable in any way in such a report.

Use of data for other purposes
The anonymous data for this project will be held in a protected file and may be used for research and teaching purposes not immediately related to this project.

Results
If you would like to be informed of the aggregated research findings, please contact Jacqueline Baker on jacqueline.baker@monash.edu or Professor Harmen Oppewal on harmen.oppewal@monash.edu.

Complaints
Should you have any concerns or complaints about the conduct of the project, please quote the project reference number (CF13/2329) and contact the Executive Officer, Monash University Human Research Ethics (MUHREC):

Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
[redacted]

[redacted]

Thank you,

Jacqueline Baker	Prof. Harmen Oppewal	Assoc. Prof. Jan Brace-Govan
Phone: [redacted]	Phone: [redacted]	Phone: [redacted]
email: [redacted]	email: [redacted]	email: [redacted]

Continuing to the next page implies informed consent

Appendix 13: Pre-testing for study 1

The pre-test was administered to 118 respondents. Manipulations included presentation style, (text or floor plan), needs focus (entertaining needs or orientation needs), instruction type (entertaining or orientation) and instruction manipulation (before or after experiment). Two attributes were chosen for the pre-test, entertaining space and orientation, and respondents were asked to consider these attributes before evaluating apartments. This was a 2 x 2 x 2 design, resulting in eight apartment alternatives. The final manipulation was a between-subjects condition and therefore the eight apartments were re-evaluated by respondents after the instruction focus. Dependent variables were how much the apartment was liked, and whether respondents would be interested in living in the apartment. Additional dependent variables were included, some of them relevant and some not depending on the needs focus respondents were assigned to. They were: How well can the apartment accommodate drying cloths on a clothes airer? What chance does the apartment have at being naturally warm in winter? How well does the apartment accommodate a separate foyer? How well does the apartment accommodate a compact laundry? A scale was included with the experiment to test whether respondents were verbal or visual learners.

Appendix 14: User-needs manipulation

User-needs Manipulation – Sustainability

Four apartment options match your search criteria. The four apartments are presented over the following pages.

When considering each apartment option, you decide to check whether they can accommodate your further requirements. Imagine that you specifically want:

To dry clothes on a clothes airer

Natural warmth in winter

A separate foyer

A compact laundry

User-needs Manipulation – Entertaining

Four apartment options match your search criteria. The four apartments are presented over the following pages.
To hold dinner parties for 6 people

Room for friends to sleepover

A separate foyer

A compact laundry
User-needs Manipulation – Entertaining

Four apartment options match your search criteria. The four apartments are presented over the following pages.

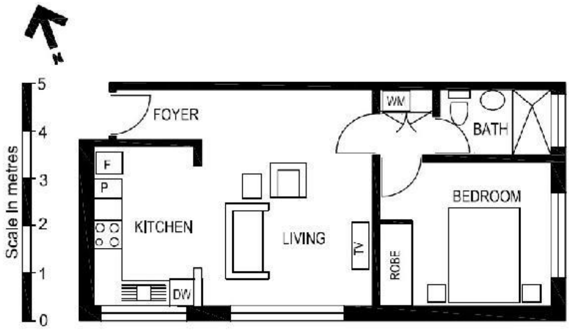
When considering each apartment option, you decide to check whether they can accommodate your further

Appendix 15: Matching task for text-format group

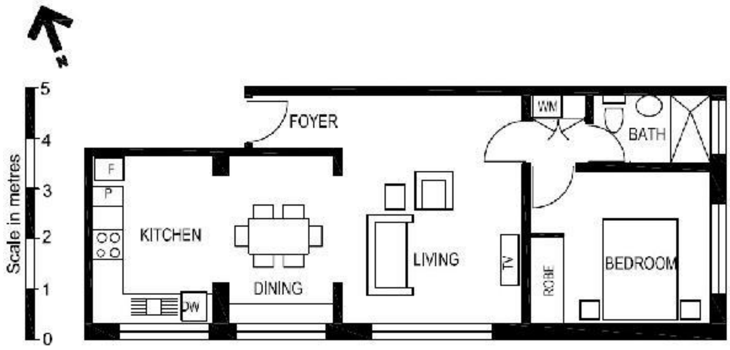
In your opinion, which floor plan (floor plans over page) best matches the following apartment description:

Total floor space 60 square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows but no direct sun
Dining space seats 6
Compact laundry in cupboard

Floorplan 1

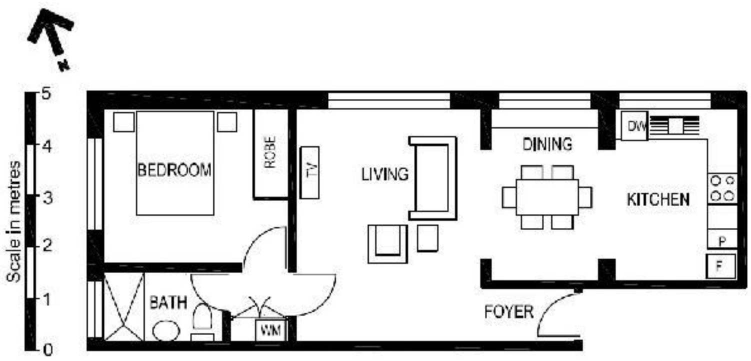


Floorplan 2



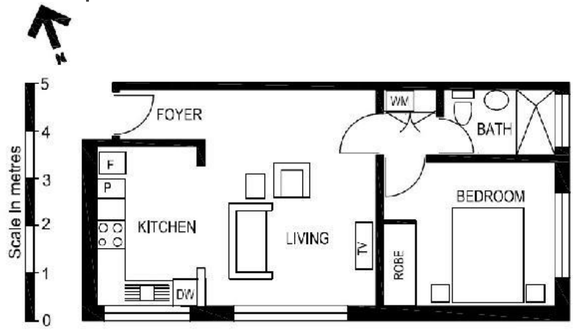
Floorplan 3

Floorplan 4



Appendix 16: Matching task for floor plan-format group

In your opinion, which floorplan best matches the following apartment description:



Apartment 1
Total floor space 60square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows and all-day direct sun
Dining space seats 6
Compact laundry in cupboard

Apartment 2
Total floor space 50 square meters
5.9m x 3.5m open plan living and kitchen
Built-in robe in bedroom
Large windows and all-day direct sun
No dining space
Compact laundry in cupboard

Apartment 3
Total floor space 50 square metres
5.9m x 3.5m open plan living and kitchen
Built-in robe in bedroom
Large windows but no direct sun
No dining space
Compact laundry in cupboard

Apartment 4
Total floor space 60 square meters
8.5m x 3.5m open plan living, dining and kitchen
Built-in robe in bedroom
Large windows but no direct sun
Dining space seats 6
Compact laundry in cupboard

Appendix 17: Property Browsing Questions

Have you ever searched for rental property on-line?

- ○ Yes
- ○ No

How many rental properties have you inspected over the past 2 years?

- ○ 1
- ○ 2-4
- ○ 5-9
- ○ 10 or more
- ○ I have not inspected any

What method have you used to search for rental property (select as many as apply)?

- ☐ Manually online
- ☐ Set up alerts for search criteria online
- ☐ Advertise online
- ☐ Other

On which property portal have you searched (select as many as apply)?

- ☐ realestate.com
- ☐ domain.com.au
- ☐ other online portals
- ☐ Gumtree
- ☐ Social media
- ☐ None

Appendix 18: Demographic questions

What is your age group?

- 18 - 20
- 21 - 23
- 24 - 26
- over 26

Please indicate your gender:

- Male
- Female

Which best describes you current living situation?

- Rent
- Own
- Share house
- With parents/family
- Other

What is your home country?

How long have you lived in Australia?

- less than 1 year
- 1 - 3 years
- 3.- 5 years
- Over 5 years but not all my life
- All my life

Appendix 19: Pre-testing for study 2

Before undertaking study 2, a pre-test was conducted to test the stimuli and to run a construal manipulation check, called the Behavioural Identification Form (BIF; Vallacher and Wegner, 1989), in a preference study. The measure is described in the methodology chapter and is included as Appendix 8: Behavioural Identification Form.

The scenarios and variables are described in the methodology chapter. In summary, the presentation style consisted of two levels, for the main study because no significant interaction effects were found between construal level and presentation style.

The BIF is a 25-item dichotomous questionnaire that records individual differences in construal level (concrete or abstract) that respondents identity with. This data is converted into a construal level index for each person and is used to evaluate the effectiveness of construal level manipulation. The (BIF) index describes activities in an abstract way and in a concrete way, and the task asked respondents to indicate which description they could most identify with. Respondents who identified with the lower level concrete description were scored 1 and those who identified with the higher level abstract description were scored 2. A construal level index was calculated for each respondent by adding up the scores and then dividing by the number of items in the questionnaire (25). The higher the index, the more the abstract the identification. The results of the overall items and individual items are presented in below.

The BIF results are reported here but not included as a manipulation check in the final study because it could not successfully assess the effectiveness of the construal level manipulation in the pre- test. For the same reason, the results of the pre-test are not reported here.

Manipulation check results

	Item	Concrete (mean)	Abstract (mean)	Sig
	All items (total)			.96
1	Eating	1.68	1.79	.32

2	Brushing teeth	1.74	1.79	.63
3	Resisting temptation	1.29	1.29	.98
4	Having cavity filled	1.26	1.54	.03
5	Talking to a child	1.50	1.46	.76
6	Locking a door	1.79	1.71	.46
7	Greeting someone	1.56	1.62	.62
8	Cleaning the house	1.32	1.38	.69
9	Washing the clothes	1.50	1.54	.76
10	Making a list	1.76	1.75	.90
11	Reading	1.53	1.71	.18
12	Joining the army	1.71	1.62	.53
13	Picking and apple	1.65	1.62	.87
14	Chopping down a tree	1.74	1.75	.87
15	Measuring room for carpeting	1.71	1.79	.90
16	Painting a room	1.62	1.71	.47
17	Paying the rent	1.44	1.42	.48
18	Caring for houseplants	1.65	1.58	.86
19	Voting	1.47	1.50	.63
20	Climbing a tree	1.76	1.83	.83
21	Filling out a personality test	1.53	1.75	.53
22	Taking a test	1.53	1.62	.09
23	Growing a garden	1.53	1.67	.48
24	Travelling by car	1.88	1.87	.30
25	Pushing a doorbell	1.65	1.67	.93

A BIF index was also created for each respondent however there was no significant difference between the concrete and abstract questions.

Ranking Task

The next section of the pre-test is an analysis for each attribute but does not test hypotheses so it is included here. A MANOVA was performed to capture the 25 dependent variables and comparing the concrete and abstract means for each item.

No significantly different means were reported on the combined dependent variables: F (25, 32) = .51, p = .96. When the results of each item were considered separately, none of them showed a significant difference between the concrete and abstract condition.

Purpose of MANOVA

The purpose of the MANOVA was to investigate differences in mean between low-level and high-level construal in a task in which respondents were asked to prioritize apartment features. This was done by ranking attributes from "the first feature you are interested in knowing about" to the last, for five attributes (rent, commute time, gym, dining and sunlight).

MANOVA results

The MANOVA results for the two construal conditions (independent variables) and each of the five apartment features are separately shown below. As can be seen, there are three significant effects: two main effects (gym and commute time) and one interaction effect (rent).

The following sections will discuss the results for each of the attributes separately.

MANOVA results

Conditions	Dependent variables	*Df*	*F*	*Sig.*
Psychological distance	Rent	1	.04	.85
	Commute time	1	4.79	.08***
	Gym	1	6.37	.04***
	Dining	1	.37	.57
	Sunlight	1	.21	.72
Construal thought manipulation	Rent	1	1.54	.22
	Commute time	1	2.07	.15
	Gym	1	.18	.68

	Dining	1	.85	.36
	Sunlight	1	.00	.98
Psychological distance * Construal thought manipulation	Rent	1	9.57	.00***
	Commute time	1	.2	.66
	Gym	1	1.33	.25
	Dining	1	.00	.98
	Sunlight	1	.84	.36

The Wilks' multivariate tests show that all of the variables *p<.05*

Rental Price

The attribute rental price varies in the experiment from $350 to $400 per week to rent the apartment.

Table of Means for Rental Price

Conditions	Sydney 1 year	Melbourne 2 months	*P* value	*Eta Squared*
Why	*M*=1.52, *SD*=.71	*M*=1.93, *SD*=1.20	F (1,255) = 9.57, p=.002	.04
How	*M*=2.06, *SD*=1.05	*M*=1.7, *SD*=.98		

A significant two-way interaction between psychological distance and construal thought manipulation was found [F (1,255) = 9.57, p=.002]. The means are considerably different for both conditions (1.7 - 1.52 = .18). The eta squared was .04 which is classified as a small effect (Cohen, 1988). The significant difference in means indicates that the attributes are indeed prioritised differently within the psychological distance variable levels, and within the mindset manipulation variable levels. However, they are also prioritised differently between the two conditions. In the psychological distance condition, low-level construal scored rental price more highly than high-level construal. However in the mindset manipulation, high-level construal scored price more highly.

Commute time

The attribute commute time varies in the experiment from 5 minutes commute time from the apartment to work to work 15 minutes commute time.

Table of Means for COMMUTE TIME

Conditions	Sydney 1 year	Melbourne 2 months	*P* value	*Eta Squared*
Why	*M*=2.45, *SD=1.202*	*M*=2.65, *SD*=1.291	F (1,255) = 43.15, p=.077	.012
How	*M*=2.16, *SD*=1.139	*M*=2.50, *SD*=1.280		

A marginally significant main effect of independent variable psychological distance on dependent variable commute time was found [F (1,255) = 43.15, p=.077] and the means are slightly different for both conditions (2.5 and 2.45) and the difference between them is small (-0.5). From the means, it can be seen that the construal condition of "how" and "why" does not differ much in terms of prioritising commute time (and it is not significant). With an eta squared of .012, this effect is classified as a small (Cohen, 1988). The difference between the two condition levels is such that low-level construal scored more highly than high-level construal for psychological distance. Although this result is not quite significant, commute time is expected to be scored more highly by those in the low-level construal condition in the experimental task.

Gym

The attribute gym varies in the experiment from gym nearby to the apartment to no gym nearby.

Table of Means for GYM

Conditions	Sydney 1 year	Melbourne 2 months	*P* value	*Eta* *Squared*
Why	*M*=4.36, *SD*=.831	*M*=3.87, *SD*=1.352	F (1,255) = 4.42, p=.036	.017
How	*M*=4.13, *SD*=1.225	*M*=3.98, *SD*=1.271		

A significant main effect of independent variable psychological distance on dependent variable gym was found [F (1,255) = 4.42, p=.036] as shown in the table above, the means are different for both conditions (4.36 and 3.98) and the difference, .38 is small. From the mean scores for gym across the construal condition of “how” - “why” it can be seen that the two levels prioritising gym much the same, however the difference in means scores for psychological distance levels on gym was significant. With an eta squared of .017, this effect is classified as a small (Cohen, 1988). The difference between the two condition levels is such that in the Sydney 1 year the mean score was higher than the Melbourne 2 months level, and psychological distance showing a significant difference in mean scores for gym. Gym is expected to be scored more highly by those in the high-level construal condition in the experimental task.

Dining

The attribute dining varies in the experiment from dining space to no dining space in the apartment.

Table of Means for DINING

Conditions	Sydney 1 year	Melbourne 2 months	*P* value	*Eta* *Squared*

Why	*M*=3.48, *SD=1.08*	*M*=3.56, *SD*=1.14	F (1,255) = .850, p=.36	.003
How	*M*=3.6, *SD*=1.12	*M*=3.68, *SD*=.95		

No significant effects were found for dining, [F (1,255) = 4.850, p=.36]. The means are slightly different for both conditions (3.68 and 2.48) and the difference between them is small (0.2). Dining is a spatial attribute used in both study 1 and study 2. From the ranking task, it is clear that dining is no difference in mean scoring between those respondent in low-level construal and those in high-level construal.

Sunlight

The attribute sunlight varies in the experiment from direct sunlight to no direct sunlight in the apartment.

Table of Means for SUNLIGHT

Conditions	Sydney 1 year	Melbourne 2 months	*P* value	*Eta Squared*
Why	*M*=3.19, *SD=1.29*	*M*=2.99, *SD*=1.24	F (1,255) = .841, p=.36	.003
How	*M*=3.05, *SD*=1.33	*M*=3.14, *SD=1.26*		

No significant effects were found for sunlight, [F (1,255) = .841, p=.36]. The means are slightly different for both conditions (3.19 and 3.14) and the difference between them is small (0.05). Sunlight is a spatial attribute used in both study 1 and study 2. From the ranking task, it is clear that sunlight is no difference in mean scoring between those respondent in low-level construal and those in high-level construal.

Pre-tests

Pre-tests	Date	No. respondents	Manipulations	Attributes
1	May 4-6 2015	175	2 (construal) x 2 (presentation style)	Orientation and entertaining space
2	Sept 16 & 17 2015	125	2 (construal) x 2 (presentation style)	Entertaining space

The first pre-test was held over three days, from the 4-6th May 2015 with 175 respondents. The survey manipulated both temporal (1 year, 1 month) and spatial (Sydney, Melbourne) psychological distance to classify respondents as being either in an abstract or concrete mindset. Presentation style was also manipulated. In both conditions, floor plans were included with the description; however in one condition only two attributes, orientation and entertaining space, were included whilst in the other, four additional attributes were included. Dependent variables were how much the apartment was liked, how well the apartment was perceived to accommodate drying clothes indoors on a clothes airer and how well the apartment is perceived to be naturally warm in winter. A further dependent variable was whether respondents would be interested in living in the apartment. There was no significant construal effect on the dependent variable, irrespective of whether it moderated presentation style or not. Further, as a construal manipulation check was not included, it was not possible to prove whether the effect did not exist at all or whether the construal priming was unsuccessful. It was decided to run a second pre-test that included a manipulation check and simplified the experimental task.

The second pre-test was held over two days, the 15-16th September 2015. It was the same as the first pre-test apart from three differences. Firstly, the attributes were changed from two to only one. Respondents were either shown a floor plan with one attribute (abstract) or a floor plan with the same attribute and a further five non-relevant attributes (concrete). The second difference was that this study only contained two dependent variables, how much respondents like the apartment and whether they would be interested in living in it. The third difference was that the BIF was included in this pre-test. Once again, analysis revealed that there was no construal effect on the DV. Additionally, the BIF manipulation check failed in that responses did not correctly predict the construal level that respondents were primed into.

Appendix 20: Psychological distance manipulation

High level (abstract) psychological distance (Sydney 1 year)

For this study, we are interested in people's decision-making process when renting apartments. Please imagine the following:

You have done well in your studies and are close to graduating. You have been looking for jobs and now have presently been offered an exciting graduate position with a company located in the central business district of **Sydney.** The position commences in **1 year.**

You are thinking about the sort of home you want in **Sydney**. Even though it is a **year** away, imagine you are already browsing on-line for apartments.

You make a list of the things important to you:

- 1 bedroom apartment style living
- a designated dining space
- sunlight
- in the range of $350 - $400 p/w rent
- to live a short commute from work.
- fitness

For this study, we are interested in people's decision-making process when renting apartments.

Low level (concrete) psychological distance (Melbourne 2 months)

For this study, we are interested in people's decision-making process when renting apartments. Please imagine the following:

You have done well in your studies and are close to graduating. You have been looking for jobs and now have presently been offered an exciting graduate position with a company located in the central business district of **Melbourne.** The position commences in **2 months.**

You are thinking about the sort of home you want in **Melbourne**. Imagine you are browsing on-line for apartments.

You make a list of the things important to you:

- 1 bedroom apartment style living
- a designated dining space
- sunlight
- in the range of $350 - $400 p/w rent
- to live a short commute from work.
- fitness

For this study, we are interested in people's decision-making process when renting apartments.

Appendix 21: Research Instrument Study One

Project: "User Perceptions of Property Floorplans"

Dear participant,
My name is Jacqueline Baker. I am a PhD student working under the supervision of Professor Oppewal and Associate Professor Brace-Govan in the Department of Marketing. This study is part of my thesis project and you are invited to participate. Please read this Explanatory Statement in full before deciding whether or not to take part in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed below.

The aim/purpose of the research
The aim of this research is to provide insights into the role of floor plans in the intention to rent residential property; examining in particular how inherent and experienced-based abilities affect the way in which individuals understand visual representations of architectural layouts in the form of two dimensional floor-plans.

Possible benefits
This research finding will contribute towards gaining a better understanding of how floor plans can assist with online marketing of property. Outcomes may help designers of real estate portals and property sellers to better utilise floor plans in online marketing and more generally, may assist with visually representing products to the target market.

What does the research involve?
You will participate in a simulated choice and preference task involving the evaluation of residential property as well as undertaking a cognitive test, filling in a behaviour identification form and answering some questions. Consenting to participate in the project and withdrawing from the research. Being part of this study is voluntary and you are under no obligation to complete tasks. However, once you have done your tasks in the lab you cannot withdraw your answers from the study as they will be anonymous.

How much time will the research take?
These tasks will take between 10 and 15 minutes to complete.

Inconvenience/discomfort
We do not anticipate that the completion of the questionnaires will cause any discomfort.

Participation reward
By partaking in this research you will be receive credit towards your unit in accordance with the rules of the Department of Marketing subject pool.

Confidentiality
Your responses will be kept anonymous. All data collected will not be shared with anyone besides the researchers involved in conducting this research.

Storage of data
Data will be stored without any identifying personal information, although the eye-tracking data will be inherently linked to individual participants. Data collected will be securely stored in accordance with Monash University regulations for 5 years. A report of the study may be submitted for publication, but individual participants will not be identifiable in any way in such a report.

Use of data for other purposes
The anonymous data for this project will be held in a protected file and may be used for research and teaching purposes not immediately related to this project.

Results
If you would like to be informed of the aggregated research findings, please contact Jacqueline Baker on jacqueline.baker@monash.edu or Professor Harmen Oppewal on harmen.oppewal@monash.edu.

Complaints
Should you have any concerns or complaints about the conduct of the project, please quote the project reference number (CF13/2329) and contact the Executive Officer, Monash University Human Research Ethics (MUHREC):

Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
[redacted]

[redacted]

Thank you,

Jacqueline Baker	Prof. Harmen Oppewal	Assoc. Prof. Jan Brace-Govan
Phone: [redacted]	Phone: [redacted]	Phone: [redacted]
email: [redacted]	email: [redacted]	email: [redacted]

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Scenario Explanation

We are interested in people's decision-making process when renting apartments.

For this study, please imagine the following:

Suppose you have graduated.

You have decided you want to live alone.

You have decided you'll search for a 1 bedroom apartment on-line.

You have selected South Yarra in Melbourne, Australia, as your preferred location. You have determined you can afford to pay $350-$450 per week rent.

. . . .

Now imagine that you enter your search criteria on-line using a real estate portal such as realestate.com:

Property Type: Apartment

Number of bedrooms: 1

Locations: South Yarra (Melbourne, Australia)

Price: $350 - $400 per week

. . . .

Priming for task to follow

Four apartment options match your search criteria. The four apartments are presented over the following pages

When considering each apartment option, you decide to check whether they can accommodate your further requirements. Imagine that you specifically want:

To dry clothes on a clothes airer

Natural warmth in winter

A separate foyer

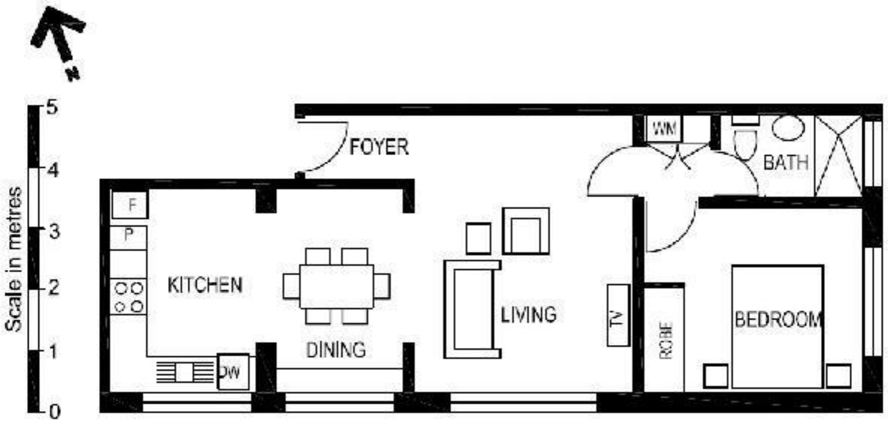
A compact laundry

. . . .

....

Example of floor plan format for each alternative -

Example of floor plan format for alternative one



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1. How much do you like this apartment?

Dislike Extremely | Dislike Very Much | neither Like nor Dislike | Like Very Much | Like Extremely

○ ○ ○ ○ ○

2. Would you be interested in inspecting this apartment?

Yes | Maybe | No

○ ○ ○

3. How well can the apartment accommodate drying clothes on a clothes airer?

Poor Fair Good Very good Excellent

○ ○ ○ ○ ○

4. What chance does the apartment have at being naturally warm in winter?

Poor	Fair	Good	Very good	Excellent
○	○	○	○	○

5. How well does the apartment accommodate a separate foyer?

Poor	Fair	Good	Very good	Excellent
○	○	○	○	○

6. How well does the apartment accommodate a compact laundry?

Poor	Fair	Good	Very good	Excellent
○	○	○	○	○

7. Given your needs, how much do you like this apartment?

Dislike Extremely	Dislike Very Much	neither Like nor Dislike	Like Very Much	Like Extremely
○	○	○	○	○

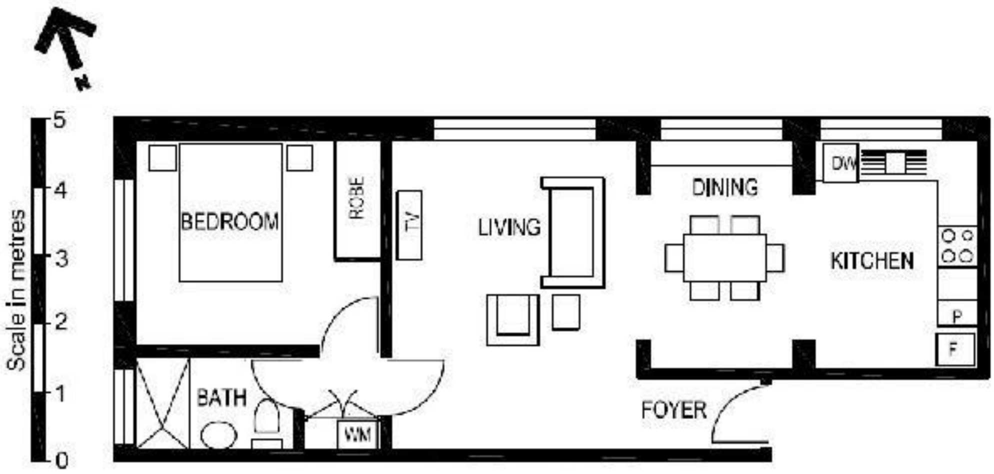
8. Given your needs, would you be interested in inspecting this apartment?

Yes	Maybe	No
○	○	○

....

…………………………………………………………………….

Example of floor plan format for alternative two



Question 1-8 repeated for apartment alternative 2

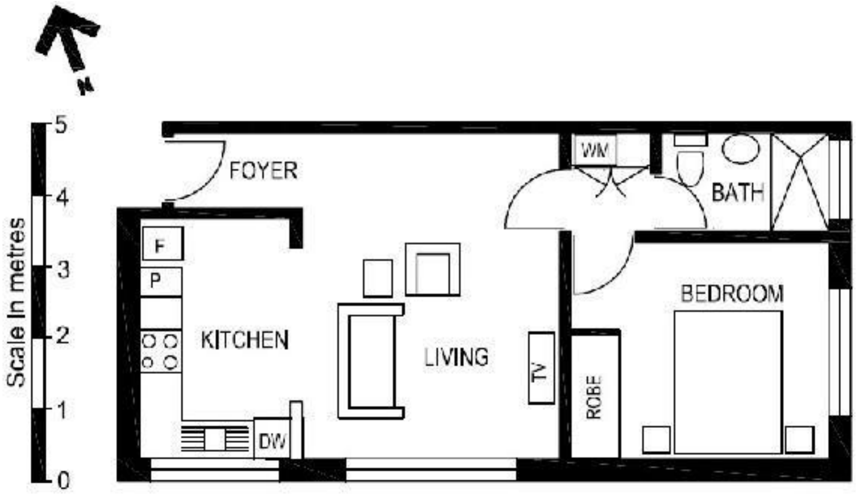
………………………………………………………………………….

Example of floor plan format for alternative three

Question 1-8 repeated for apartment alternative 3

………………………………………………………………

Example of floor plan format for alternative four



Question 1-8 repeated for apartment alternative 4

…………………………………………………………………

Understanding Property Descriptions

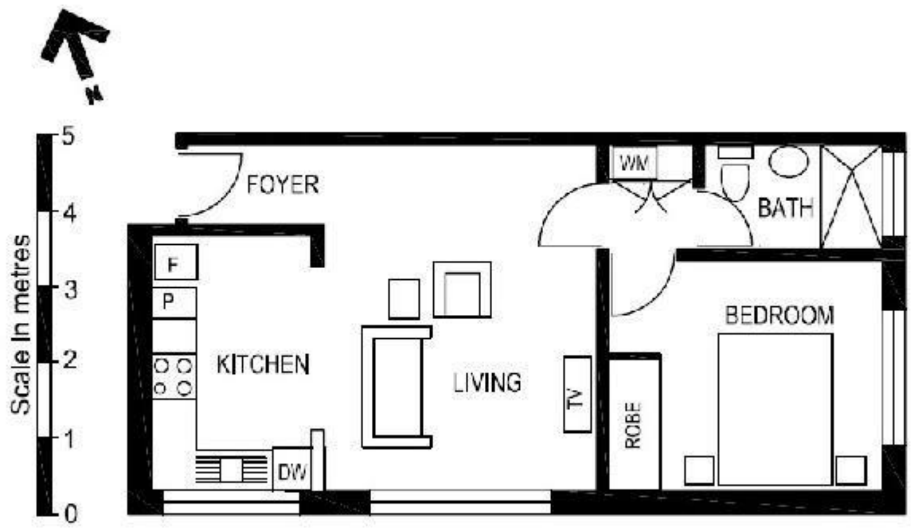
Property is commonly marketed to consumers by describing features and benefits with text, symbols, photographs and floorplans.
In this survey you are being presented with visual descriptions of apartments in the form of floorplans. When searching for property online, it is important that you understand floorplans in order that you can evaluate properties and decide whether or not to attend an inspection.

Floorplans, such as the floorplan of an apartment shown below, are two dimensional diagrams that communicate the important characteristics of property such as the layout, the space available for activities and the position in relation to the sun.

When assessing the position of property in relation to the sun, check the direction of the North Point adjacent to the floorplan. North indicates roughly the direction of the sun at midday. The sun rises to the east of north and sets to the west of north.

Knowing the direction of north can assist in checking whether direct sunlight will penetrate any of the window openings on the outside walls of the apartment. **If the windows of the apartment are located to the east or west of north and/or directly north, this tells you that the apartment is well positioned in relation to North.**

The floorplan shown below indicates that the apartment is positioned poorly in relation to north. None of the windows are penetrated by direct sun and so this apartment would not receive any direct sunlight and would not be naturally warm in winter. This could have the drawback of feeling cold and dark and heating bills would be higher than apartments facing north.



....

With respect to the evaluation questions that you've answered so far, to what extent did you consider whether the apartments were north-facing so that they could accommodate your needs?

Never	Rarely	Sometimes	Often	All of the Time
○	○	○	○	○

How useful has this information been?

Very Useless	Useless	Neutral	Useful	Very Useful
○	○	○	○	○

Please now consider four more apartment floorplans and answer the evaluation questions. Remember to Imagine that you specifically want:

To dry clothes on a clothes airer

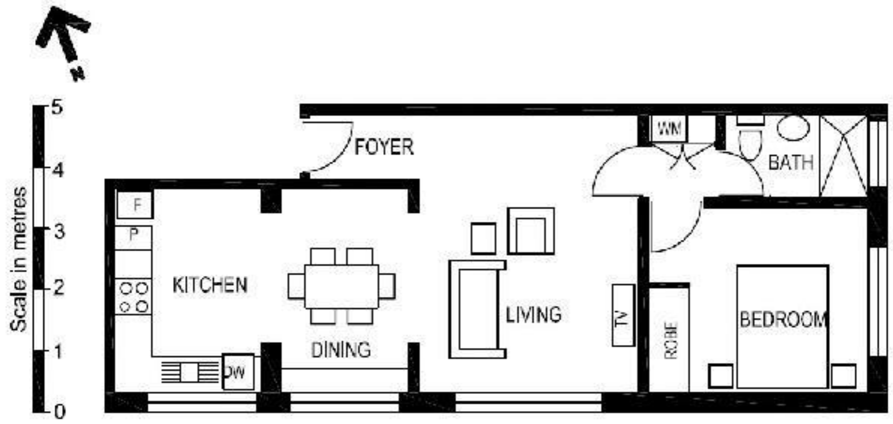
Natural warmth in winter

A separate foyer

A compact laundry

....

Example of floor plan format for alternative one



1. How well can the apartment accommodate drying clothes on a clothes airer?

Poor	Fair	Good	Very good	Excellent
○	○	○	○	○

2. What chance does the apartment have at being naturally warm in winter?

Poor	Fair	Good	Very good	Excellent
○	○	○	○	○

3. How well does the apartment accommodate a separate foyer?

Poor	Fair	Good	Very good	Excellent

○ ○ ○ ○ ○

4. How well does the apartment accommodate a compact laundry?

Poor Fair Good Very good Excellent

○ ○ ○ ○ ○

5. Given your needs, how much do you like this apartment?

Dislike Extremely | Dislike Very Much | neither Like nor Dislike | Like Very Much | Like Extremely

○ ○ ○ ○ ○

6. Given your needs, would you be interested in inspecting this apartment?

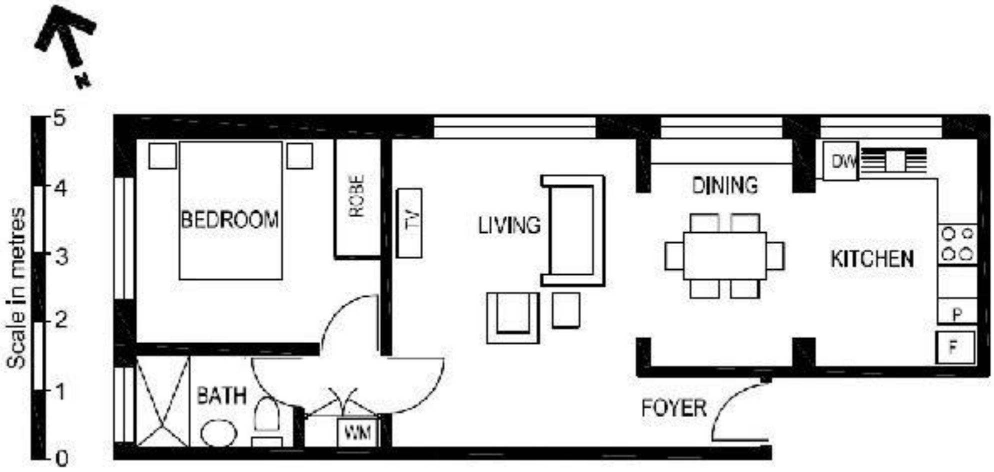
Yes | Maybe | No

○ ○ ○

....

…………………………………………………………………

Example of floor plan format for alternative two



Question 1-6 repeated for apartment alternative 2

…………………………………………………………………

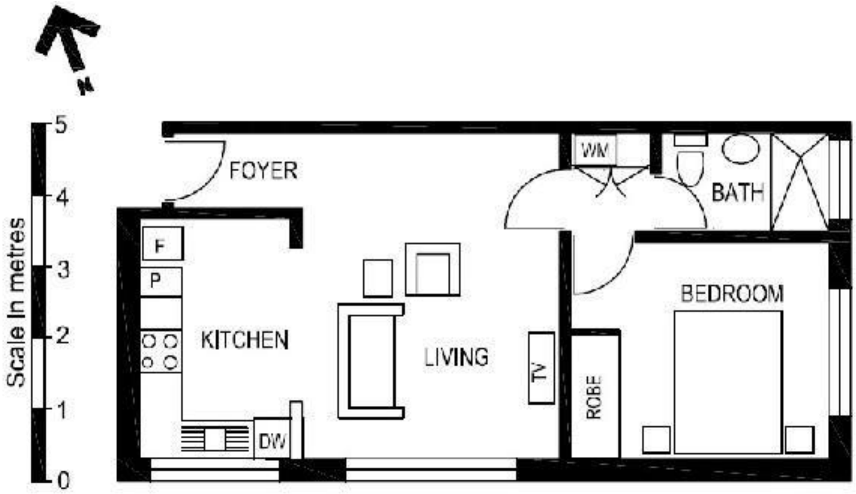
Example of floor plan format for alternative three

Question 1-6 repeated for apartment alternative 3

…………………………………………………………………

……………………………………………………………

Example of floor plan format for alternative four

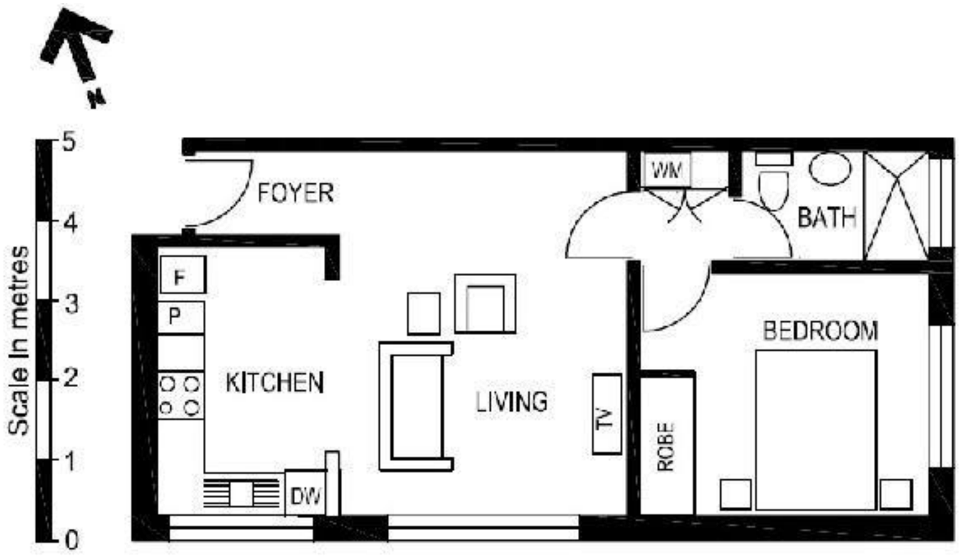


Question 1-6 repeated for apartment alternative 4

……………………………………………………………

……………………………………………………………

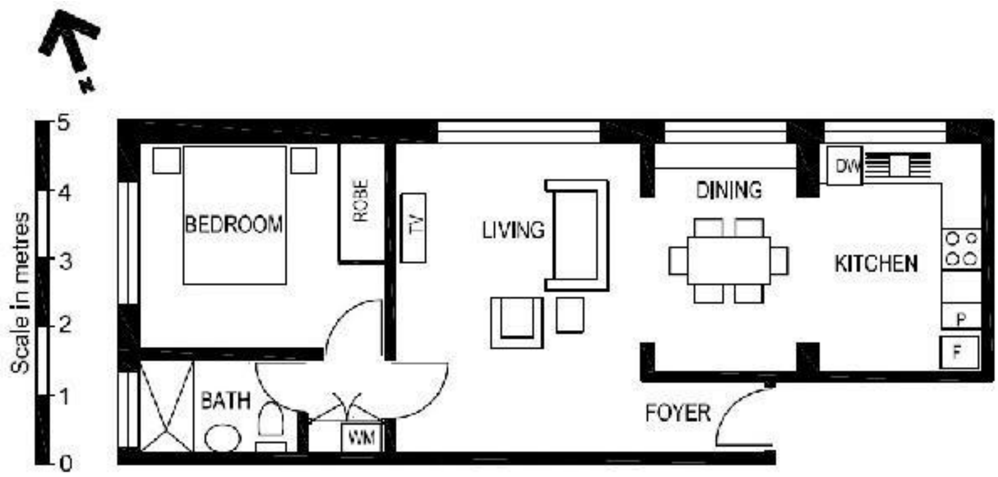
In your opinion, which apartment description best matches the following floor plan:



□ Apartment 1 Total floorspace 60square meters 8.5m x 3.5m open plan living, dining and kitchen Built-in robe in bedroom Large windows and all-day direct sun Dining space seats 6 Compact laundry in cupboard	□ Apartment 3 Total floorspace 50 square metres 5.9m x 3.5m open plan living and kitchen Built-in robe in bedroom Large windows but no direct sun No dining space Compact laundry in cupboard
□ Apartment 2 Total floorspace 50 square meters 5.9m x 3.5m open plan living and kitchen Built-in robe in bedroom Large windows and all-day direct sun No dining space Compact laundry in cupboard	□ Apartment 4 Total floorspace 60 square meters 8.5m x 3.5m open plan living, dining and kitchen Built-in robe in bedroom Large windows but no direct sun Dining space seats 6 Compact laundry in cupboard

……………………………………………………………

Please take some time to describe the apartment below in your own words, in a few keywords or sentences (at least three):



Searching for rental property

Have you ever searched for rental property?

- ☐ Yes
- ☐ No

Have you ever searched for rental property on-line?

- ☐ Yes
- ☐ No

How many rental properties have you inspected over the past 2 years?

- ☐ 1
- ☐ 2-4
- ☐ 5-9
- ☐ 10 or more
- ☐ I have not inspected any

What method have you used to search for rental property (select as many as apply)?

- ☐ Manually online
- ☐ Set up alerts for search criteria online
- ☐ Advertise online
- ☐ Other

On which property portal have you searched (select as many as apply)?

- ☐ realestate.com
- ☐ domain.com.au
- ☐ other online portals
- ☐ Gumtree
- ☐ Social media
- ☐ None

Demographic questions

What is your age group?

- ☐ 18 - 20
- ☐ 21 - 23
- ☐ 24 - 26
- ☐ over 26

Please indicate your gender:

- ☐ Male
- ☐ Female

Which best describes you current living situation?

- ☐ Rent
- ☐ Own
- ☐ Share house
- ☐ With parents/family
- ☐ Other

What is your home country?

How long have you lived in Australia?

- ☐ less than 1 year
- ☐ 1 - 3 years
- ☐ 3.- 5 years
- ☐ Over 5 years but not all my life
- ☐ All my life

Processing Style Scales

To finalize this survey, we have chosen three scales that ask you questions about your style of thinking.

Research shows that people have different styles of thinking through tasks. This information will help us to understand how processed information about the apartments that you evaluated.

Scale 1

You are required to indicate how much you agree or disagree with the 6 statements.

Items	Strongly agree	Moderately Agree	Slightly agree	Neither agree nor disagree	Slightly disagree	Moderately disagree	Strongly disagree
I prefer to learn visually							
I prefer to learn verbally							
I am a visual learner							
I am a verbal learner							
I am good at learning from labelled pictures, illustrations, graphs, maps and animations							
I am good at learning from printed text							

Scale 2

Items	Always true	Usually true	Usually False	Always false
1. I enjoy doing work that requires the use of words				
2. There are some special times in my life that I like to relive by mentally "picturing" just how everything looked				
3. I can never seem to find the right word when I need it				
4. I do a lot of reading				
5. When I'm trying to learn something new, I'd rather watch a demonstration than read how to do it				
6. I think I often use words in the wrong way				
8. I like to picture how I could fix up my apartment or a room if I could buy anything I wanted				
9. I often make written notes to myself				
10. I like to daydream				
11. I generally prefer to use a diagram than a written set of instructions				
12. I like to "doodle"				
13. I find it helps to think in terms of mental pictures when doing many things				
14. After I meet someone for the first time, I can usually remember what they look not much about them				
15. I like to think of synonyms for words				
16. When I have forgotten something, I frequently try to form a mental picture to remember it				

Scale 3:

You are required to indicate how much you agree or disagree with each of the statements:

	Strongly Agree								Strongly Disagree
	1	2	3	4	5	6	7	8	9
1. Intuition can be a useful way to solve problems									
2. I don't like situations in which I have to rely on intuition									
3. Thinking hard for a long time about something gives me little satisfaction									
4. I like to rely on my intuitive impressions									
5. Thinking is not my idea of an enjoyable activity									
6. I am much better at figuring things out logically than most people									
7. I try to avoid situations that require thinking in depth about something									
8. I prefer complex problems to simple problems									
9. I am not a very analytical thinker									
10. I trust my initial feelings about people									
11. I generally don't depend on my feelings to help me make decisions									
12. I think it is fooling to make important decisions based on feelings									
13. If I were to rely on my gut feelings, I would often make mistakes									
14. I enjoy intellectual challenges									
15. Using my gut feelings usually works well for me in figuring out problems in my life									
16. I am not very good at solving problems that require careful logical analysis									
17. I often go by my instincts when deciding on a course of action									
18. I'm not that good at figuring out complicated problems									
19. I don't have a very good sense of intuition									
20. I enjoy solving problems that require hard thinking									

Thank you for your participation. Please type any comments you may have for the researchers about this study

Appendix 22: Research Instrument Study Two

Project: “User Perceptions of Property Floorplans”

Dear participant,
My name is Jacqueline Baker. I am a PhD student working under the supervision of Professor Oppewal and Associate Professor Brace-Govan in the Department of Marketing. This study is part of my thesis project and you are invited to participate. Please read this Explanatory Statement in full before deciding whether or not to take part in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed below.

The aim/purpose of the research
The aim of this research is to provide insights into the role of floor plans in the intention to rent residential property; examining in particular how inherent and experienced-based abilities affect the way in which individuals understand visual representations of architectural layouts in the form of two dimensional floor-plans.

Possible benefits
This research finding will contribute towards gaining a better understanding of how floor plans can assist with online marketing of property. Outcomes may help designers of real estate portals and property sellers to better utilise floor plans in online marketing and more generally, may assist with visually representing products to the target market.

What does the research involve?
You will participate in a simulated choice and preference task involving the evaluation of residential property as well as undertaking a cognitive test, filling in a behaviour identification form and answering some questions. Consenting to participate in the project and withdrawing from the research. Being part of this study is voluntary and you are under no obligation to complete tasks. However, once you have done your tasks in the lab you cannot withdraw your answers from the study as they will be anonymous.

How much time will the research take?
These tasks will take between 10 and 15 minutes to complete.

Inconvenience/discomfort
We do not anticipate that the completion of the questionnaires will cause any discomfort.

Participation reward
By partaking in this research you will be receive credit towards your unit in accordance with the rules of the Department of Marketing subject pool.

Confidentiality

Your responses will be kept anonymous. All data collected will not be shared with anyone besides the researchers involved in conducting this research.

Storage of data
Data will be stored without any identifying personal information, although the eye-tracking data will be inherently linked to individual participants. Data collected will be securely stored in accordance with Monash University regulations for 5 years. A report of the study may be submitted for publication, but individual participants will not be identifiable in any way in such a report.

Use of data for other purposes
The anonymous data for this project will be held in a protected file and may be used for research and teaching purposes not immediately related to this project.

Results
If you would like to be informed of the aggregated research findings, please contact Jacqueline Baker on jacqueline.baker@monash.edu or Professor Harmen Oppewal on harmen.oppewal@monash.edu.

Complaints
Should you have any concerns or complaints about the conduct of the project, please quote the project reference number (CF13/2329) and contact the Executive Officer, Monash University Human Research Ethics (MUHREC):

Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
[redacted]

[redacted]

Thank you,

Jacqueline Baker	Prof. Harmen Oppewal	Assoc. Prof. Jan Brace-Govan
Phone: [redacted]	Phone: +[redacted]	Phone: [redacted]
email: [redacted]	email: [redacted]	email: [redacted]

Continuing to the next page implies informed consent

For this study, we are interested in people's decision-making process when renting apartments.

Please imagine the following:

You have done well in your studies and are close to graduating. You have been looking for jobs and now have presently been offered an exciting graduate position with a company located in the central business district of **Sydney.** The position commences in **1 year.**

You are thinking about the sort of home you want in **Sydney**. Even though it is a **year** away, imagine you are already browsing on-line for apartments.

You make a list of the things important to you:

- 1 bedroom apartment style living
- a designated dining space
- sunlight
- in the range of $350 - $400 p/w rent
- to live a short commute from work.
- Fitness

…………………………………………………………………

As it may be difficult to imagine what it means to accept a new position and move house, we ask you to think carefully about this situation. Please list three reasons **WHY** you would move from your current accommodation to a new apartment in **Sydney** in **1 year**

WHY (1)

WHY (1)

WHY (1)

…………………………………………………………

You will soon be presented with eight apartment options. Each one varies in whether it has a dining space, whether it gets direct sunlight, whether it has a gym nearby, whether it has a commute time of 5 minutes or 15 minutes and whether the rent is closer to $350 or closer to $400 per week.

But before you evaluate the apartments, we would like to understand which of the features is the first one you would be interested in?

Click the FIRST feature you would be interested in knowing about when renting a new apartment.

- ☐ Whether the rent is closer to $350 or closer to $400 per week
- ☐ Whether it has a commute time of closer to 5 or closer to 15 minutes
- ☐ Whether there is a gym nearby
- ☐ Whether it has a dining space
- ☐ Whether it gets direct sunlight

(the selected feature will disappear and the respondent will be asked the same question for the remaining four features, and so on until they have all been selected)

…………………………………………………………

You will now be presented with four pairs of apartments that will be available in a year in Sydney.

For each apartment option, please evaluate the features and consider whether you would be interested in living in it.

…………………………………………………………

. . . .

Information about two different apartments is provided below. Please study them and answer the corresponding questions

Alternative 1

Rent $400 per week

15 minute commute to work on train

No gym nearby

With dining space

All-day direct sunlight

1. How much do you like this apartment?

Like a lot | Like moderately | like a little | neither like nor dislike | dislike a little | dislike moderately| dislike a lot

○ ○ ○ ○ ○ ○ ○

Alternative 2

Rent $400 per week

15 minute commute to work on train

Gym nearby

No dining space

All-day direct sunlight

2. How much do you like this apartment?

Like a lot | Like moderately | like a little | neither like nor dislike | dislike a little | dislike moderately| dislike a lot

○ ○ ○ ○ ○ ○

Which of these two apartments would you choose to rent?

First | Second | Neither

○ ○ ○

…………………………………………………………

Information about two different apartments is provided below. Please study them and answer the corresponding questions

Alternative 3

Rent $350 per week

15 minute commute to work on train

Gym nearby

No dining space

No direct sunlight

1. How much do you like this apartment?

Like a lot | Like moderately | like a little | neither like nor dislike | dislike a little | dislike moderately| dislike a lot

○ ○ ○ ○ ○ ○ ○

Alternative 4

Rent $350 per week

15 minute commute to work on train

No gym nearby

With dining space

No direct sunlight

2. How much do you like this apartment?

Like a lot | Like moderately | like a little | neither like nor dislike | dislike a little | dislike moderately| dislike a lot

○ ○ ○ ○ ○ ○

Which of these two apartments would you choose to rent?

First | Second | Neither

○ ○ ○

……………………………………………………………

You will soon be presented with **one final pair of apartment options.** As before, they vary in whether they have a dining space, whether they get direct sunlight, whether they have a gym nearby, whether they have a commute time of 5 minutes or 15 minutes and whether the rent is closer to $350 or closer to $400 per week.

But before you evaluate the final pair of apartments, we would like to understand whether the features that are most important to you have changed since you evaluated the 8 apartments.

Click the FIRST feature you would be interested in knowing about when renting a new apartment.

- □ Whether the rent is closer to $350 or closer to $400 per week
- □ Whether it has a commute time of closer to 5 or closer to 15 minutes
- □ Whether there is a gym nearby
- □ Whether it has a dining space
- □ Whether it gets direct sunlight

(the selected feature will disappear and the respondent will be asked the same question for the remaining four features, and so on until they have all been selected)

……………………………………………………………

You will now be presented with one final pair of apartments to evaluate

Alternative 1

Rent $400 per week

15 minute commute to work on train

No gym nearby

With dining space

All-day direct sunlight

1. How much do you like this apartment?

Like a lot | Like moderately | like a little | neither like nor dislike | dislike a little | dislike moderately| dislike a lot

○ ○ ○ ○ ○ ○

Alternative 2

Rent $400 per week

15 minute commute to work on train

Gym nearby

No dining space

All-day direct sunlight

2. How much do you like this apartment?

Like a lot | Like moderately | like a little | neither like nor dislike | dislike a little | dislike moderately| dislike a lot

○ ○ ○ ○ ○ ○

Which of these two apartments would you choose to rent?

First | Second | Neither

○ ○ ○

……………………………………………………………

At the beginning of the survey, we asked you to imagine you are renting an apartment in a city in Australia. Can you recall which city that was? (Please write the city below)

____

We also asked you to imagine moving in a specific time-frame. Can you recall what that was? (Please write the timeframe below)

____

Can you recall what you stated as your major reason WHY or HOW you wanted to move to a new apartment?

____

____

____

____

____

This 22-item scale asks you questions about your preferred style of thinking.

Research shows that people differ in how they use words and pictures. This information will help us to understand how your preferred way of information processing influenced your apartment evaluations.

I enjoy doing work that requires the use of words

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

There are some special times in my life that I like to relive by mentally "picturing" just how everything looked

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I can never seem to find the right word when I need it

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I do a lot of reading

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

When I'm trying to learn something new, I'd rather watch a demonstration than read how to do it

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I think I often use words in the wrong way

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I enjoy learning new words

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I like to picture how I could fix up my apartment or a room if I could buy anything I wanted

- ◯ Always True
- ◯ Usually True
- ◯ Usually False
- ◯ Always False

I often make written notes to myself

- ◯ Always True
- ◯ Usually True
- ◯ Usually False
- ◯ Always False

I like to daydream

- ◯ Always True
- ◯ Usually True
- ◯ Usually False
- ◯ Always False

I generally prefer to use a diagram than a written set of instructions

- ◯ Always True
- ◯ Usually True
- ◯ Usually False
- ◯ Always False

I like to "doodle"

- Always True
- Usually True
- Usually False
- Always False

I find it helps to think in terms of mental pictures when doing many things

- Always True
- Usually True
- Usually False
- Always False

After I meet someone for the first time, I can usually remember what they look like, but not much about them

- Always True
- Usually True
- Usually False
- Always False

I like to think of synonyms for words

- Always True
- Usually True
- Usually False
- Always False

When I have forgotten something, I frequently try to form a mental picture to remember it

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I like learning new words

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I prefer to read instructions about how to do something rather than have someone show me

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I prefer activities that don't require a lot of reading

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I seldom daydream

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

I spend very little time trying to increase my vocabulary

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

My thinking often consists of mental “pictures” or images

- ○ Always True
- ○ Usually True
- ○ Usually False
- ○ Always False

To finalize this survey, we have included some questions about yourself

What is your age group?

- ○ 18 - 20
- ○ 21 - 23
- ○ 24 - 26
- ○ over 26

Please indicate your gender:

- ○ Male
- ○ Female

Which best describes you current living situation?

- ○ Rent
- ○ Own
- ○ Share house
- ○ With parents/family
- ○ Other ____

Do you currently live in an apartment?

- ○ Yes
- ○ No

When did you last move house?

- ○ < 6 months
- ○ 6 months - 2 years
- ○ 2-3 years
- ○ 3 years+

What is your home country?

____

In which hemisphere is your home country?

- ○ Northern Hemisphere
- ○ Southern Hemisphere

Is English your first language?

- ○ Yes
- ○ No

How long have you lived in Australia?

- ○ less than 1 year
- ○ 1 - 3 years
- ○ 3.- 5 years
- ○ Over 5 years but not all my life
- ○ All my life

Have you visited Sydney in the past 5 years?

○ No

○ Yes. If so, how much time have you spent there?

____

If you were offered a job with a company after graduation and you could choose between working in their Melbourne office and their Sydney office, which location would you prefer?

○ Melbourne (1)

○ Sydney (2)

Do you have any comments or feedback about this survey?

____

____

____

____

....

Appendix 23: Discussion and Analysis of measures in Study 1

Santa Barbra Learning Style Questionnaire (SBLSQ)

The SBLSQ is a simple self-rating questionnaire about learning style which could be an effective substitute for longer more time consuming instruments according to Mayer and Massa, (2003). The SBLSQ measure contains only 6 items on which participants are asked to rate the degree to which they are more verbal or more visual learners on a 7-point scale. The SBLSQ consists of two sub-scales, the first containing three items collectively named "visual learner" items and the second containing also three items, collectively named "verbal learner". 823 respondents participated in this scale.

Relevance of the SBLSQ to the study

The purpose of including the SBLSQ in the survey was to determine the preferred cognitive processing style of participants and prepare it for hypothesis testing as a moderator of preferences of apartments.

The most interesting of differences to be tested are between the between-groups condition of presentation style. It is expected that visual learners will understand floor plans better than verbal learners supported by a larger effect size than verbal learners.

Santa Barbra Learning Style Questionnaire (SBLSQ)

	Scale Items	Strongly agree	Moderately agree	Slightly agree	Neither agree nor disagree	Slightly disagree	Moderately disagree	Strongly disagree
1	I prefer to learn visually (VIS)							
2	I prefer to learn verbally (VERB)							
3	I am a visual learner (VIS)							
4	I am a verbal learner (VERB)							

5	I am good at learning from labelled pictures, illustrations, graphs and maps (VIS)							
6	I am good at learning from printed text (VERB)							

Reliability test

Chronbach's alpha measures internal consistency which in turn describes the extent to which all the items in a test measure the same construct. Internal consistency therefore depicts the inter-relatedness of the items within the test. As the SBLSQ consists of two sub-scales, reliability was tested on the three visual items and the three verbal items separately. The Chronbach's alpha coefficient for the visual items of the scale was $\alpha = 0.89$. The general "rule of thumb" is that Chronbach's alpha coefficient should be > .7 to be classified as adequate. Based on this the visual learner sub-scale is classified as adequate. The Chronbach's alpha coefficient for the verbal learner sub-scale was $\alpha = 0.78$ and so it is classified as adequate; therefore, this 6-item scale is considered to be adequate for use with this sample.

Factor Analysis

The 6-item SBLSQ measure was submitted to a three-part process of data reduction. This involved assessing the suitability of the data for factor analysis, data extraction and factor rotation. The first step, assessing the data, was done by inspecting the correlation matrix for coefficients of 0.3 and above and calculating the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity. The correlation matrix revealed that there were many coefficients of .3 and above. The Kaiser-Meyer-Olkin value was .65 exceeding the recommended value of .6 (H. F. Kaiser, 1970; M. Kaiser, 1974) and the Bartlett's test of Sphericity (Bartlett, 1954) reached statistical significance, supporting the factorability of the items in the SBLSQ. This means that the SBLSQ measure is suitable for factor analysis.

The second step of data reduction was factor extraction. This involved using principal components analysis to ascertain how many underlying factors the items contain. The process of factor extraction revealed two components with eigenvalues exceeding 1, explaining 45.8%, and 31% of the variance respectively. A scree plot was generated, confirming that an "elbow" shape occurred in the plot at the location between the second the third component. Using Catell's (1966) scree test, it was decided to retain the first two components for further investigation because they capture much more eigenvalue between the components than the other four items. This was confirmed by the component matrix which contained loadings of each of the six items on the two components. The two components were automatically retained as these were the only components of eigenvalue 1 or greater than 1.

The third step of data reduction was for the purpose of aiding interpretation of the retained components. This involved rotating component 1 and component 2 using Varimax and Kaiser Normalization. The rotated solution revealed the presence of simple structure (Thurstone, 1947) ,with both components showing a number of strong loadings and all variables loading substantially on only one component. The two factor solution explained a total of 76.8% of variance, with component 1 contributing 41.2 % and component 2 contributing 35.6 %.

Looking at the rotated component matrix, the main loadings on component 1 are "I prefer to learn visually", "I am a visual learner" and "I am good at learning from labelled pictures, illustrations, graphs and maps". The main items in component 2 are "I prefer to learn verbally" and "I am a verbal learner" and "I am good at learning from printed text". The interpretation of the two components was consistent with Mayer and Massa, (2003) visual learner and verbal learner scale, with all visual items loading onto component 1 and named "visual learner" and all verbal items loading onto component 2 and named "verbal learner".

In summary, the interpretation of the two components showed that visual items loaded strongly on component 1 and verbal items on component 2. The results of this analysis supports the use of the visual factor being labelled as "visual learners" and the verbal factor labelled as "verbal learners" which is consistent with Mayer and Massa's, (2003) sub-scale factors.

Rotated Component Matrix

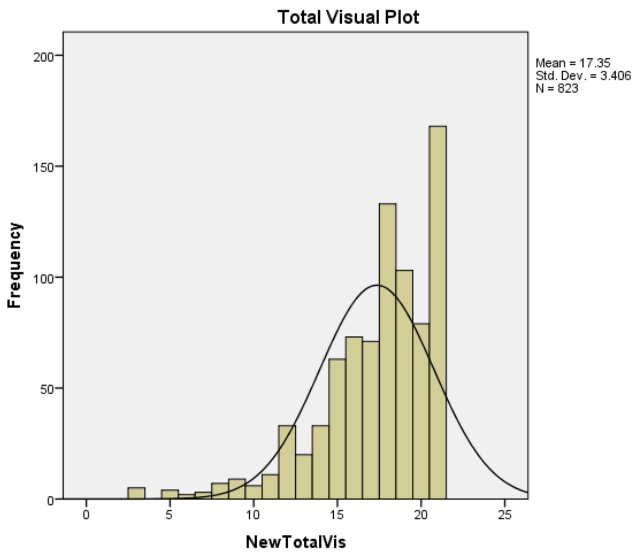
Scale Items	Component	
	1 Visual learner	2 Verbal learner
I am a visual learner	.93	
I prefer to learn visually	.93	
I am good at learning from labelled pictures, illustrations, graphs, maps and animations	.85	
I am a verbal learner		.93
I prefer to learn verbally		.91
I am good at learning from printed text		.64
% variance	**41.2%**	**35.6%**

Preparing the SBLSQ measure for hypothesis testing

Hypothesis 3 states that: *Cognitive style moderates the utility estimates of apartment evaluations such that the more visual an individual is, the greater the importance of the spatial attribute.* As has been established, the SBLSQ measure was included in the survey instrument to test how cognitive processing style moderates utility estimates of apartment estimates. Now that the two styles have been established, the next step is to add the moderator to the study's basic model to examine whether there are significant differences between the two factors. For each of the 6 items, participants were given seven options, the 1st, 2nd and 3rd options presented were in agreement with the statements, the 1st the most strongly. The 4th option indicated neither a visual nor a verbal preference for learning and 5th, 6th and 7th indicating disagreement with the statements, the 7th the most strongly. The options were coded 1 – 7, from strongly in agreement (1) to strongly in disagreement (7). The coding of the scores was then reversed so that the more strongly in agreement participants are of the items, the higher the scores.

To prepare the SBLSQ scores for each participant, a subset of visual items were summed together to give individuals a visual learner score. This was repeated with the verbal learner subset of items. Since Hypothesis 3 states that Cognitive style moderates the utility estimates of apartment evaluations such that the more visual an individual is, the greater the importance of the spatial attribute, it was decided to plot the frequency of scores for the visual items only, shown below.

As can be seen from the histogram (Graph XX) which plots the frequency of visual scores, the distribution of scores is not normal, but is positively skewed. This does



not reflect a problem with the scale but more the nature of the construct being measured (visual learner). This is backed up by the skewness and kurtosis values which would be zero if distribution is normal but they are -1.3 and 2.3 respectively. Further to this, a non-significant result of the Kolmogorov-Smirnov which assesses the normality of the distribution of scores, indicates normality. This test has a significance of 0.000 suggesting a violation of the assumption of normality (should be >.05). As this sample is large, it is not an unexpected result. Also, the boxplot was examined which revealed that several outliers extend from the whiskers protruding downward from the rectangular box.

Next, it was decided to transform the variable summing the visual item scores and compute a nominal variable of three groups, called NewVisgp3. The splits between the groups was determined by examining the distribution (histogram) of the total visual scores, as analysed above. As can be seen, there is a group at 18-21 (483 participants), another at 15-17 (207 participants) and a further group 0-7 (133). All of the participants that took park in this scale were included in variable.

The visual learner variable (NewVisgp3) was tested in the model. There were many significant effects, however no significant interactions were found with the variable NewVisgp3, so hypothesis 3b is not carried. According to the SBLSQ, in this sample, visual people do not understand spatial attributes size and orientation better than verbal people.

Conclusive remarks

In conclusion, the purpose of including the SBLSQ in the survey was to determine the preferred learning style of participants and prepare it for hypothesis testing as a moderator of preferences of apartments. Although the SBLSQ performed well in reliability testing, the scoring, measured over 823 participants was skewed towards visual learners. This perhaps suggests that despite the direct nature and short length of the scale, this sample could have benefited from more detailed scale items that describe the types of thoughts or actions that a verbal or visual learner could identify with. For example, the directness of the item “I prefer to learn visually” does not tell the participant about the nature of a visual learner which could have helped them with scoring. It seems many participants in this study thought they were strong visual learners whereas other more detailed scales may have produced a different result. The scores from the verbal items in the scale did not assist the study as no significant effects were found for three groups of visual learners (high, medium and low levels) on the model. Ultimately this means that visual learners could not better understand spatial attributes than verbal learners, as measured on this scale. Visual versus verbal styles of learning did not matter in this sample.

Style of Processing scale (SOP)

The SOP scale is a self-rating 22-item questionnaire about processing style developed by Childers, Houston, and Heckler (1985). “Processing style” was conceptualised as a “preference and propensity to engage in a verbal or visual modality of processing" (pg. 130, 1985). The scale asks for agreement (on a 4-point bipolar scale), with 11 statements related to preference for visual style of processing such as "I generally prefer to use a diagram than a written set of instructions" and 11 statements related to preference for a verbal style of processing such as "I do a lot of reading." The 4-point scale consisted of choosing from "always true", "usually true", "usually false" and "always false". The SOP is made up of two sub-scales, the first containing 11 items collectively named "verbal processor" and the remaining 11 items collectively named "visual processor". The SOP is included as Appendix 2: Style of Processing Scale (SOP)

Relevance of the SOP to the study

The purpose of including the SOP into the survey instrument was to determine whether participants evaluate apartments differently if their mental processing is either more visual or more verbal. It is expected that when faced with stimuli, individuals that prefer visual processing will allocate more attention to the visual elements of stimuli. The reverse is true for the verbal style of processing (Ramsey & Deeter-Schmelz, 2008). An individual's style of processing is also believed to influence how they use working memory (Heckler, Childers, & Houston, 1993). Individuals prefer to form mental representations of cues in their preferred modality. This means that visual elements of stimuli (in this case floor plans) could be better understood by visual processors and verbal elements of stimuli (text descriptions) could be better understood by verbal processors. Some researchers have demonstrated that visual versus verbal processing is correlated with verbal and spatial ability (Kirby, Moore, & Schofield, 1988). Since visual processors could also have spatial ability, it follows that they could be better at reading floor plans than verbal processors.

By testing the study for moderation of processing style using the SOP, it is expected to find significant differences in the way participants evaluate apartments. The most interesting of differences to be examined therefore are the three modes of presentation style on processing style. It is expected that visual processors will understand floor plans better than verbal processors supported by a larger effect size than verbal learners.

Reliability test

As can be seen in Table in the measure, several items in the scale are negatively worded, consistent with the original (Childers et al., 1985) SOP scale. This practice assists in the prevention of response bias. The verbal and visual scale items were mixed together in the survey and the order of presentation was randomised. The negatively-worded items (items 2, 3, 5, 6, 8, 10, 11, 12, 13, 14, 16, 19, 21, 22), marked with an asterisk were reverse-scored prior to reliability testing and then all items values were reversed so that "always true" was scored the highest score (4) and "always false was scored the lowest score (1).

Replicating the steps taken by Childers et al., 1985, the reliability of linear combinations for the SOP scale was calculated. According to Childers et al., (1985) the internal consistency of the SOP scale has good internal consistency, with a Chronbach alpha coefficient reported of .88. The Cronbach's alpha for this sample was $\alpha = .718$ so the scale can be considered reliable (Nunnally & Bernstein, 1994) in the current study. The two sub-scales were also tested Childers et al., (1985) for reliability and were found to be .81 for the verbal component and .86 for the visual component, was also Looking at the "Chronbach's alpha if deleted" of each item, removal of items would no results in a better alpha so no items were removed.

Factor Analysis

The SOP measure was submitted to a three-part process of data reduction. This involved assessing the suitability of the data for factor analysis, data extraction and factor rotation. The first step, assessing the data, was done by inspecting the correlation matrix for coefficients of 0.3 and above and calculating the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity.

The correlation matrix revealed that there was a number of coefficients of .3 and above. The Kaiser-Meyer-Olkin value was .74 exceeding the recommended value of .6 (H. F. Kaiser, 1970; M. Kaiser, 1974) and the Bartlett's test of Sphericity

(Bartlett, 1954) reached statistical significance, supporting the factorability of the items in the SOP.

The second step of data reduction was factor extraction. This involved using principal components analysis to ascertain how many underlying factors the items contain. The process of factor extraction revealed seven components with eigenvalues exceeding 1, explaining 17%, 12%, 7.2%, 6.3%, 5.7% ,5.2% and 4.6% of the variance respectively (total 58%). However examination of the scree plot confirmed that an "elbow" shape occurred in the plot at the location between the third and the fourth component. Using Catell's (1966) scree test, it was decided to retain the first two components above the "elbow" for further investigation (extraction) because they capture much more eigenvalue between the components than the remaining five items. The component matrix containing loadings of each of the seven items confirmed that most items loaded onto the two components found in the scree plot.

The third step of data reduction was taken for the purpose of aiding interpretation of the two retained components. This involved rotating component 1 and component 2 using Varimax and Kaiser Normalization. The rotated solution revealed the presence of simple structure (Thurstone, 1947), with both components showing a number of strong loadings on most variables. The two factor solution explained a total of 30% of variance, with component 1 contributing 17% and component 2 contributing 12%.

Examining the rotated component matrix below, it appears that the main item loadings on component 1 and component 2, fit with Childers et al., (1985) SOP factors of visual and verbal processing (items called either "words" and "pictures"). The results of this factor analysis therefore supports the use of the scale to measure individual differences in processing style.

Rotated Component Matrix

Scale Items	**Words or pictures**	**Factor 1**	**Factor 2**
I enjoy learning new words	W	.78	

I like learning new words	W	.76	
I do a lot of reading	W	.66	
I prefer activities that don't required a lot of reading*	W	.62	
I like to think of synonyms for words	W	.59	
I enjoy doing work that requires the use of words	W	.57	
I spend very little time trying to increase my vocabulary*	W	.55	
I can never seem to find the right word when I need it*	W	.39	.34
I think I often use words in the wrong way*	W	.37	
I often make written notes to myself	W	-	-
I find it helps to think in terms of mental pictures when doing many things*	P		.71
My thinking often consists of mental "pictures" or images*	P		.70
When I have forgotten something I frequently try to form a mental "picture" to remember it*	P		.57
There are some special times in my life that I like to relieve by mentally "picturing" just how everything looked*	P		.54
I generally prefer to use a diagram rather than a written set of instructions*	P		.46
I like to daydream*	P		.46
I like to doodle*	P		.44
When I'm trying to learn something new, I'd rather watch a demonstration than read how to do it*	P		.40
I like to picture how I could fix up my apartment or a room if I could buy anything I wanted*	P		.37
I seldom daydream	P	-	-
I prefer to read instructions about how to do something rather than have someone show me	W	-	-

After I meet someone for the first time, I can usually remember what they look like but not much about them*	P	-	-
% Variance		**17%**	**12%**

Preparing the SOP measure for hypothesis testing

As has been established, the SOP measure was included in the survey instrument to test how cognitive style moderates utility estimates of apartment estimates. Hypothesis 3 states that: *Cognitive style moderates utility estimates of apartment evaluations such that the more visual an individual is, the greater the importance of the spatial attribute.* Now that the scale has been subjected to reliability testing and factor analysis, the next step is to split the sample into two groups of visual and verbal processors, and look for significant differences between visual and verbal modality of processing and the scoring of visual and verbal representations of apartments. A new variable was made summing up all the SOP items (total SOP), the higher the total score, the more visually the respondent processes information because the highest score for each item indicated "always true" and the lowest indicated "always false" and the scale items as shown with an asterisk in Table XX were reverse coded. Childers et al., designed the SOP measure to compute a single score "representing a point on a continuum ranging from verbally oriented to visually oriented processing" (1985, pg. 131) with observations in the middle being neither preference for one or the other. The total scores ranges from 36 – 68 with a mean of 50.84 and a standard deviation of 6.03 (N=260).

As it is of interest to the researcher to split the total SOP variable into strongly verbal, strongly visual and not strong on either, the variable was split into three equal groups. The frequency of the variable was put into a histogram graph and scores appear to be reasonably distributed. The scores were divided into three groups and recoded into a new three-level variable in preparation for the preference model (refer to the results section of study 2). The low scoring group, verbal processors scored 36-47, neither verbal nor visual scored 48-54 and visual processors scored 55-68.

Conclusive remarks

In conclusion, the SOP performed adequately in reliability testing, and two main components were found in factor analysis that seem to match the visual and verbal SOP sub-factors designed by Childers et al., (1985). The measure was prepared for testing in study 2 by dividing the total scale score into in 3 equal groups of processing style in order to capture a middle group that were neither strongly visual neither strongly verbal. The groups were; highly visual, highly verbal and neither strongly visual nor verbal.

The 20-item Rational-Experiential Inventory (REI)

The REI is a self-rating 20-item measure of two thinking styles. The first is the rational-analytical system and the second is the experiential-intuitive system. The original scale by Pacini and Epstein (1999) consisted of 40 items, however this was reduced to 20 items in subsequent applications. This study uses the twenty-item scale. It consists of ten items to measure ability and engagement of rational-analytical thinking and ten to measure ability and engagement of experience-intuitive thinking (REI, Epstein, Pacini, Denes-Raj, & Heier, 1996; Pacini & Epstein, 1999). The REI therefore consists of two sub-scales, the first containing 10 items collectively named "rational-analytical" and the remaining 10 items collectively named "experiential-intuitive". For each of the 20 items, participants were given a 9-point opinion scale from which to rate how much they agreed or disagreed with the item statements. For example, the item "I generally don't depend on my feelings to help me make decisions", was given 9 points that participants could choose from, with "1" indicating "strongly agree", "9" indicating "strongly disagree". 406 respondents participated in this measure.

The relevance of the REI to the study

The purpose of including the REI into the survey instrument was to measure participants' dispositional thinking style for testing as a moderator of participants' preferences and choices of apartments in the experimental analysis section of the thesis. This will enable the model to test rational thinking and intuitive thinking groups to enable the research to find and explain possible differences in preferences by virtue of thinking style. The REI is one of three scales used to test cognitive style in the survey instrument. It is expected that difference in cognitive style will assist with testing apartment evaluations for moderation. The most interesting of differences to be tested is presentation style. It is expected that visual processors will understand floor plans better than verbal processors, supported by a larger effect size than verbal learners.

Reliability test

As can be seen in Varimax Rotation of Two Factor Solution for REI Items ,several items in the scale are negatively worded, consistent with the original Pacini and Epstein (1999)'s REI scale. This practice assists in the prevention of response bias. Additionally, the rational and intuitive measures were mixed together in the survey as can also be seen from the order number and variable name shown in the table. The negatively-worded items were reverse-coded prior to reliability testing.

Replicating the steps taken by Pacini and Epstein (1999), the reliability of linear combinations for the REI scale was calculated (Nunnally & Bernstein, 1994). The Cronbach's alpha for the sample was 0.00. As the REI consists of two sub-scales, reliability was tested on the ten rational items and the ten intuitive items separately. The Chronbach's alpha coefficient for the intuitive items of the scale was $\alpha = 0.306$. The general "rule of thumb" is that Chronbach's alpha coefficient should be > .7 to be classified as adequate. The intuitive sub-scale is therefore not adequate. The Chronbach's alpha coefficient for the rational sub-scale was $\alpha = 0.534$ and so it is not adequate either; therefore, this REI scale is not adequate for use with this sample. Considering the "alpha if deleted" items, the intuitive item of EXP_12 would afford the analysis 0.435 if removed which unfortunately is still not adequate. The rational item of RAT_4 would afford the analysis an alpha coefficient of 0.652 if deleted, which is closer to 0.7 but still not adequate.

Factor Analysis

The 20-item REI measure was submitted to a three-part process of data reduction. This involved assessing the suitability of the data for factor analysis, data extraction and factor rotation. The first step, assessing the data, was done by inspecting the correlation matrix for coefficients of 0.3 and above and calculating the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity. The correlation matrix revealed that there were many coefficients of .3 and above. The Kaiser-Meyer-Olkin value was 0.779, exceeding the recommended value of .6 (H. F. Kaiser, 1970; M. Kaiser, 1974) and the Bartlett's test of Sphericity (Bartlett, 1954) reached statistical significance, supporting the factorability of the items in the REI. This means that the REI measure is suitable for factor analysis.

The second step of data reduction was factor extraction. This involved using principal components analysis to ascertain how many underlying factors the items contain. Considering only those with eigenvalues exceeding 1, there were six such factors, explaining 20.6%, 14.0%, 8.7%, 7.4%, 5.7%, and 5.1% respectively of the total variance and a total of 61.607%. Looking at the screeplot the first two components capture much more of the variance than the other items. Although there are a number of changes in the plot, the first change, after the second component, is the strongest and it is therefore clear that only the first two components should be extracted. Using Catell's (1966) scree test, it was decided to retain the first two components for further investigation because they capture much more eigenvalue between the components than the remaining four items. This was confirmed by the component matrix which contained loadings of each of the twenty items on the two components. The two components were automatically retained as these were the only components of eigenvalue 1 or greater than 1.

The third step of data reduction was for the purpose of aiding interpretation of the retained components. This involved rotating component 1 and component 2 using Varimax and Kaiser Normalization. The rotated component matrix shows that all the items load onto components one and two with the exception of "Rat_3" and

“Exp_3”. Upon closer inspection of the rotated solution, presented below, Varimax Rotation of Two Factor Solution for REI items, it became apparent that the two groups of items (rational thinking and intuitive thinking) are not loading onto the expected factors of “intuitive thinking” and “rational thinking”. The data does not display the two thinking style factors that this factor analysis seeks to confirm.

It was found that the first factor correlates with the positively worded items (regardless of whether it be rational or intuitive) and the second factor correlates with the negatively worded items. A run of descriptive statistics showed that 12 out of 20 items were most frequently scored with “5” than any other score. This could be evidence of repeated scoring in the data, such that participants mostly selected “5” which is the middle number between “1” and “9”. When reverse coded these items remained “5”. There is also evidence that participants selected “3” many times as three positively worded items have “3” as their most frequently scored number and a further three negatively worded items were also initially selected as “3” and therefore subsequent to reverse coding, became “7”. The REI is therefore not suitable for use as hypothesis testing with this sample.

Varimax Rotation of Two Factor Solution for REI Items

Item	Variable	Factor 1	Factor 2
I'm not that good at figuring out complicated problems (ra -)	Rat_2	.78	
I try to avoid situations that require thinking in depth about something (re -)	Rat_1	.74	
I try to avoid situations that require thinking in depth about something (re -)	Exp_9	.73	
I try to avoid situations that require thinking in depth about something (re -)	Rat_8	.71	
Thinking is not my idea of an enjoyable activity (re -)	Rat_7	.70	
I don't have a very good sense of intuition (ea -)	Exp_2	.70	

I am not very good at solving problems that require careful logical analysis (ra -)	Rat_4	-.56	
I generally don't depend on my feelings to help me make decisions (ee -)	Exp_14	.45	
I don't like situations in which I have to rely on intuition (ee -)	Exp_10	.37	
I think it is foolish to make important decisions based on feelings (ee -)	Exp_12	-.35	
Thinking hard for a long time about something gives me little satisfaction (re -)	Rat_11	.32	
I enjoy intellectual challenges (re)	Rat_3		
I like to rely on my intuitive impressions (ee)	Exp_1		.69
Intuition can be a useful way to solve problems (ee)	Exp_5		.69
I trust my initial feelings about people (ea)	Exp_7		.65
I enjoy solving problems that require hard thinking (re -)	Rat_6		.63
I am much better at figuring things out logically than most people (ra)	Rat_13		.57
I often go by my instincts when deciding on a course of action (ee)	Exp_6		.57
I prefer complex problems to simple problems (re)	Rat_10		.45
Using my gut feelings usually works well for me in figuring out problems in my life (ea)	Exp_3		
% Variance Explained		**20.6%**	**14.8%**

It is clear that participants did not understand the questions or did not properly engage in the task - the latter possibly from respondent fatigue. The task was the final scale of a total of three scales adopted in the survey, also, it was at the tail end of an experimental questionnaire that presented varying apartment layouts with repeated questioning after each of them. Subsequent to replicating Pacini and Epstein (1999)'s analysis of the 20-item scale, it is concluded that the data collected from this scale is not able to be reduced into two thinking styles, and therefore the confirmatory factor analysis was not successful.

This section is for the BIF measure which was included in study 2 as a manipulation check.

The Behaviour Identification Form

The effectiveness of individuals' construal level and psychological distance manipulation were assessed using the responses to the experimental task as well as a behaviour identification form (BIF); which tests whether participants were thinking in an abstract-related way or a concrete-related way at the time of the survey. (Vallacher and Wegner, 1989)[11]. The BIF form was taken directly from Vallacher and Wegner, 1989 for use in this research.

The BIF scale was included with the study because it is commonly used to gauge the efficiency of construal manipulation (Yan & Sengupta, 2011). It is used in study 2 to gauge the effectiveness of the spatial and temporal manipulation.

Relevance to the study

The BIF was chosen for the survey for study 2 as a psychological distance (NTS spatial and temporal: 1 year / 2 months + Sydney / Melbourne) manipulation assessment and construal task (NTS why / how) given to respondents. The purpose of the assessment was to increase confidence in the effectiveness of psychological distance manipulation assessment and construal (how or why) task. This particular form of construal manipulation assessment was selected for the manipulation check because it is commonly used in prior research for this assessing construal level and psychological distance (Liberman and Trope, 1998).

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[11] Need to bring two other papers into this discussion – or maybe in the methodology chapter

Scale Structure

The BIF is a 25-item dichotomous questionnaire that is used to assess individual differences in action identification level. Action identification level means the level at which people identify with specific behaviours. The scale consists of 25 items which are every-day type behaviours, for example the activity of eating or writing or exercising. Behaviour can be described in many ways. For example, one person might describe a behaviour as "writing a thesis," while another person might describe the same behaviour as "counting words." Yet another person might describe it as "getting my thesis finished." The BIF focuses on individual preferences for how a number of different behaviours should be described. Two action identification levels are described for each item which distinguish between two levels of construal mindset. These are described by Vallacher and Wegner, 1989, p. 661 as

> Low-level construals emphasize how to do the action, the means of achieving the action, and the details of the action. High-level construals emphasize why the action is performed, the motives behind the action, and the meanings of the action.

As established, for each item, two descriptions are suggested, one of them describes the item in terms of higher level abstract identification, for example chewing and swallowing, and the other describes the item in terms of lower level concrete identification, for example "getting nutrition". Respondents were asked to choose one description of the two that they most identify in describing the item using a forced choice format. The order of the 25 items was randomised because the answers to later questions can be biased by the presentation of earlier questions. Randomising the question order means that the influence is no longer subject to this ordering bias Vallacher and Wegner (1989).

(Maybe in results section?) Scoring was coded as follows. Participants who chose the item described at lower level concrete identification were given the score of 0 (check) and the participants who chose the item described at higher level abstract identification were given the score of 1. The scores for each participant were added and the total was divided by the total number of items, producing a construal level index. Interpreted, the higher the individuals' score, the higher the level of abstract identification.

BIF items

Activity / Behaviour	**Description**
Eating	Chewing and swallowing Getting nutrition
Tooth brushing	Moving a brush around one's mouth Preventing tooth decay
Resisting temptation	Saying "no" Showing moral courage
Having cavity filled	Going to the dentist Protecting your teeth
Talking to a child	Using simple words Teaching a child something
Locking a door	Putting a key in the lock Securing the house
Greeting someone	Saying hello Showing friendliness
Cleaning the house	Vacuuming the floor Showing one's cleanliness
Washing clothes	Putting clothes into the machine Removing odours from clothes
Making a list	Writing things down

	Getting organised
Reading	Following lines of print Gaining knowledge
Joining the army	Signing up Helping the nation's defence
Picking an apple	Pulling an apple off a branch Getting something to eat
Chopping down a tree	Wielding an axe Getting firewood
Measuring room for carpeting	Using a yardstick Getting ready to remodel
Painting a room	Applying brush strokes Making the room look fresh
Paying the rent	Writing a cheque Maintaining a place to live
Caring for houseplants	Watering plants Making the room look nice
Voting	Making a ballot Influencing the election
Climbing a tree	Holding on to branches Getting a good view
Filling out a personality test	Answering questions Revealing what you like

Taking a test	Answering questions Showing one's knowledge
Growing a garden	Planting seeds Growing fresh vegetables
Travelling by car	Following a map Seeing countryside
Pushing a doorbell	Moving a finger See if someone's home

Reliability

Vallacher and Wegner, 1989, initially started with a 60-item behavioural identification form, finding that a single dimension was being tapped and reporting a Chronbach's alpha of **.84** (n = 274). The item-total correlations for these items ranged from .05 to .45 with a mean of.25. To reduce the number of items the authors used an item-total correlation of .27 as the criterion for item inclusion. This reduced the BIF to 25 items. Item- total correlations in the reduced scale ranged from .28 to .48, and the internal consistency (alpha) of this scale was .85. The 25 items of the final BIF are presented in Table XX.

Respondent's level of personal agency was defined by Vallacher and Wegner, 1989, as the number of high-level alternatives chosen on the BIF. The consistency was tested further by sampling 13 (mainly) university undergraduates at several universities. Mean BIF scores proved to be similar across 13. The BIF therefore provides an internally consistent and temporally stable means of assessing individual differences in level of identification across an array of (25) actions.

Validity

The BIF was tested for divergent validity to illustrate that constructs that should have no relationship do, in fact, not have any relationship. When compared to 13 other measures divergence from dimensions such as cognitive style and intelligence indicate the relevance of personal agency to action rather than to mental functioning generally. (This shows how it is different from 13 other measures but nothing was found to show the measure measures what is says it does).

Appendix 24: Text format Study 2 (all options)

Apartment Features:
Rent $400 per week
15 minute commute to work on train
No gym nearby
With dining space
All-day direct sunlight

Apartment Features:
Rent $400 per week
15 minute commute to work on train
Gym nearby
No dining space
All-day direct sunlight

Apartment Features:
Rent $350 per week
15 minute commute to work on train
Gym nearby
No dining space
No direct sunlight

Apartment Features:
Rent $350 per week
15 minute commute to work on train
No gym nearby
With dining space
No direct sunlight

Apartment Features:
Rent $400 per week
5 minute commute to work on train
No gym nearby
No dining space
No direct sunlight

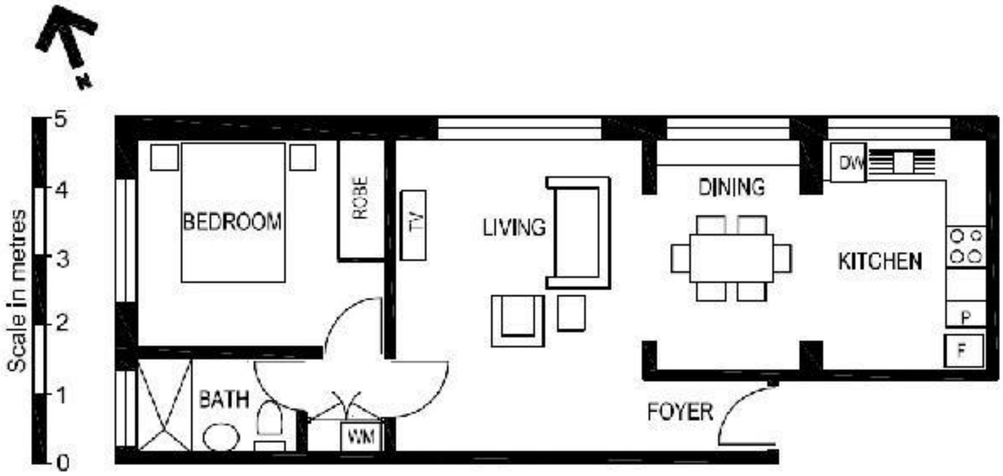
Apartment Features:
Rent $400 per week
5 minute commute to work on train
Gym nearby
With dining space
No direct sunlight

Apartment Features:
Rent $350 per week
5 minute commute to work on train
No gym nearby
No dining space
All-day direct sunlight

Apartment Features:
Rent $350 per week
5 minute commute to work on train
Gym nearby
With dining space
All-day direct sunlight

Appendix 25: Floor plan with text Study 2 (all options)

Apartment 1:
Rent $400 per week
15 minute commute to work on train
No gym nearby
With dining space
All-day direct sunlight

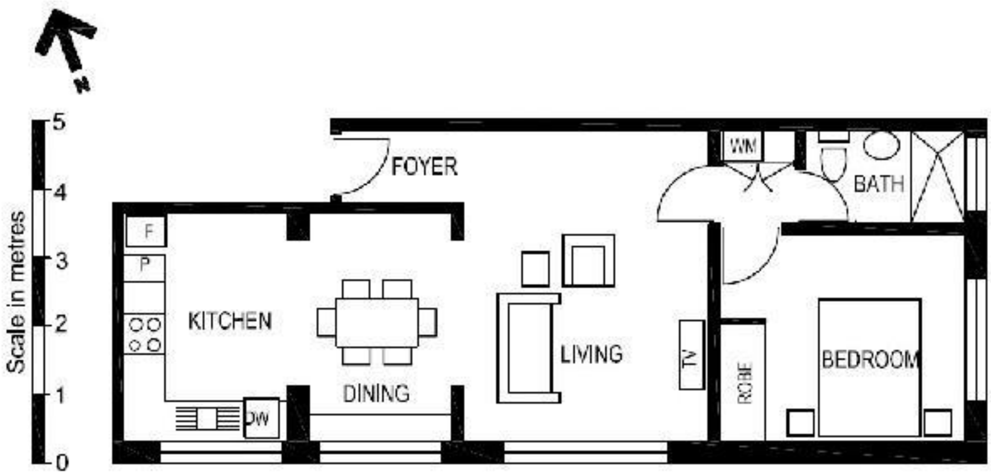


. . . .

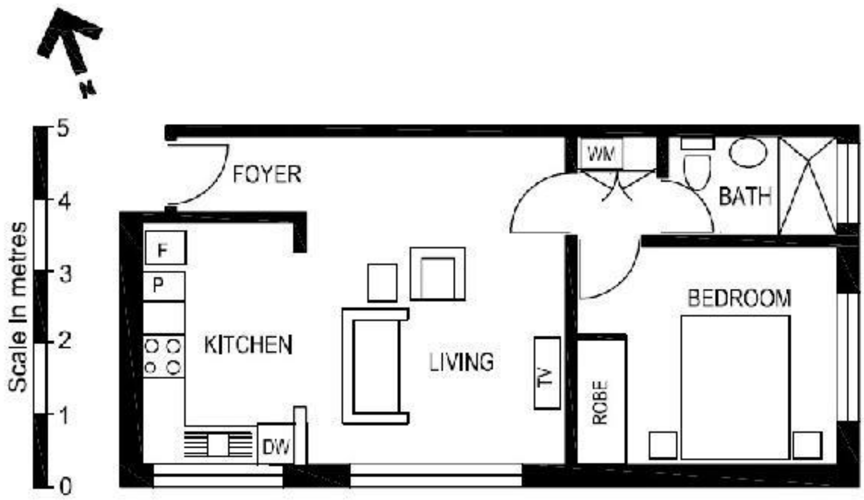
Apartment 2
Rent $400 per week
15 minute commute to work on train
Gym nearby
No dining space
All-day direct sunlight

Apartment 3:
Rent $350 per week
15 minute commute to work on train
Gym nearby
No dining space
No direct sunlight

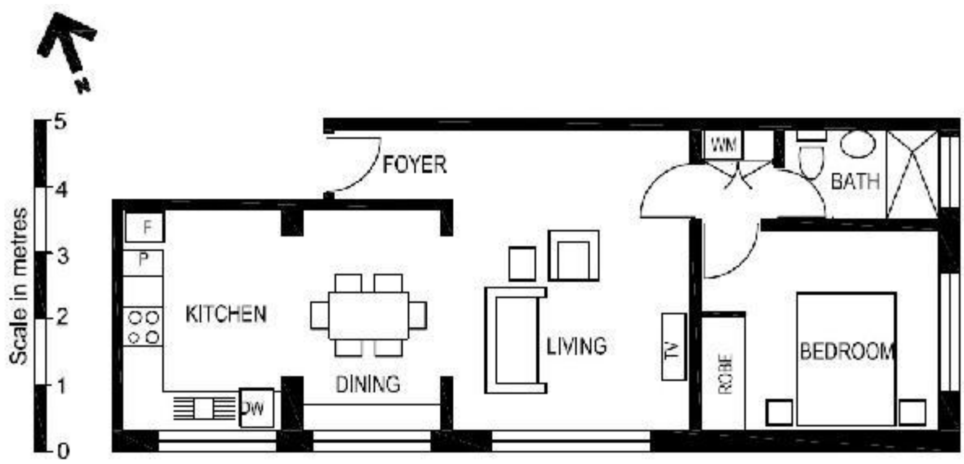
Apartment 4:
Rent $350 per week
15 minute commute to work on train
No gym nearby
With dining space
No direct sunlight



Apartment 5:
Rent $400 per week
5 minute commute to work on train
No gym nearby
No dining space
No direct sunlight



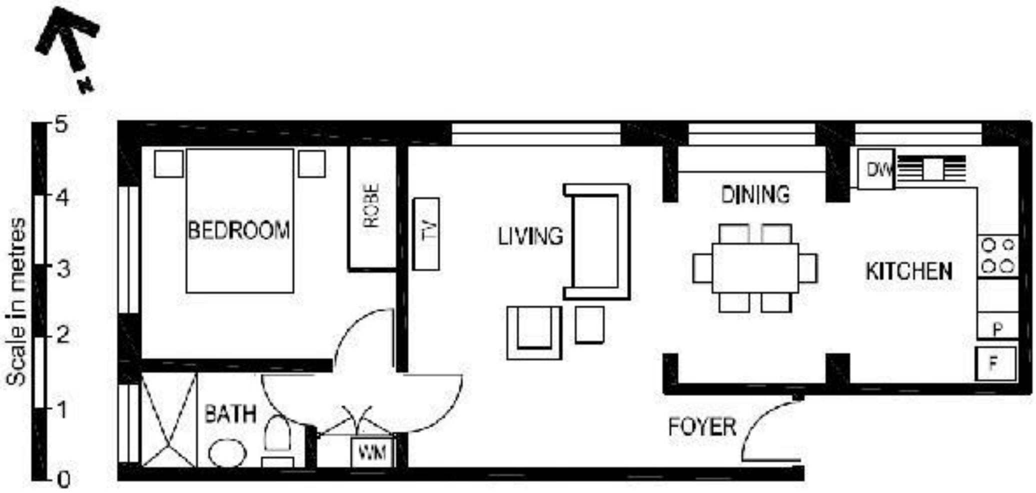
Apartment 6:
Rent $400 per week
5 minute commute to work on train
Gym nearby
With dining space
No direct sunlight



Apartment 7:
Rent $350 per week
5 minute commute to work on train
No gym nearby
No dining space
All-day direct sunlight

. . . .

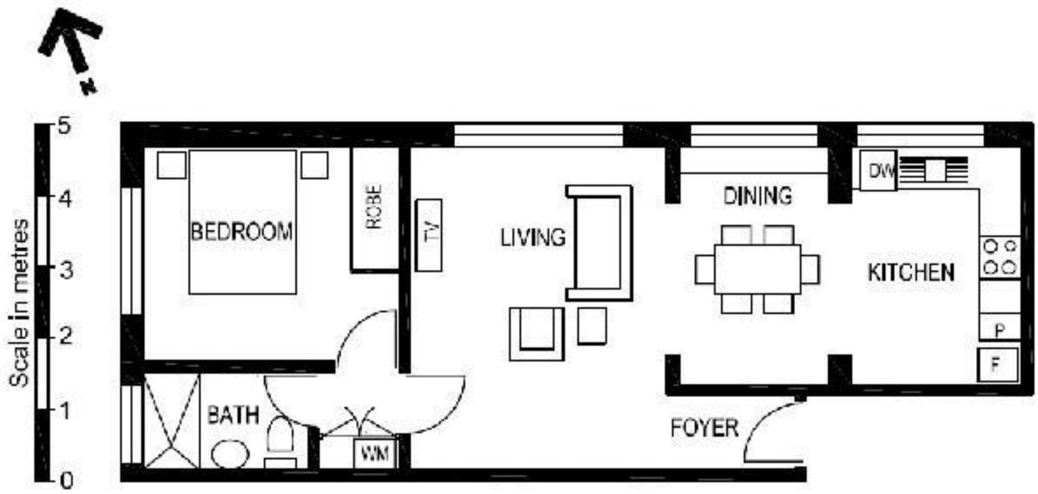
Apartment 8:
Rent $350 per week
5 minute commute to work on train
Gym nearby
With dining space
All-day direct sunlight



Appendix 26: Floor plan with limited text Study 2 (all options)

Apartment 1:

Rent $400 per week
15 minute commute to work on train
No gym nearby

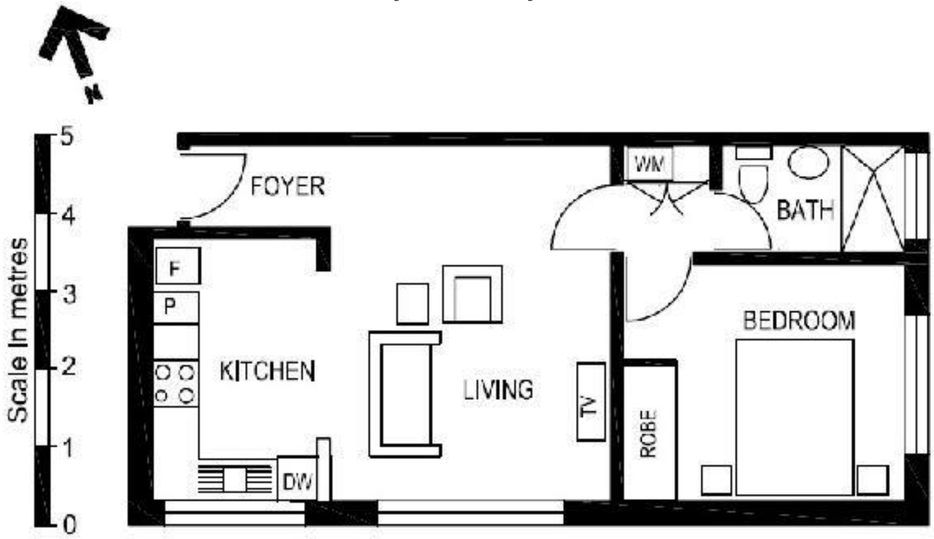


Apartment 2:

Rent $400 per week
15 minute commute to work on train
Gym nearby

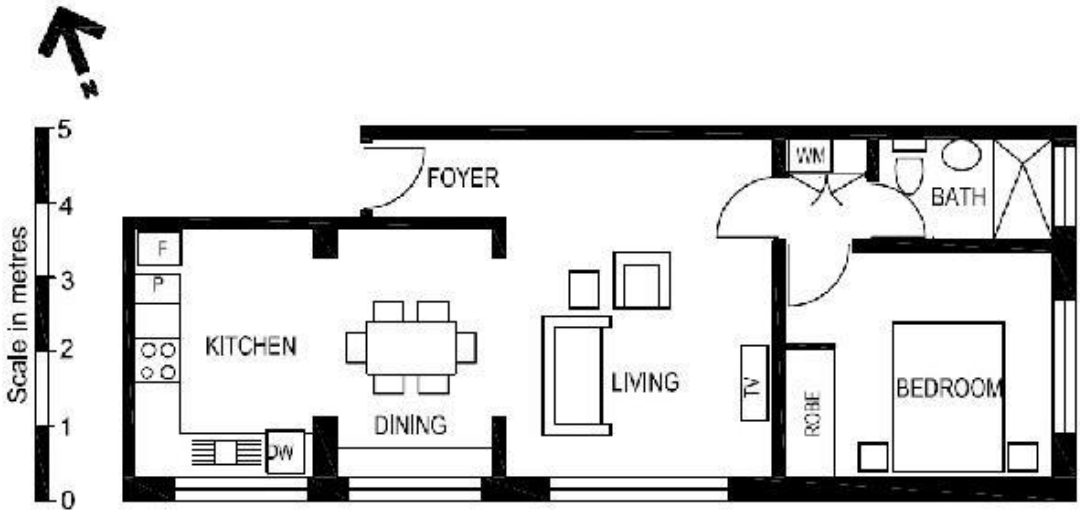
Apartment 3:

Rent $350 per week
15 minute commute to work on train
Gym nearby



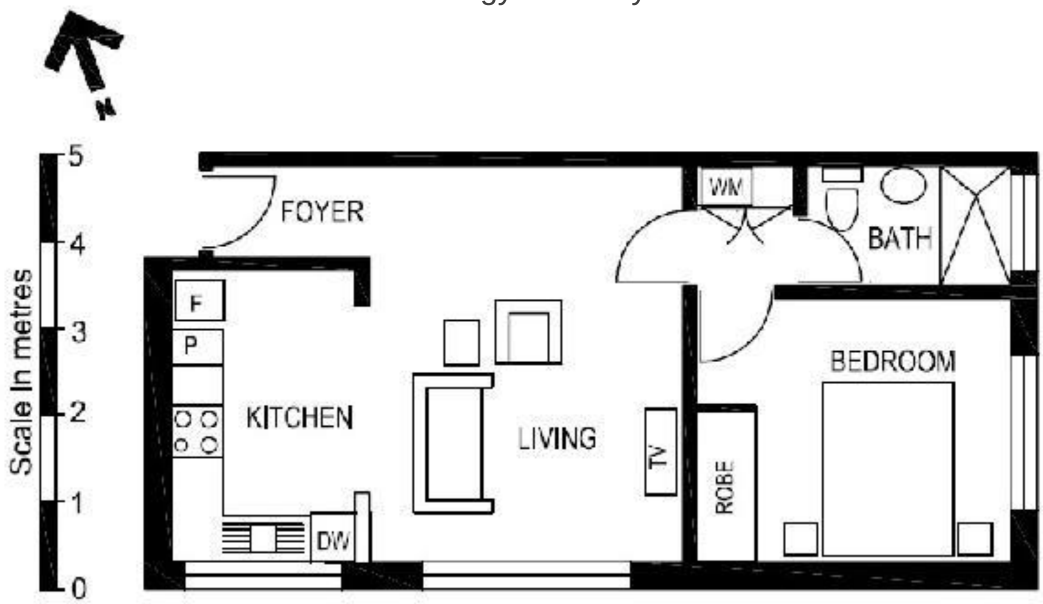
Apartment 4:

Rent $350 per week
15 minute commute to work on train
No gym nearby



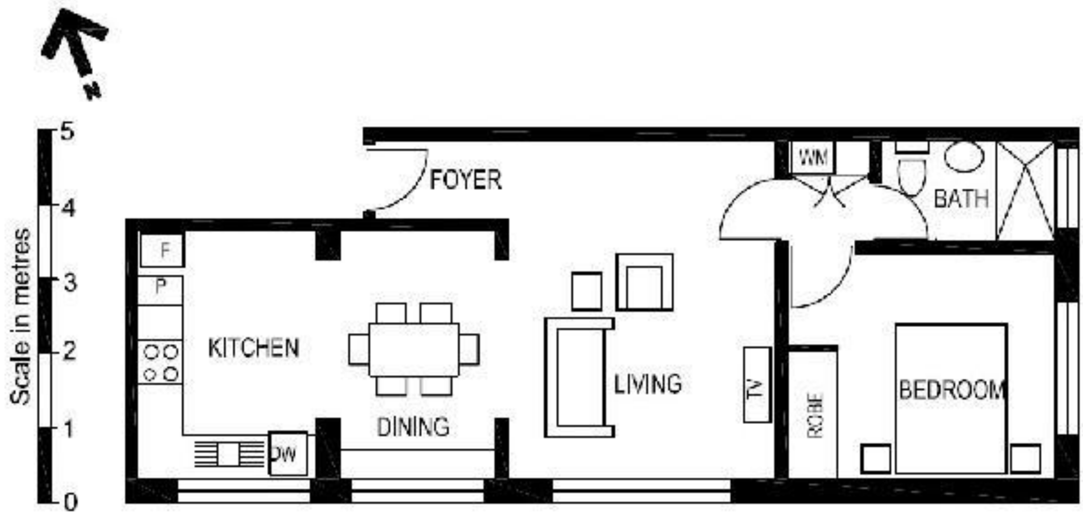
Apartment 5:

Rent $400 per week
5 minute commute to work on train
No gym nearby



Apartment 6:

Rent $400 per week
5 minute commute to work on train
Gym nearby



Apartment 7:

Rent $350 per week
5 minute commute to work on train
No gym nearby

Apartment 8:

Rent $350 per week
5 minute commute to work on train
Gym nearby