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FACULTY OF ARTS AND HUMANITIES

Winchester School of Art

Enhancing the grocery shopping experience of customers aged 65 and above in the UK by using emerging technologies

by

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ABSTRACT

FACULTY OF ARTS AND HUMANITIES

Winchester School of Art

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Enhancing the grocery shopping experience of customers aged 65 and above in the UK by using emerging technologies

By Fahad Alhathal

The number of older people is increasing more rapidly than other age groups worldwide. Older people are becoming wealthier and living longer, making them an attractive target for retailers. Grocery shopping plays a significant role in older people's lives, and they have multiple options to choose from in light of the UK's competitive grocery market, so to attract them, supermarkets must address current issues. The literature reviews highlighted the research gap and how emerging technologies can strategically enhance customer experience. This thesis followed User-Centred Design (UCD) and inclusive design approaches to provide design insights and recommendations that fill the research gap.

This research explores how emerging technologies can be applied to enhance supermarket service for customers aged 65+ in the UK. It accomplished this by applying a mixed-methods and method triangulation approach that included a Systematic Literature Review (SLR), card sorting, and a questionnaire to discover the grocery experiences and the main pain points. This project recruited 20 participants for card sorting sessions with ages ranging between 65 and 84 years and received 213 valid responses to the questionnaire, aged 65 years and over.

As a result, this research contributes to the existing knowledge of older customers' post-COVID grocery shopping behaviour by discovering changes in shopping frequency and the emergence of new shopping behaviour. Regarding older customers' experience and unmet needs, 'product availability and location' has been identified as the main pain point because the store is moving the products around. Based on the literature reviews, design insights and recommendations were made to incorporate Augmented Reality (AR) into existing supermarket apps or devices to guide customers inside the store. This study benefits supermarkets by indicating considerable areas for improving their retail services. It also helps researchers and policymakers in ageing-related fields who can leverage the research findings and methodologies for broader applicability and future research directions.

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Declaration of Authorship

Print name: Fahad Alhathal

Title of thesis: Enhancing the grocery shopping experience of customers aged 65 and above in the UK by using emerging technologies.

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

This work was done wholly or mainly while in candidature for a research degree at this University;

Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;

Where I have consulted the published work of others, this is always clearly attributed;

Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;

I have acknowledged all main sources of help;

Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

Parts of this work have been published as:

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Definitions and Abbreviations

Grocery shopping ..... the act of purchasing items that are commonly found in a supermarket for household consumption, including food, beverage, and non-food items.

Emerging technologies ..... consists of five attributes, as follows: (i) radical novelty, (ii) growing relatively fast, (iii) coherence persisting over time, (iv) major impact, and (v) uncertainty and ambiguity about potential applications (Rotolo, Hicks and Martin, 2015).

Methodology ..... encompassing the strategy, plan of action or procedures used to choose appropriate methods and linking the choice of methods to the desired outcomes.

Methods ..... the techniques or processes used to collect and analyse data in order to answer research questions.

Theoretical perspective ..... is informing the methodology and providing a context for the process and grounding of its logic and criteria.

Epistemology ..... the theory of knowledge which embedded in the theoretical perspective.

Steps\Stages ..... refer to a section of a customer's journey.

Touchpoints .....refer to an individual point of a customer's journey.

Pain point .....indicates the difficulties users encounter during their journey.

High-cost supermarkets.....Waitrose and M&S

Medium-cost supermarkets Sainsbury's, Tesco, Asda, Morrisons, and The Co-operative

Low-cost supermarkets ..... Aldi, Lidl and Iceland

UK .....United Kingdom

IADL .....Instrumental Activities of Daily Living

SLR .....Systematic Literature Review

AR .....Augmented Reality

Chapter 1 Introduction

1.1 Ageing population trends and their characteristics

The world's population is ageing, and almost every country is experiencing an increase in the number of older people in its population. The population aged 65 and above is rising faster than all other age groups around the world (Office for National Statistics, 2022; UN DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS, 2023). Globally, the number of older people is predicted to double to 1.6 billion in 2050 compared to 703 million people aged 65 years or above in 2019 (UN DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS, 2023). Throughout most of the world, older people are expected to live longer (Centre for Ageing Better, 2022; Office for National Statistics, 2022; UN DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS, 2023), with a person aged 65 years old in 2015-2020 expected to live longer - on average an additional 17 years; furthermore, between 2045 and 2050, this is expected to increase to 19 years (United Nations, Department of Economic and Social Affairs, 2020). In the UK, there have been changes in the population of different age groups at varying rates, with the number of those aged 65 years and above increasing by 22.9% to 13 million (Centre for Ageing Better, 2022).

There is generally no agreed basis for the definition of 'older people'; however, Orimo *et al.*(2006) state that it originally dates back decades to when Prince Bismarck selected 65 as the age at which citizens would be able to participate in a pension plan in Germany. Accordingly, In the UK, the government recently raised the state pension from 65 years to 66 years in 2020 and plans to increase the state pension age to 68 years between 2037 and 2039 (Department for Work & Pensions, 2017). Therefore, future research should take these changes into account. However, since this research is currently being carried out, it has included people aged 65 years and over who are responsible for grocery shopping in a physical store with no permanent disability as the main target group.

Older people are as different in their needs and wants as the rest of the population. Yet there are some products and services, such as everyday things designed to work better, that are more attractive to older people especially, which support individual lifestyles and perceived social roles (Department for Business and Innovation and Skills, 2011; Pettigrew *et al.*, 2017; Venn *et al.*, 2017; Rahman and Yu, 2019; Phua *et al.*, 2020). This target group presents an important and growing market for products and services because they are willing to spend and have an extraordinary pattern of consumption. (Department for Business and Innovation and Skills, 2011;

Venn *et al.*, 2017; Rahman and Yu, 2019; Phua *et al.*, 2020). Therefore, existing and new businesses should prepare and adjust their products and services according to older people's needs (Moschis, Curasi and Bellenger, 2004; Yoon, Cole and Lee, 2009; Venn *et al.*, 2017; Phua *et al.*, 2020). The elderly are seen as one segment, but in fact, there are differences between them and their needs, with regard to age, socio-economic status, geographic location, personal transport, and so on. The classification of (Angell et al., 2012) and (Angell et al., 2014) is considered an appropriate starting point for understanding the types of older shoppers, as they have focused on dividing older people in the UK based on the context of grocery shopping. Angell *et al.* (2012) have identified six types of older grocery shoppers based on shopping behaviour. In addition, Angell *et al.* (2014) have classified older shoppers into five clusters based on store image factors. Therefore, researchers and practitioners need to take these differences into account to achieve effective outcomes.

1.2 Grocery industry trend

The retail industry is a major sector in the economy (Gielens, Gijsbrechts and Bronnenberg, 2018), and the grocery industry in the UK is made up of retail chains, including hypermarkets, supermarkets, convenience stores, discount stores and online shopping (De Silva Kanakaratne, Bray and Robson, 2020). In addition, spending on grocery has increased overall in the UK retail sector (Woo, Shu and Lee, 2018). Therefore, the grocery industry is considered the largest retail industry (Woo, Shu and Lee, 2018; De Silva Kanakaratne, Bray and Robson, 2020), constituting 94.9% of the retail industry in the UK (De Silva Kanakaratne, Bray and Robson, 2020). Also, the food and grocery market in the UK is projected to increase by 14.8% between 2018 and 2023, which gives it a value of £218.5bn (IGD, 2019). Importantly, supermarkets form a significant sector of the UK grocery industry (Woo, Shu and Lee, 2018).

In the UK market, there are more than 20 grocery retail chains and they operate with different strategies, and De Silva Kanakaratne, Bray and Robson (2020) summarised the main grocery store chains, as shown in Table 1-1; these together control approximately 90% of the grocery industry. In addition, almost all households in the UK shopped at medium-cost supermarkets in 2015, such as Tesco, Sainsbury's, Asda, The Co-operative, Morrisons and Somerfield (Pechey and Monsivais, 2015).

Table 1-1 Major grocery store chains and their strategies in the UK (De Silva Kanakaratne, Bray and Robson, 2020)

Retailer	Positioning Strategy	Comments
Tesco	Price and Value	Collectively known as the "Big Four"
Sainsbury's	Value	Collectively known as the "Big Four"
Asda	Everyday Low Price (EDLP)	Collectively known as the "Big Four"
Morrisons	Price and Value	Collectively known as the "Big Four"
Marks & Spencer	Premium position	Collectively known as Premium Retailers
Waitrose	Premium position	Collectively known as Premium Retailers
Aldi	Deep discount	Collectively known as Discounters
Lidl	Deep discount	Collectively known as Discounters

Therefore, in this very competitive market, New Product Development (NPD) is an important factor for business growth in the fast-moving consumer goods sector. Accordingly, every year, a high number of new products or services are launched. In addition to that, businesses have become highly reliant on the income generated by the NPD (Walton, Petrovici and Fearne, 2017). However, due to the economy, environmental impacts and the shift in consumer behaviour and requirements, the UK grocery industry has undergone unprecedented change in recent years (Benson and Louis, 2019). There are a large number of new products launched each year in the UK grocery industry, and as a result, high failure rates. For instance, in the UK market, Tesco launched over 6,600 new products, but only 6% reached peak weekly sales, and within one year more than 1,800 products were delisted (Walton, Petrovici and Fearne, 2017).

1.3 The role of grocery shopping for older people

Grocery shopping in-store represents a significant activity in older people's lives (Stitt, O'Connell and Grant, 1995; Lesakova, 2016), as it is considered one of the Instrumental Activities of Daily Living (IADL), as classified by Spector *et al.*(1987), which helps older people to live independently (Host *et al.*, 2016). More importantly, grocery shopping for older people is not just for food, but more than that, for instance, it helps meet their social and emotional needs (Lim et al., 2019). Also, they have more discretionary time for grocery shopping than younger customers (Rahman and Yu, 2019).

More importantly, older people have become a valuable segment for business due to the increase in their numbers, and spending on groceries compared to other age groups due to the increase

nine times in their wealth at the age 60-64 compared 30-to-34 age group (Hare, 2003a; Moschis, Curasi and Bellenger, 2004; Sudbury and Simcock, 2009; Thompson and Thompson, 2009; Omar, Tjandra and Ensor, 2014a; Lesakova, 2016; Venn *et al.*, 2017; ONS, 2022). Older people experience various changes in their habits and behaviour during their lives based on many factors, such as health, income level, and so on (Rahman and Yu, 2019). Conversely, supermarkets still do not meet the needs of older people (Cameron et al., 2016; Hare et al., 2001; Lesakova, 2016; Myers and Lumbers, 2008; Omar et al., 2014; Pettigrew et al., 2005; Rahman and Yu, 2019).

1.4 The role of emerging technologies for the retail industry

Over the last decade, there have been rapid advancements in Information Technology (IT) (Balaji and Roy, 2017). Thus, noticeably, IT has brought about significant change in many industries in the market. These rapid advances in technology have led to various innovations in the retail industry (Roy *et al.*, 2018). Thus, new technology and continual innovation are essential for helping retailers to establish a sustainable competitive advantage (Inman and Nikolova, 2017). The capabilities of these technologies have never been greater; for this reason, retailers are currently faced with a large and complex number of technologies and their cost (Inman and Nikolova, 2017). Moreover, in general, supermarkets are becoming increasingly interested in using Information Technology (Tukkinen and Lindqvist, 2015).

In today's market, emerging technologies play a fundamental role in the retail sector (Ferracuti *et al.*, 2019) and are dramatically transforming the industry and customer shopping experience (Roy *et al.*, 2018). By understanding, supporting and analysing their customers (Ferracuti *et al.*, 2019), retail outlets are adopting a variety of technologies to increase their productivity and enhance customer satisfaction by providing new and convenient channels for shopping (Demoulin and Djelassi, 2016). Technologies such as AI-based, robots, Augmented Reality (AR), Virtual Reality (VR) and machine learning are changing the physical and the online retail industry (Pillai, Sivathanu and Dwivedi, 2020), as well as bridging the gap between the real world and the digital world (Balaji and Roy, 2017). Retailers that have focused on using these technologies to create value for customers first have shown successful results, and as a result, shareholder value has followed (Blitz, 2016). For this reason, designing the right technological solution is essential to help a company increase its value.

1.5 Technology acceptance by older people

As indicated previously, it is important to use emerging technologies in the retail industry; therefore, it is crucial for businesses to understand the motivation behind individuals adopting and accepting new Information Systems (IS) to find the best way forward for future development

(Taherdoost, 2018). Several models and frameworks have been developed in order to explain user acceptance of new technology. Taherdoost(2018) (Figure 1-1) and Rondan-Cataluña, Arenas-Gaitán and Ramírez-Correa (2015) (Figure 1-2) have identified the main models and frameworks most widely used, such as the Technology Acceptance Model (TAM) (Davis, 1985; Davis, Bagozzi and Warshaw, 1989); TAM2 (Viswanath Venkatesh *et al.*, 2003); TAM3 (Venkatesh and Bala, 2008); Theory of Planned Behaviour (TPB) (Ajzen, 1985); Diffusion of Innovation theory (DOI) (Rogers, 2003); Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975); Model of PC Utilization (MPCU) (Thompson, Higgins and Howell, 1991); Motivational Model (MM) (Davis, Bagozzi and Warshaw, 1992); Unified Theory of Acceptance and Use of Technology (UTAUT) (V Venkatesh *et al.*, 2003), and UTAUT2 (Venkatesh, Thong and Xu, 2012). In the context of older people, several theorists have focused on the acceptance of older people of technology in different areas (Renaud and Van Biljon, 2008; Chen and Chan, 2011; Peek *et al.*, 2014, 2016; WEEGH and KAMPEL, 2015; Chung, Demiris and Thompson, 2016; Liu *et al.*, 2016; Mostaghel, 2016; Yusif, Soar and Hafeez-Baig, 2016; Klimova and Poulova, 2018; Manis and Choi, 2019; Tsertsidis, Kolkowska and Hedström, 2019). This highlights some important factors that need to be considered when designing a technology solution for older people. For instance, the characteristics of older people, the need for technology, the level of fit of the technology for the task, and social influence.

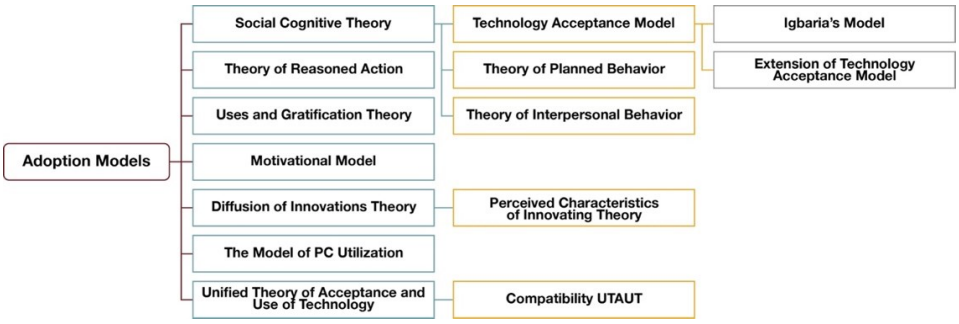


Figure 1-1 Overview of the adoption/acceptance models taken from (Taherdoost, 2018)

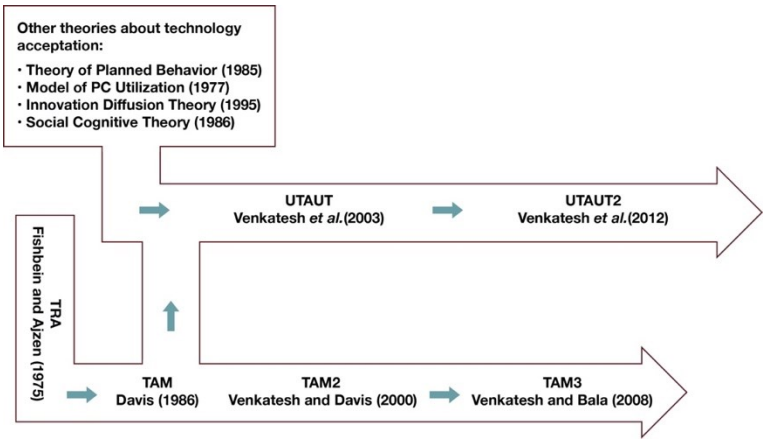


Figure 1-2 Overview of the adoption/acceptance models taken from (Rondan-Cataluña, Arenas-Gaitán and Ramírez-Correa, 2015)

1.6 The need to combine business goals with emerging technologies for better impact on the customer experience

As explained earlier, emerging technologies are important for the retail industry. Increasingly, businesses are looking for technologies that could help to react to opportunities or unexpected environmental threats (Tallon *et al.*, 2019). The integration of technology is of significant interest to a broad spectrum of stakeholders, primarily since companies can provide their customers with added value propositions to generate optimal customer experiences through a combination of virtual-physical touchpoints (Meyer and Schwager, 2007; Brakus, Schmitt and Zarantonello, 2009; Breitzman and Thomas, 2015).

Lemon and Verhoef (2016) consider that the customer experience is a multidimensional construct. Thus, recent developments of these technologies can influence the customer experience significantly (Lemon and Verhoef, 2016). Specifically, the ways the customer experiences the physical and the virtual environment (Flavián, Ibáñez-Sánchez and Orús, 2019).

Therefore, prior knowledge of these technologies has received great interest from companies to empower them to make strategic investments (Kyebambe *et al.*, 2017). However, the complexity of the customer journey and the rapid changes in technology and consumer behaviour makes identifying the appropriate technology a major challenge (Breitzman and Thomas, 2015; Kumar et al., 2016; Lemon and Verhoef, 2016), especially when considering the overwhelming amount of information and technologies available (Breitzman and Thomas, 2015). Consequently, companies may require new and flexible strategies (Lemon and Verhoef, 2016).

Hence, there has been recent interest from researchers in exploring and analysing this field (Breitzman and Thomas, 2015; Lemon and Verhoef, 2016). In this digital era, technology

forecasting and patent analysis offers a variety of relevant opportunities in this direction (Abbas, Zhang and Khan, 2014; Kyebambe *et al.*, 2017). To illustrate, these analyses are important for companies because of the value it adds to them through identifying their competitors, road mapping for promising technologies, and finding the gap or sweet spot for their business (Abbas, Zhang and Khan, 2014). These reasons have led many companies to adopt intelligent agent technologies (Kumar *et al.*, 2016). However, since these technologies are considered to be relatively new, complex and not yet fully developed, this means accurate forecasting is still problematic (Kumar *et al.*, 2016; Kyebambe *et al.*, 2017).

Various methods and tools have been developed to recognise and analyse these technologies (Kim, Suh and Park, 2008; Abbas, Zhang and Khan, 2014). However, previous methods have some drawbacks and there is a lack of consistency in the use of these terms (Bowman and Hodges, 1999; Tamura, Yamamoto and Katayama, 2001; Kim, Suh and Park, 2008; Flavián, Ibáñez-Sánchez and Orús, 2019; Yung and Khoo-Lattimore, 2019).

Therefore, there is a need to provide wide and flexible guidance and tools to companies to choose the appropriate solution for them and their strategy (Kumar *et al.*, 2016; Flavián, Ibáñez-Sánchez and Orús, 2019) in order to create a competitive advantage (Cearley *et al.*, 2017).

1.7 Research gap and conclusion

In the UK context, there have been several projects and research studies regarding exploring the grocery shopping experience of older people, such as the silver shoppers project (UK Research and Innovation, 2017), which has focused on exploring the grocery shopping experience of older people in the UK and China and has a range of publications and data (Lim et al., 2019; Waight and Yin, 2021; Yin, 2018; Yin et al., 2014). In addition, Towers and Howarth's (2020) study focused on Nottingham and Nottinghamshire areas. Furthermore, (Lim, Giacomin and Nickpour, 2018), (Omar et al., 2014) and (Meneely et al., 2009) addressed an overview of the grocery shopping experience for older people. These projects and research studies only focused on identifying general issues of older people grocery shopping without clarifying their main or most significant pain point. In addition, some of these projects and research studies suggested using technology to solve these issues. However, they did not specify which type of technology and how the technology can be applied to develop solutions for these issues. To address the gaps in existing research, this study applies User-Centred Design (UCD) and inclusive design approaches to gain a better understanding of the issues faced by older customers. This study takes the topic a step further by validating the previous results, identifying the main pain point, discovering and evaluating existing

smart retail technologies for older customers, and then providing design insights to improve supermarket service for customers aged 65+ in the UK via emerging technologies.

Therefore, to conclude this section, as highlighted in Figure 1-3, the literature has identified a rapid increase in the aging population in almost every country, and this group is growing faster than all other age groups. In terms of older people's lifestyles, grocery shopping plays a significant role for them as it is considered one of the Instrumental Activities of Daily Living (IADL). More importantly, older people represent a valuable segment for business as they spend more on groceries compared to other age groups. In contrast, considering the competition between grocery stores in the UK, older people still face grocery shopping issues that the supermarket has not resolved. Notably, in today's market, technologies are developing rapidly and play an important role in improving the shopping experience and providing a competitive advantage. Accordingly, it is preferable to use broad and flexible guidelines or frameworks to choose the appropriate technology for the design insights and recommendations in this thesis. Hence, this research contributes to the existing knowledge of older customers' grocery shopping experience, behaviour, and challenges by providing a comprehensive and updated view of the current grocery shopping experience of older people in the UK due to the lack of research in this field; by systematically reviewing the literature and validating it, then highlighting the key main issues using card sorting methods and questionnaire. Also, provide design insights and recommendations to improve supermarket service that can be implemented using the most appropriate emerging technology. This research provides valuable insights for supermarkets by identifying significant areas for enhancing their retail services to increase satisfaction among the growing older customer segment. Additionally, researchers can benefit from these findings to identify future research directions, whether focused on enhancing the grocery shopping experience for older customers or exploring the integration of emerging technologies. Also, policymakers in ageing related fields stand to gain valuable insights, empowering them to make informed decisions and act with effective strategies in addressing age related challenges.

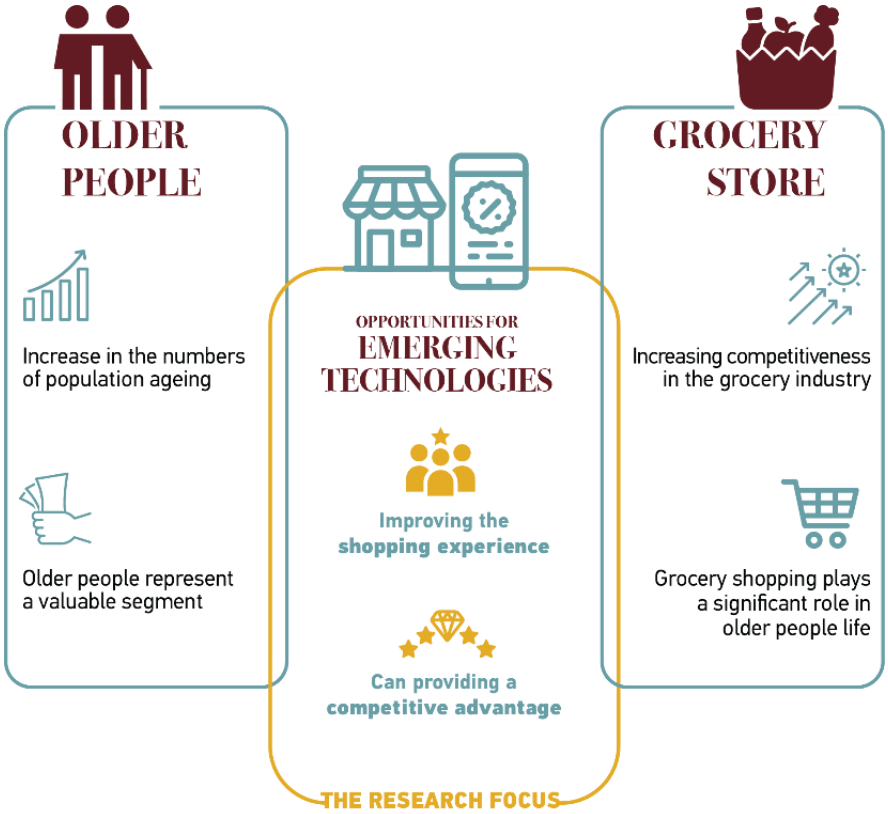


Figure 1-3 The research summary and focus

1.8 Scope of the study

The field of using emerging technologies to improve supermarket service and enhance grocery shopping may be too broad. Therefore, it is necessary to define the scope of work for this thesis. Starting with the meaning of grocery shopping in this thesis is the act of purchasing items that are commonly found in a supermarket for household consumption, including food, beverage, and non-food items (Etumnu and Widmar, 2020). About emerging technologies, (Rotolo, Hicks and Martin, 2015)'s definition will be followed, which was determined after reviewing 12 definitions and consists of five attributes, as follows: (i) radical novelty, (ii) growing relatively fast, (iii) coherence persisting over time, (iv) major impact, and (v) uncertainty and ambiguity about potential applications. With regard to the region, this study focuses on supermarkets in the UK. As for the targets and participants in this study are people aged 65 and over in the UK who were responsible for grocery shopping in physical stores before and during the Covid-19 pandemic with no permanent disability as the main target group. Since this study aims to provide design insights to improve supermarket service via emerging technologies, only participants who use technologies or have access to it are included.

1.9 Thesis structure

This chapter has demonstrated the main areas related to this thesis in order to formulate and focus the research topic, which includes understanding the target group, and the context of grocery shopping and its role in older people's lives, in addition to the opportunities and benefits that technologies can provide in solving these issues. Thus, the thesis is structured as follows:

Chapter 2: provides the background on current design approaches that are appropriate to the research objectives; the meaning of the shopping experience and its terminology; the impact of emerging technologies on the customer experience, and the presentation of several frameworks to analyse these new technological realities. This is followed by the research aim, objectives and questions.

Chapter 3: presents the rationale for the methodology and methods to clarify the position and the direction of this thesis. This chapter describes how the research design was applied in this thesis, and the reason for a mixed methods approach, including method triangulation to validate the findings. The methods selected are a systematic literature review, card sorting and a questionnaire.

Chapter 4: study 1 - a systematic literature review to discover the current grocery shopping experience of older people in the UK to gain a better understanding of the context and then form an appropriate direction for the research.

Chapter 5: study 2 - using the card sorting method to explore the current grocery shopping experience of customers aged 65+ in the UK. This is in order to validate the findings of study 1 and find out if there are other difficulties in the grocery shopping experience of customers aged 65 and above in the UK.

Chapter 6: study 3 - using a questionnaire as the research instrument to obtain large scale opinions about the current grocery shopping experience of customers aged 65+ in the UK and expand the knowledge gained from study 2 in order to find the main pain point.

Chapter 7: study 4 – using in-person card sorting method to investigate deeply the main pain point that was found in study 3. Also, to understand how participants navigate and obtain insights from them.

Chapter 8: review and examine the existing technologies in UK supermarkets and the current emerging navigation-focused technologies, then provide design insights to improve supermarket service for customers aged 65+ in the UK via emerging technologies.

Chapter 9: the thesis conclusion, contribution, limitations and recommendations for future work.

Chapter 2 Literature Review

2.1 Introduction

This chapter presents the background to current design approaches that are appropriate for meeting the research objectives; in addition to clarifying the meaning of the experience, what it includes and its terminology. Then, the impact of emerging technologies on the customer experience is explained. This is followed by the most appropriate framework for analysing these new technologies in order to improve the customer experience.

2.2 Design and co-design approaches that focus on people

It is necessary here to clarify the meaning of design. Design as a term is both a verb and a noun. Design as a verb is a creative process used in solving a problem. Design as a noun is the deliverable or the outcome of the design process (Steinitz, 1995). Design approaches that focus on people are commonly accepted as overlapping and blurred (Sanders and Stappers, 2012). Therefore, this section will briefly present the design approaches that are relevant to the research aim to provide more clarity and explain where it sits in the research.

2.2.1 Service design

Services need designing to deliver real value for the end user that will lead to a fulfilling and satisfying experience (Polaine, Reason and Løvlie, 2013). Service design plays a key role in encouraging service innovation (Yu and Sangiorgi, 2018; Prestes Joly *et al.*, 2019). It is a multidisciplinary approach that has grown as a human-centred, creative, and collaborative approach focused on enhancing existing services or creating and bringing new ones to life to provide a better experience (Blomkvist, Holmlid and Segelström, 2010; Zomerdijk and Voss, 2010; Ostrom *et al.*, 2015; Grenha Teixeira *et al.*, 2017; Patrício, Gustafsson and Fisk, 2018; Stickdorn *et al.*, 2018; Yu and Sangiorgi, 2018; Prestes Joly *et al.*, 2019). Originally, Shostack(1982) employed the term ‘service design’ in service blueprint design as a specific step within the New Service Development process.

There are several ways to perform a service design, and Polaine, Reason and Løvlie(2013) suggest three levels based on insights: Low-level insight "*What they say*", middle-level insight "*What we saw*", and high-level insight "*What it means*". Figure 2-1 shows the eight steps of the service

design methodology presented by (Service Design Toolkit, 2019) , namely: framing, user insights, personas, design scope, ideation, service concept, prototype and test, and feasibility.

Figure 2-1 Service design methodology from (Service Design Toolkit, 2019)

A number of tools and methods have been developed to carry out these steps. For instance, in the user insights step, Figure 2-2 and Figure 2-3 show the user/customer experience or journey map tool. The benefit of this tool that it leads to a representation that describes how a user/customer interacts step by step with a service (see Section 2.3 for further explanation).

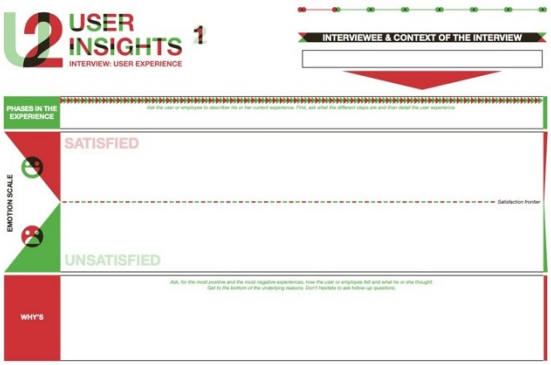


Figure 2-2 User experience tool from (Service Design Toolkit, 2019)

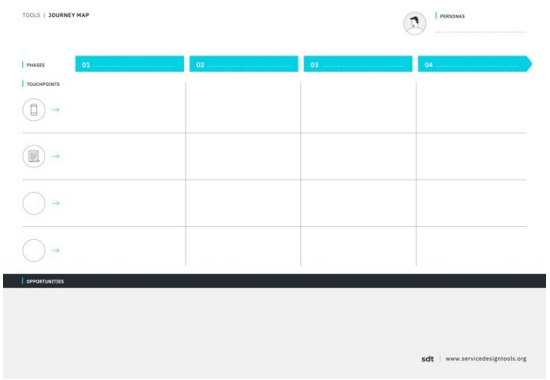


Figure 2-3 Journey map tool from (Service Design Tools, 2019)

In addition, card sorting can help uncover the participants' mental models and understand how they prioritise information (Service Design Tools, 2019), which is explained in more depth in Section 3.7.2. Furthermore, a persona is one of the most well-known tools for representing the end-user. Persona is a fictional character, which is created based on research to represent different types of users. Also, it helps to understand users' needs, goals, experiences, and behaviours. Moreover, it is a way of assessing a design's development (Dam and Siang, 2021). Figure 2-4 and Figure 2-5 shows different ways to represent a persona.

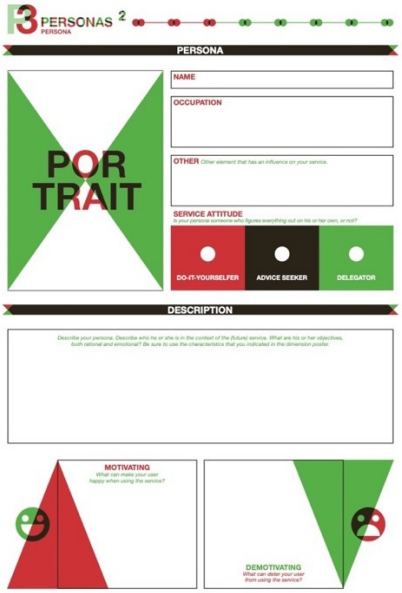


Figure 2-4 Persona tool from (Service Design Toolkit, 2019)

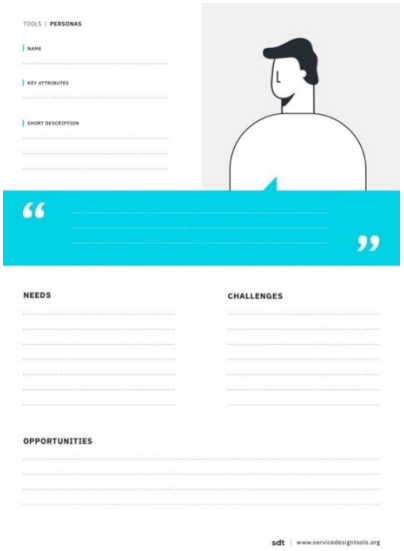


Figure 2-5 Persona tool from (Service Design Tools, 2019)

2.2.2 Inclusive design

Inclusive design aims to provide a product, service, or environment designed to be used by as many people as possible for better life opportunities, through understanding user diversity and equality (Clarkson *et al.*, 2003; Coleman, Clarkson and Cassim, 2016). It considers as a user-centred approach to design (Keates and Clarkson, 2004). The term inclusive design was first used by Roger Coleman in 1994. Also, inclusive design is known as *Design for All* and *Universal Design* in Europe and the US (Clarkson *et al.*, 2003; John Clarkson and Coleman, 2015; Coleman, Clarkson and Cassim, 2016). More importantly, that does not suggest it is always possible or appropriate to design a solution that meets the entire population's needs. Instead, inclusive design aims to extend the target segment. Figure 2-6 shows how an inclusive design aims to deliver an

appropriate solution that extends the target segment based on the pyramid model of diversity (Hosking, Waller and Clarkson, 2010).

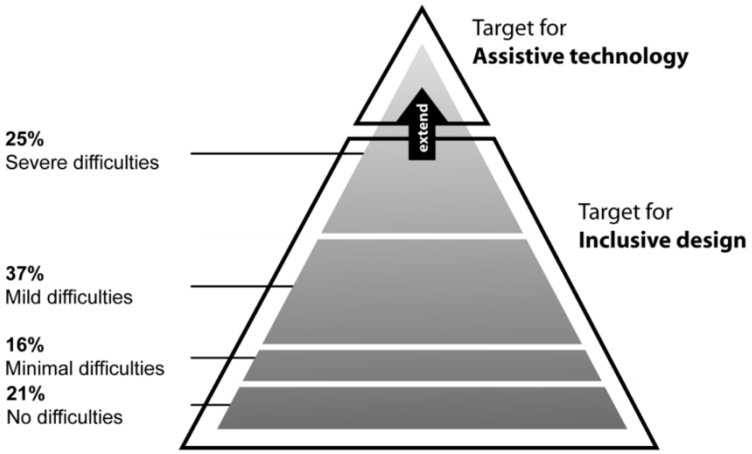


Figure 2-6 The target of inclusive design based on the pyramid model of diversity (Hosking, Waller and Clarkson, 2010)

Clarkson *et al.*(2003) came up with the Inclusive Design Cube Figure 2-7, which contains three design approaches that can address the needs of the wider population when combined. Designing for the whole population falls into three categories: first, user-aware design - pushing the boundaries of mainstream products to include as many people as possible; second, customisable/modular design - design to minimise the difficulties of adaptation to specific users; third, special-purpose design - designing for specific users with specific needs. The Inclusive Design Cube contains three capability types: the user's cognitive, sensory, and motor capability, and these together reflect the capabilities of the entire population. In addition, the Inclusive Design Cube is particularly useful to identify who will be included or excluded and why through the Design Exclusion.

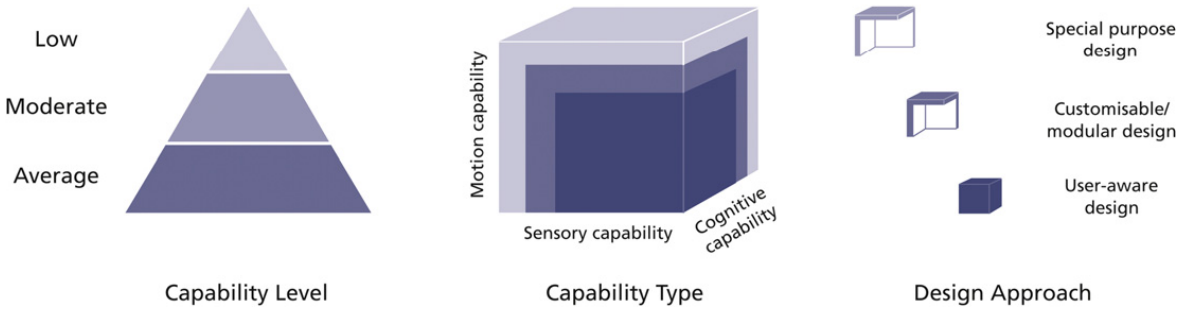


Figure 2-7 The Inclusive Design Cube from (Clarkson *et al.*, 2003)

Several methods and toolkits have been developed for inclusive design, such as the BS 7000-6:2005 standard from the British Standards Institute, Inclusive Design Toolkit (Exclusion

Calculator), Design with People (Persona, Scenario, etc.), and the Design Wheel. However, Newell et al.(2010) suggested "User-Sensitive Inclusive Design" because they argue that the current inclusive design might be unusable because it often takes the user as a means of evaluating prototyping at the last stage of the design process, without real empathy during the design process. Therefore, including a co-design approach might be useful to ensure real empathy with the end-user.

Furthermore, psychosocial inclusivity in design was introduced to fill the gap in the theory and practice of inclusive design by focusing beyond physical aspects (Lim, Giacomin and Nickpour, 2021). It was used for the first time by Lim *et al* (2019) in the context of the grocery shopping experience for older individuals in the UK. It includes four constructs, namely: cognitive, emotional, social and value, and is often evaluated through the Instrumental Activities of Daily Living (IADL) (Lim et al., 2019).

2.2.3 Co-design

Co-design aims for active collaboration in the design process by involving future end-users and people from different disciplines in the design process in order to design more meaningful and useful output. According to a definition provided by Sanders and Stappers (2012), co-design is a design approach that invites designers to work together with potential future users and people from non-design disciplines in a range of creative interactions applied across the design and development process. Figure 2-8 illustrates the shifting roles in the co-design process, where the end-user is given a primary role in the design process compared to the classical design process (Sanders and Stappers, 2008). Visser *et al.*(2007) propose a model for understanding the levels of knowledge to be accessible by each design research technique, as shown in Figure 2-9. Thus, involving people in the making of the results will lead to deeper knowledge of their experience.

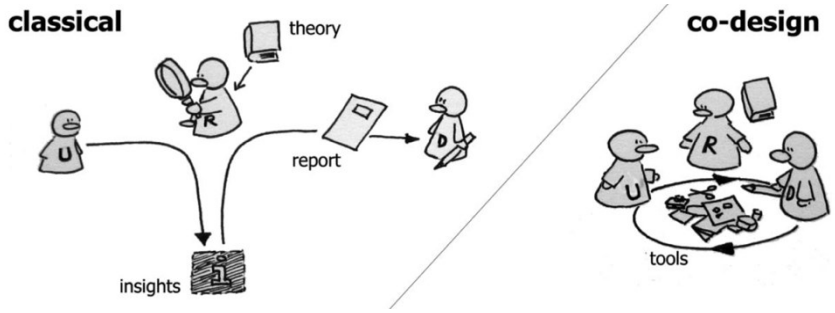


Figure 2-8 Different roles of Users(U), Researchers(R), and Designers(D) in the design process between classical and co-designing (from Sanders and Stappers(Sanders and Stappers, 2008)

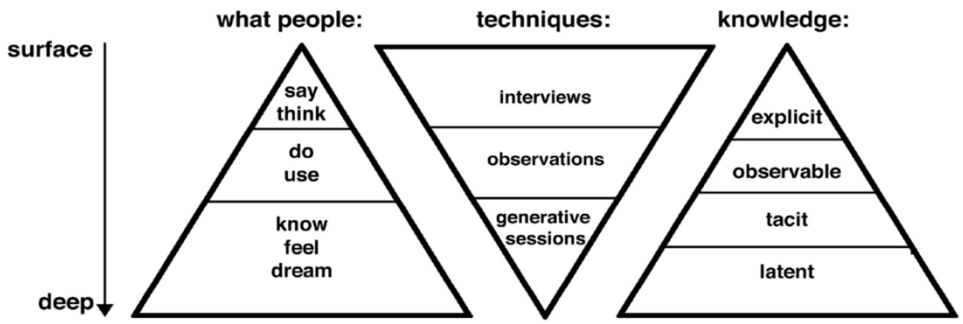


Figure 2-9 Different levels of knowledge to be accessible by each design research technique from Visser *et al.*(2007)

One of the benefits associated with co-design is discovering what to design has better quality in that it meets users' needs (Sanders and Jan Stappers, 2008; Roser and Samson, 2009; Sanders and Stappers, 2012). In the design of services, co-design is seen as crucial to success and improved service quality. Also, it can improve the creative process and is beneficial to both organisations and the target group (Steen, Manschot and Koning, 2011; Trischler *et al.*, 2018). Despite these benefits associated with co-design, there are a range of issues that need to be addressed. For instance, there are debates around what type of participant should be included in the study in order to represent the target group and obtain effective results (Hippel, 2005; Sanders and Stappers, 2012). A possible solution to overcome this challenge is to include participants who best represent typical future users. Also, there are issues surrounding ethics and intellectual property ownership in the co-design processes (Sanders and Stappers, 2012). In addition, there are some challenges concerning facilitating co-design activities effectively, which requires practice and experience (Sanders and Stappers, 2008).

Several tools, methods and techniques are used in co-design activities and processes. Table 2-1 shows a framework presented by Sanders, Brandt and Binder(2010) for design tools that can be used in co-design and participatory design based on their role. This is useful in understanding the roles of certain activities or tools, and whether they are appropriate for an individual, group, face-to-face or online applications, as well as the outcomes that can be achieved from using them. Based on Sanders, Brandt and Binder(2010), "cards" appear to be face-to-face only; however, based on Baxter, Courage and Caine(2015), "cards" can be done on-line (see Chapter 3, Section 3.7.2.3).

Table 2-1 Tools and techniques and their purpose and context in co-design, as described by Sanders, Brandt and Binder(Sanders, Brandt and Binder, 2010)

CURRENT APPLICATIONS OF THE TOOLS AND TECHNIQUES	PROBE	PRIME	UNDERSTAND	GENERATE	INDIVIDUAL	GROUP	FACE-TO-FACE	ON-LINE
MAKING TANGIBLE THINGS								
2-D collages using visual and verbal triggers on backgrounds with timelines, circles, etc.	✓	✓	✓	✓	✓	✓	✓	✓
2-D mappings using visual and verbal components on patterned backgrounds		✓	✓	✓	✓	✓	✓	
3-D mock-ups using e.g. foam, clay, Legos or Velcro-modeling			✓	✓	✓	✓	✓	
TALKING, TELLING AND EXPLAINING								
Stories and storyboarding through writing, drawing, blogs, wikis, photos, video, etc					✓	✓	✓	✓
Cards to organize, categorize and prioritize ideas. The cards may contain video snippets, incidents, signs, traces, moments, photos, domains, technologies, templates and what if provocations.			✓	✓	✓	✓	✓	
Diaries and daily logs through writing, drawing, blogs, photos, video, etc.	✓	✓	✓		✓		✓	✓
ACTING, ENACTING AND PLAYING								
Game boards and game pieces and rules for playing		✓	✓	✓	✓	✓	✓	
Props and black boxes			✓	✓	✓	✓	✓	
Participatory envisioning and enactment by setting users in future situations				✓	✓	✓	✓	
Improvisation				✓	✓	✓	✓	
Acting out, skits and play acting			✓	✓				

2.2.4 Human\User centred design

User Centred Design (UCD) is a broad design approach that focuses on users and their needs by using various collection of methods and tools throughout the design process (Abras, Maloney-Krichmar and Preece, 2004; Mao *et al.*, 2005). The field of user centred design has been popularised and documented by multiple authors, such as Donald Norman, Bill Moggridge and Bill Buxton (Abras, Maloney-Krichmar and Preece, 2004; Halse *et al.*, 2010). *User Centred System Design: New Perspectives on Human-Computer Interaction* by Norman and Draper (1986) is one of the first books which was a reaction to the complexity of the new technologies at that time, and this led to new design challenges (Abras, Maloney-Krichmar and Preece, 2004).

Figure 2-10 shows Human Centred Design processes for interactive systems (ISO 13407:1999). The process consists of several activities that are iterated till the design meets the requirements, and the goal is for activities to be planned in such a way that iterations can be achieved (Vilpola, 2008). Regardless of the fact that user involvement is evident in the Human Centred Design process, and at every stage of the process, the meaning of user involvement varies greatly, both in theory and in practice (Kotamraju and Geest, 2011). Therefore, Wever, Kuijk and Boks(2008) suggest when and how users should be involved in the design cycle, as shown in Figure 2-11.

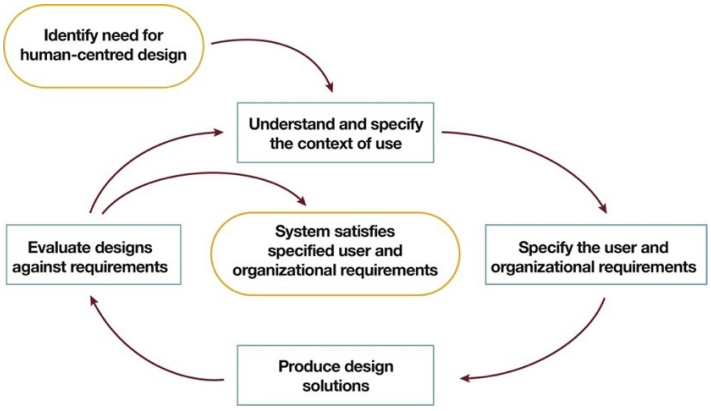


Figure 2-10 Human Centred Design processes for interactive systems (ISO 13407:1999)

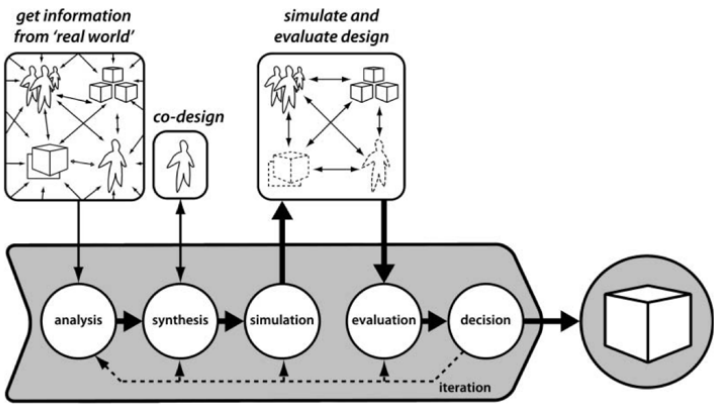


Figure 2-11 The User Centred Design cycle from (Wever, Kuijk and Boks, 2008)

There are various methods that have been used within User Centred Design, and Table 2-2 shows the main methods (Bruseberg and Mcdonagh-Philp, 2000; Monk, 2000; Goodman-Deane, Langdon and Clarkson, 2009) .

Table 2-2 List of methods used in User Centered Design

Process	Methods
Preparation and understanding the problem	• Focus groups • Interviews • Observation • Task analysis • Problem abstraction
Idea generation	• Brainstorming • Brainwriting • Mood boards
Testing and concept selection	• Scenario • Sketching • Prototyping • Usability Labs

2.3 Customer experience, customer journey and its terminology

There has been growing interest in, and awareness of, service processes and customer experience over the past three decades (Følstad and Kvale, 2018; Tueanrat, Papagiannidis and Alamanos, 2021). The experiential and processual aspects of the experiences in the service field are crucial (Edvardsson, Gustafsson and Roos, 2005), and several definitions of customer experience have been proposed. Historically, customer experience is broadly defined by (Abbott, 1955) and (Alderson and Stanley, 1957) as focusing on satisfying experiences - not products. Customer experience is crucial to providing a competitive advantage in service, and it encompasses different aspects (Pine and Gilmore, 1998; Meyer and Schwager, 2007; Verhoef *et al.*, 2009; Schmitt, Joško Brakus and Zarantonello, 2015; Lemon and Verhoef, 2016a; Bolton *et al.*, 2018; Følstad and Kvale, 2018; Flavián, Ibáñez-Sánchez and Orús, 2019; De Keyser *et al.*, 2020). Through a multidimensional and holistic view, (Schmitt, 1999) categorised the experiences into five types: sense (sensory), feel (emotional), think (cognitive), act (behavioural) and relate (social-identity). In a retailing context, customer experience can be classified along the lines of the retail mix such as price experience and promotion experience (Grewal, Levy and Kumar, 2009; De Keyser *et al.*, 2020). Customer experience can be designed, delivered, and managed through multiple perspectives: the firm's point of view, the customer's point of view, and a co-creation perspective

(Berry, Carbone and Haeckel, 2002; Stuart and Tax, 2004; Schmitt, 2011; Chandler and Lusch, 2015; Lemon and Verhoef, 2016a). Customer experience can be presented and understood through the customer journey and service blueprinting (Følstad and Kvale, 2018; Lemon and Verhoef, 2016).

Customer journey and service blueprinting are commonly used approaches within service design (Halvorsrud, Haugstveit and Pultier, 2016; Halvorsrud, Kvale and Følstad, 2016; Følstad and Kvale, 2018). The main focus of service blueprinting is divided between the customer's perspective and issues with the organisation and the underlying service infrastructure (Halvorsrud, Haugstveit and Pultier, 2016; Følstad and Kvale, 2018). The customer journey aims to represent the processual and experiential aspects of a service delivery process from the customer's perspective as an "engaging story" or a " walk in the customer's shoes" (Halvorsrud, Kvale and Følstad, 2016; Følstad and Kvale, 2018; Nam and Kannan, 2020), and can help to understand complex customer behaviour and gain insights into their experiences (Tueanrat, Papagiannidis and Alamanos, 2021). Følstad and Kvale(2018) classified the customer journey into two types: customer journey mapping "as is" which are the activities performed to analyse the process of existing services, and customer journey proposition "to be" which represents a generative design activity within the perspective of the customer's journey, leading to the available services.

There are some terminologies associated with customer journey and it may be divided into two main groups. Terms that refer to sections of the customer journey and terms that refer to individual points of interaction between a customer and a service provider (Følstad and Kvale, 2018). Terms that refer to a section of a customer's journey, such as steps or stages, can be divided into pre-purchase, purchase, and post-purchase (Lemon and Verhoef, 2016a; Følstad and Kvale, 2018; Nam and Kannan, 2020). Terms that refer to an individual point in a customer's journey include touchpoints that encompass channels or physical surroundings (Følstad and Kvale, 2018; Nam and Kannan, 2020). Lemon and Verhoef(2016) categorised touchpoints into four main types: brand-owned, partner-owned, customer-owned, and social/external touchpoints. The term pain point in a customer journey indicates the difficulties users encounter during their journey (Halvorsrud, Haugstveit and Pultier, 2016; Halvorsrud, Kvale and Følstad, 2016; Lemon and Verhoef, 2016a; Moon *et al.*, 2016).

2.4 The impact of new realities technologies on the customer experience

In terms of understanding and classifying different realities, Milgram and Kishino(1994) introduced the "Virtuality continuum", which has been the starting point for a wide range of research studies classifying different realities (see Figure 2-12). Then, different taxonomies

appeared and expanded Milgram and Kishino's (1994) continuum to include the new realities that have appeared with the development of new technologies.

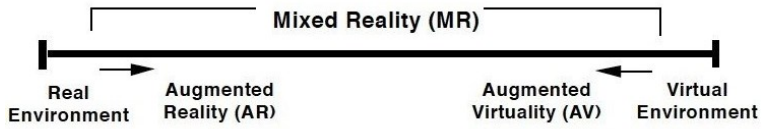


Figure 2-12 The Virtuality continuum (from Milgram and Kishino, (Milgram and Kishino, 1994)

For instance, Mann (2002) added the concept of mediation to Milgram and Kishino's (1994) continuum, which was introduced by Stratton (1897, 1896) (Figure 2-13).

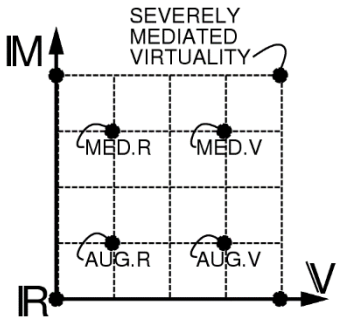


Figure 2-13 Taxonomy of Reality, Virtuality and Mediality from Mann (2002)

Based on Milgram and Kishino (1994) and Mann (2002), Schnabel et al. (2007) added new dimensions and draws a clear distinction between Virtual Reality (VR), Mixed Reality (MR), Augmented Reality (AR), and Augmented Virtuality (AV) (see Figure 2-14). In addition, some researchers have focused on a particular aspect, such as Milgram et al. (1995) who discussed AR displays within the context of the "Virtuality continuum".

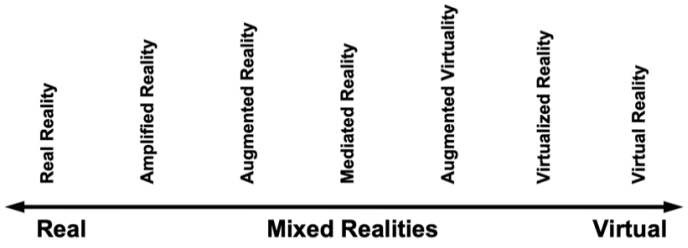


Figure 2-14 Order of different reality concepts ranging from Reality to Virtuality presented by Schnabel et al. (2007)

Other studies have presented different frameworks or models that attempt to classify these technologies. For instance, Bowman and Hodges (1999) discuss the interactive techniques of

Immersive Virtual Environments. Williams, Szafir and Chakraborti (2019) have presented "The Reality-Virtuality Interaction Cube" for categorising Augmented Reality and Virtual Reality. Also, León, Hernández-Serrano and Soriano (2012) have proposed two models for the 'Future Internet of Things'. In addition, others have analysed and classified patents predicting based on Milgram and Kishino's (1994) continuum. Moreover, some scholars (Milgram, 1999; Schroeder, 2008; Jeon and Choi, 2009; Rauschnabel, Rossmann and tom Dieck, 2017) have used Milgram and Kishino's (1994) continuum to focus on analysing AR and VR.

However, these previous studies have some limitations or weaknesses. Hence, Flavián, Ibáñez-Sánchez and Orús (2019) have proposed the Embodiment-Presence-Interactivity (EPI) Cube, by critically reviewing the previous frameworks and integrating appropriate aspects for a better understanding of the differences between these technologies and the impact of them on the customer experience. Thus, the EPI is an appropriate framework that could be used in this research to analyse existing technologies.

2.4.1 The Embodiment-Presence-Interactivity (EPI Cube)

Figure 2-18 shows the EPI Cube, which is a combination of several variables from different areas that cover all the factors involved in Human Technology Interaction (HTI). The three main factors are behavioural interactivity (Figure 2-15), technological embodiment (Figure 2-16) and perceptual presence (Figure 2-17).

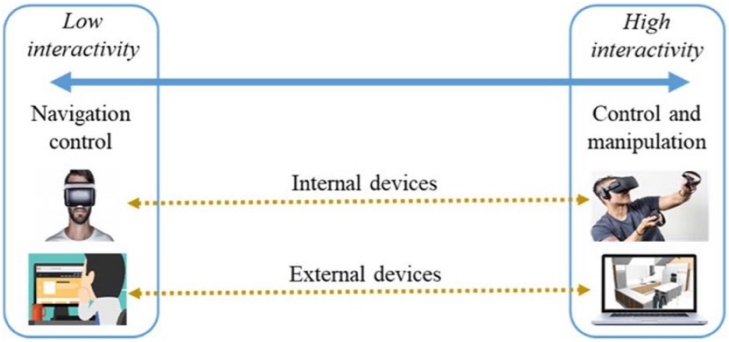


Figure 2-15 Behavioural interactivity continuum (Flavián, Ibáñez-Sánchez and Orús, 2019)

Figure 2-16 Technological embodiment continuum (Flavián, Ibáñez-Sánchez and Orús, 2019)

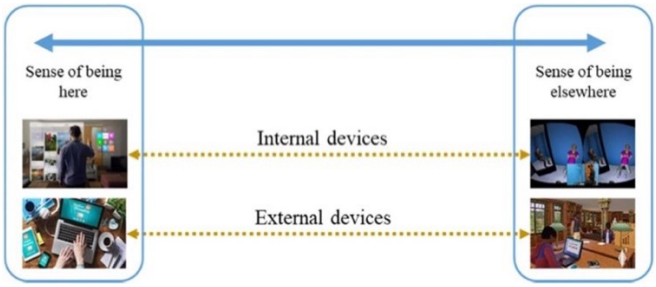


Figure 2-17 Perceptual presence continuum (Flavián, Ibáñez-Sánchez and Orús, 2019)

In Figure 2-18, external devices are placed in vertices 1 to 4. Vertex 1 represents technologies that are unintegrated in the body, and which the user feels are in their actual place and they just can control the content display only but not modify it, such as computer 1.0 websites and TV. Vertex 2 is similar to vertex 1; the only difference is that the user can manipulate and modify the environment and content, such as online website simulators. Vertex 3 is similar to vertex 1 in terms of behavioural interactivity, but vertex 3 has a high level of presence where users may feel that they are in a place other than their actual place, such as Video Wall or 3D cinema. Vertex 4 is like vertex 2, but in vertex 4, users have a high level of presence, such as videogames and virtual worlds/platforms.

Internal devices are placed in vertices 5 to 8, where technologies are more integrated into the human body. Vertex 5 refers to where users can control the content display only, but not modify it, such as Augmented Reality glasses. In vertex 6, users can modify and manipulate the content, such as Pure Mixed Reality glasses (e.g., holographic devices). Vertex 7 is like vertex 5, but in vertex 7 users have a high level of presence where they may feel that they are elsewhere, such as 360- degree HMD videos. Vertex 8 is similar to vertex 6, and the only difference is that users may feel that they are in a place other than their actual place: a "high level of presence", such as virtual reality HMD with haptic suit.

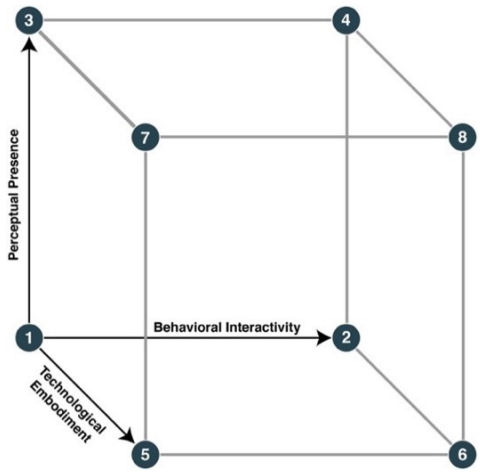
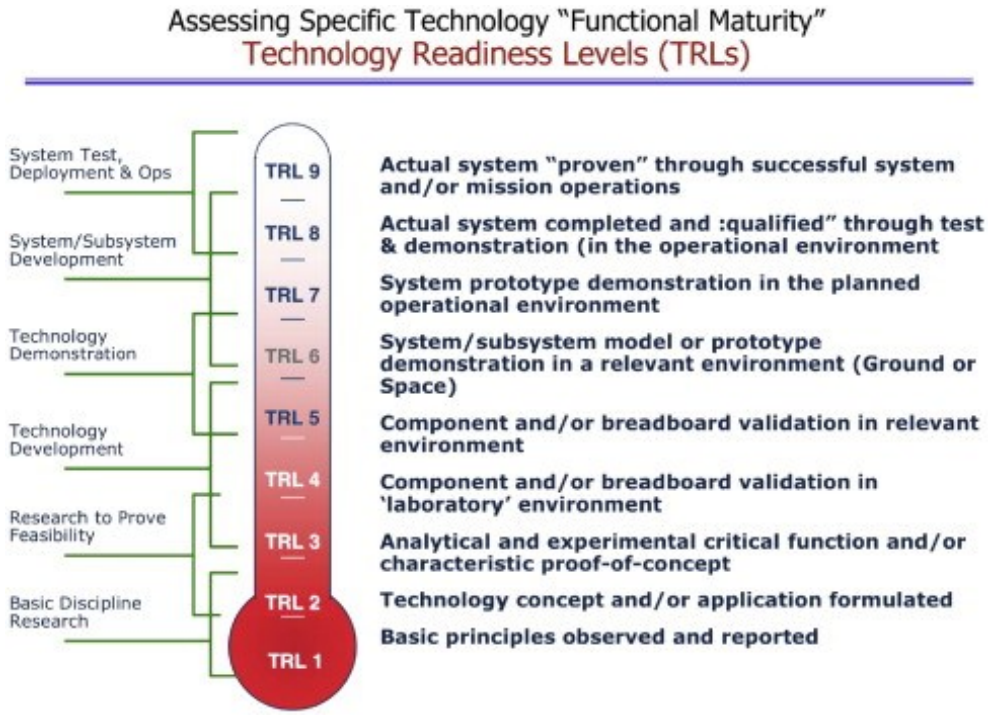


Figure 2-18 EPI Cube adopted from Flavián, Ibáñez-Sánchez and Orús, 2019

2.4.2 The Technology Readiness Level (TRL)

With the technology variety that exists in the current market, it is important to have tools to help understand the state of the technology and make strategic decisions. The technology readiness level (TRL) scale is the most widely used tool for technology maturity assessment (Mankins, 2009; Olechowski, Eppinger and Joglekar, 2015). The TRL scale was introduced by the National Aeronautics and Space Administration (NASA) in the 1970s as an effective method for assessing the maturity of new technologies (Mankins, 2009; Olechowski, Eppinger and Joglekar, 2015; Rybicka, Tiwari and Leeke, 2016; Beims, Simonato and Wiggers, 2019). Also, this scale is currently used as a de facto standard for technology assessment and oversight in multiple industries (Mankins, 2009; Olechowski, Eppinger and Joglekar, 2015). The TRL involved nine levels, as shown in Figure 2-19 from Mankins (2009).

Figure 2-19 The nine levels of the TRL scale summarised by Mankins (2009)



2.5 Research Aim and Objectives

This research aims to investigate aged 65+ customers' grocery shopping experience in the UK, so as to identify the main pain point and provide design insights and recommendations to improve supermarket service via emerging technologies. The research objectives are:

OB 1. To review state of the art customer experience design and related design approaches, the shopping experiences and needs of older people, emerging technologies, and smart retailers in the context of supermarkets.

This is to gain a general understanding of these concepts in order to identify boundaries and opportunities for the research.

OB 2. To map out the current grocery shopping experience of customers aged 65 and over in the UK in order to identify their shopping patterns as well as shoppers' pain points.

The goal is to discover the main pain points that customer aged 65 and over face concerning their grocery shopping, and to check if there are new problems in the current shopping experience, in addition, to measuring their satisfaction with these issues.

OB 3. To examine the appropriate use of emerging technologies in relation to supermarkets and older people.

This will help identify boundaries and opportunities for using emerging technologies to provide design insights to improve supermarket service for customers aged 65+ in the UK.

OB 4. To provide design insights for incorporating Augmented Reality (AR) into existing apps or devices to improve supermarket service for customers aged 65+ in the UK.

By providing a persona that represents older people and their characteristics, then delivering design insights and recommendations for incorporating Augmented Reality (AR) into existing supermarket apps or devices to guide customers inside the store and meet their needs.

2.6 Research Questions

RQ1. What are the main pain points of the current grocery shopping experience for customers aged 65 and over in the UK?

RQ2. What is the appropriate emerging technology to overcome the main pain point in the grocery shopping experience of customers aged 65 and over in the UK?

Figure 2-20 illustrates the research aim, questions, objectives, methods, and their connection with each other.

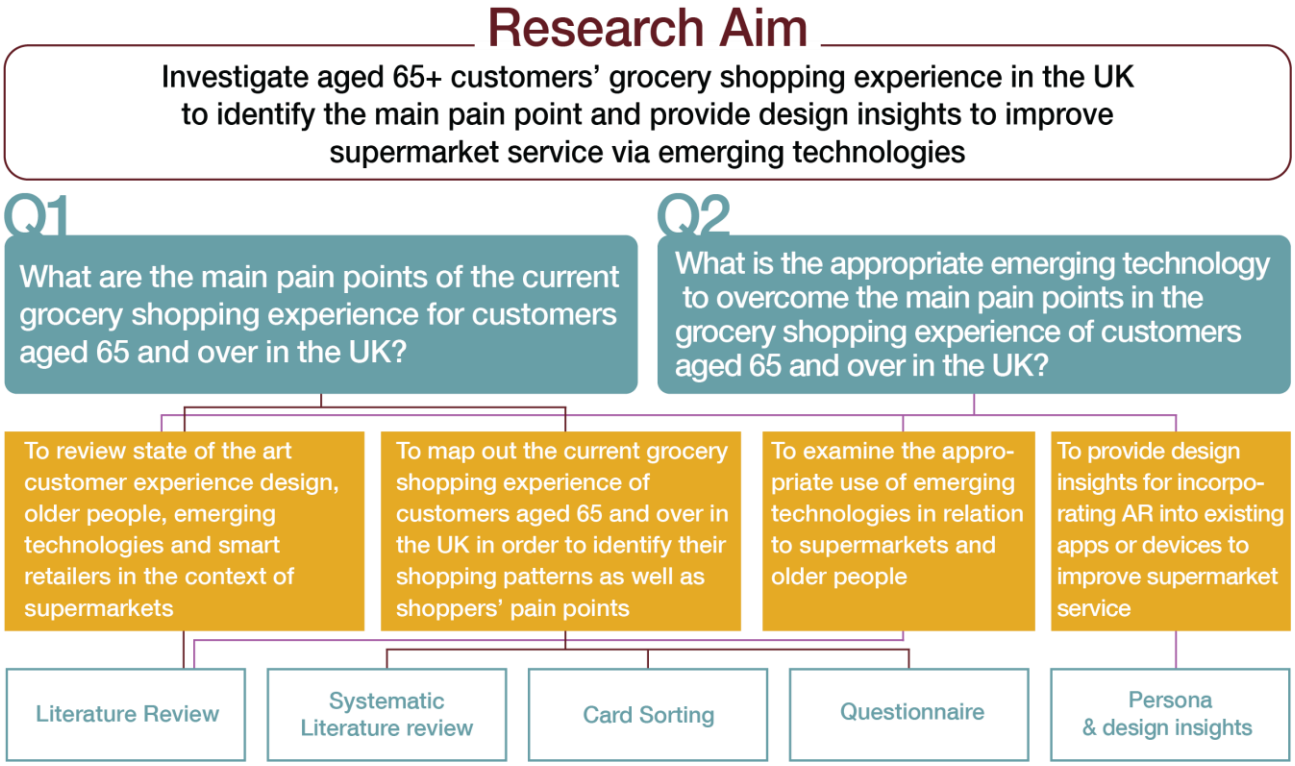


Figure 2-20 Overview of the research plan

2.7 Conclusion

This chapter has presented the background of the literature relating to different design approaches, the meaning of the customer experience and its terminology, and the impact of emerging technologies on the customer experience, which has included several frameworks to analyse these new realities technologies. This was followed by the research aim, objectives and questions. Therefore, to achieve this thesis' aim, a mixed-methods approach involving a systematic literature review, card sorting, and a questionnaire, has been adopted using the double diamond and the three diamonds diagrams, as described in the next chapter.

Chapter 3 Research methodology

3.1 Introduction

This chapter outlines the overarching research approach and strategy designed to achieve the aim and objectives of this thesis. The Research Onion has been adopted to structure this chapter since it delivers an effective procedure for designing a research methodology (Saunders, Lewis and Thornhill, 2019).

As shown in Figure 3-1, the Research Onion contains six layers, which are as follows: philosophical paradigms, research approach, methodological choice, research strategy, time horizon, data collection and data analysis.

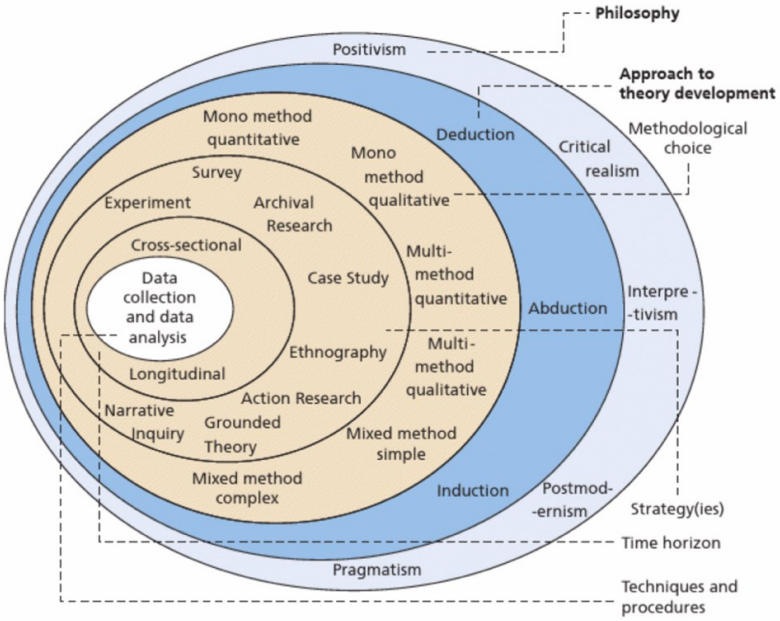


Figure 3-1 The Research Onion from (Saunders, Lewis and Thornhill, 2019)

This chapter discusses these layers, and then the rationale for choosing a particular approach or method is presented. Then, the most appropriate way to apply these methods is determined in this thesis. As a result, the pragmatic approach was adopted as the philosophical paradigm for this thesis. Mixed methods and method triangulation have been employed to understand better the research problem using systematic literature review, card sorting methods, and questionnaires. Finally, the double diamond has been used as a simple and comprehensive graphical representation of the design strategy.

3.2 Research philosophical

There are different types of research paradigms, and these can be classified based on their characteristics and components, including philosophical assumptions and the methods or procedures used (Pantano and Vannucci, 2019; Grewal *et al.*, 2020). Also, there are five main components, which are ontology, epistemology, methodology (Creswell, 2014), methods, and sources (Crotty, 1998; Hay, 2002). Figure 3-2 below shows the relationship between these components and the corresponding definitions.

Research paradigms are generally categorised by their characteristics in terms of these main components (ontology, epistemology and methodology) (Hay, 2002). Ontology is about "*what's out there to know*" or what exists (Hay, 2002). Epistemology is the theory of knowledge "*how and what can we know*", which is embedded in the theoretical perspective (Grix, 2002). The theoretical perspective informs the methodology and provides the context for the process and grounding of its logic and criteria. The methodology encompasses the strategy, plan of action or procedures used to choose appropriate methods and links the choice of methods to the desired outcomes "*how can we go about acquiring that knowledge*" (Grix, 2002). According to the definitions provided by Crotty (1998), methods refer to the techniques or processes used to collect or analyse data in order to answer the research questions. Sources are about the type of data we can collect (Grix, 2002).

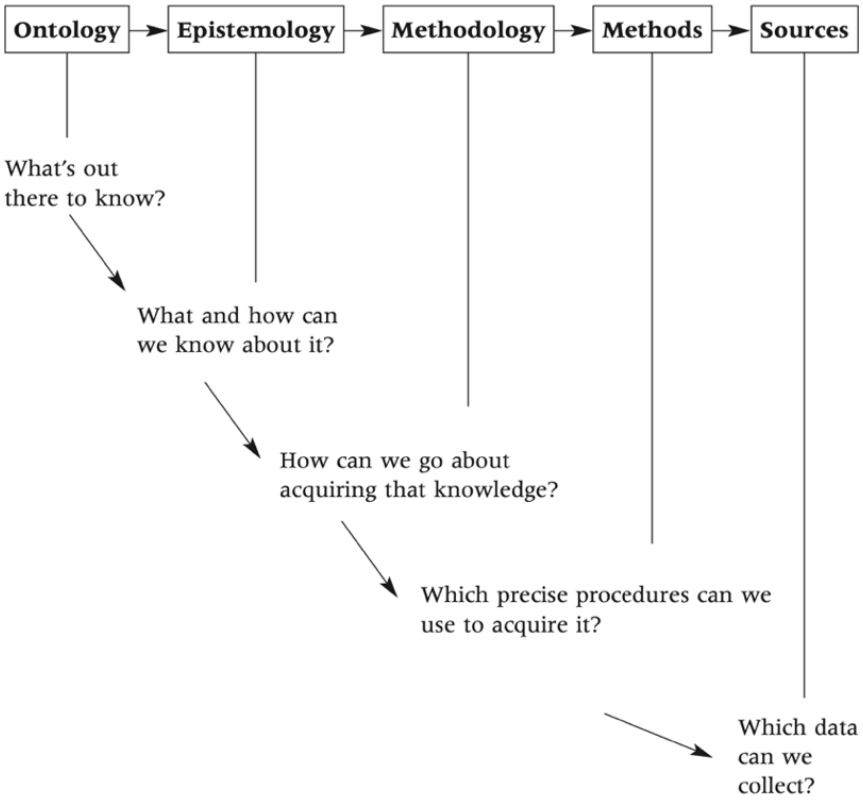


Figure 3-2 The research components adopted from (Grix, 2002)

The philosophical view of the researcher impacts on the practice of the research, even though they remain hidden in the research, so there is a need to identify them (Hay, 2002) and make them explicit (Creswell and Creswell, 2022). The term worldview means a set of beliefs that guide action, which some researchers call paradigms (Creswell and Creswell, 2022). The worldview helps determine the type of methods required to address the research question, Creswell (2014) has classified them into four types that are widely accepted by researchers, and they are: postpositivism, constructivism, transformative and pragmatism. Table 3-1 below highlights the primary elements of each worldview.

Table 3-1 The philosophical worldviews based on (Creswell and Creswell, 2022) classification.

Postpositivism	**Constructivism**
• Determinism • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meaning • Social and historical construction • Theory generation
Transformative	**Pragmatism**
• Political • Power and justice oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-Centred • Pluralistic • Real-world practice oriented

The postpositivism worldview is a traditional form of research used mainly in quantitative research than qualitative research (Creswell and Creswell, 2022). This worldview challenges the notion of absolute truth in knowledge when studying human behaviour and actions. Postpositivists believe that causes (probably) determine effects or outcomes and seek to identify and assess the causes which influence outcomes, such as experiments (Creswell and Creswell, 2022). Postpositivist research starts with a theory, then collects data that supports or rebuts the theory, and then makes required revisions and performs additional tests.

The constructivist worldview believes that people seek an understanding of the world where they live and work. It suggests that knowledge is not absolute or objective; individuals develop their own subjective interpretation of the world based on their cultural background and experiences (Creswell and Creswell, 2022). Thus, the constructivist worldview is used in qualitative research with open-ended questions so individuals can share their views. The qualitative research process is primarily inductive.

The transformative worldview has no uniform body of literature characterising it, but it includes different groups of researchers, such as critical theorists, community-based participatory researchers, and participatory action researchers (Creswell and Creswell, 2022). This worldview focuses on the needs of individuals and groups in our community that may be marginalised or disenfranchised to create a just and equitable world through transformative change and collective action.

The pragmatic worldview suggests that there are multiple ways of conducting research and interpreting the world to investigate reality which provides a more comprehensive understanding of the phenomena being studied (Creswell and Creswell, 2022). Pragmatic research does not pretend there is only one absolute truth and avoids abstract, fixed principles, according to William James, one of the major figures in this philosophy (James, 1975). The research designs for the pragmatic worldview involve operational decisions based on '*what will work best at the time*' in finding answers to the research questions, enabling researchers to conduct research creatively and dynamically (Anthony and Education, 2018). The pragmatic worldview holds that meaning is made by human experience and can be understood through language and communication (James, 1975; Anthony and Education, 2018).

With regard to the choice of the worldview for this thesis, it is essential to return to the research questions introduced in Section 2.6. The pragmatic approach appeared to be the appropriate philosophical paradigm for finding suitable solutions for this thesis. Particularly since the research aims investigate aged 65+ customers' grocery shopping experience in the UK, which relies on gathering data about the customers' views and perceptions, which consider less objective paradigms.

3.3 Research approach

(Crotty, 1998) proposed two research approaches to determine where research sits, namely, inductive (top-down) and deductive (bottom-up). These approaches are defined based on epistemology, theoretical perspective, methodology, and methods. Since this research falls under the pragmatic approach, which requires the researcher to go up and down according to the need of the research, this research is neither strictly top-down (inductive) nor bottom-up (deductive).

There are several ways to describe design processes; (Dubberly, 2015) has gathered over a hundred definitions of design and development processes. There is a combination of two main modes of thinking in the design process: divergent and convergent thinking. Divergent thinking starts from a single point and generates varied ideas, whereas convergent thinking starts from multiple points and seeks one most true or valuable finding (Brophy, 2010).

There are many models and frameworks available for the methodology in the design process to ensure that research is performed scientifically (Crotty, 1998). These provide a logical structure to guide the research process. Since this thesis is a multidisciplinary research, two methodologies were taken into account, namely research methodologies and design methodologies. Research methodologies include a five-stage framework for research design (Robson and McCartan, 2016), Design Research Methodology (DRM) framework (Blessing and Chakrabarti, 2009), and spiral of applied research (Eckert *et al.*, 2003). Design methodologies are as follows design wheel model (Waller *et al.*, 2015) *Figure 3-3* and double diamond diagram launched in 2004 (Design Council, 2019) *Figure 3-4*, which was later revisited and presented by (Tassoul and Buijs, 2007) with three diamonds *Figure 3-5.*

The five-stage framework for research design aims to help researchers identify research topics and select suitable methods to guide a research project. It contains the purpose, conceptual framework, research questions, methods, and sampling procedures. The design research methodology framework provides a hands-on approach to research design. It has four stages: research clarification, descriptive study I, prescriptive study, and descriptive study II. The spiral of applied research framework is used in large research teams to guide design research.

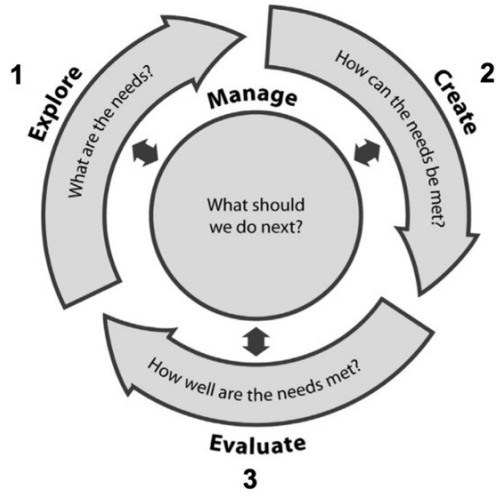


Figure 3-3 The Design Wheel Model (Waller *et al.*, 2015)

The design wheel model helps to develop a clearer understanding of needs with a better solution to fulfil those needs and more robust evidence that needs are being met (Waller *et al.*, 2015). Figure 3-3 shows the four main components of the design wheel: manage, explore, create and evaluate. These components focus on answering four important questions (Waller *et al.*, 2015): What are the needs? How can the needs be met? How well are the needs met? And what should

we do next. The model is of fundamental value in supporting concept design and provides enhanced ability for rapid iteration and early stage evaluation (Cross, 2000).

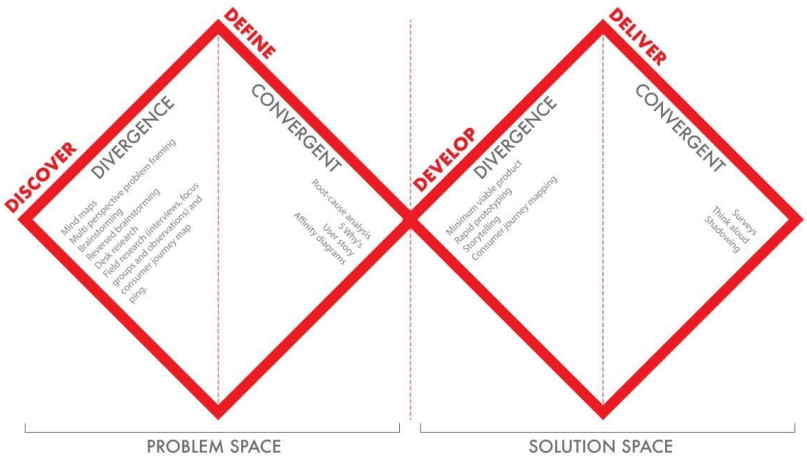


Figure 3-4 The Double diamond diagram from Design Council

The double diamond diagram, as shown in Figure 3-4, is a simple and comprehensive graphical way of representing the design process, which maps the divergent and convergent stages. Four distinct phases in the diagram, namely, discover, define, develop, and deliver. The double diamond design process was developed by the Design Council to support public, private and third-sector institutions to transform how they develop and deliver their ideas and services (Design Council, 2019). However, it would be helpful to use this simple graphical method of mapping the design process to present this thesis process, as shown in the next Section 3.5. More specifically, since this thesis is carried under a Design department, design methodologies are preferred for more authentic outcomes.

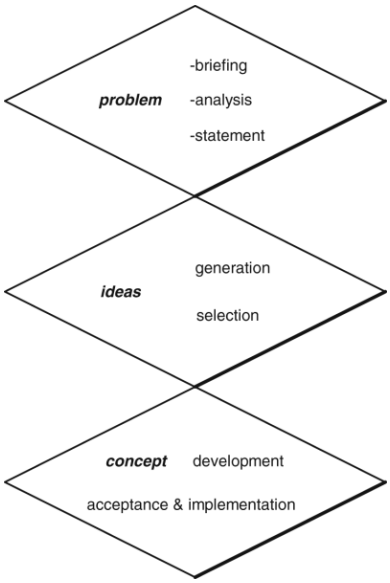


Figure 3-5 The three diamonds presented by (Tassoul and Buijs, 2007)

3.4 Methodological choice

The third layer of the Research Onion model *Figure 3-1* is the methodological choice which refers to the way in which researchers decide to combine qualitative and quantitative data collection techniques and data analysis methods (Saunders, Lewis and Thornhill, 2019). There are three different ways of combining qualitative and quantitative procedures and techniques, which include mono method, multi method and mixed methods choice. In mixed methods research, researchers use both qualitative and quantitative methods to gain a better understanding of a research problem (Creswell and Creswell, 2022), which fits with the pragmatic approach that is used in this thesis, as mentioned previously in Section 3.2 (Johnson and Onwuegbuzie, 2004).

In mixed methods research, qualitative data tends to be open-ended with no predetermined responses, such as interviews and card sorting (Creswell and Creswell, 2022). In contrast, quantitative data commonly includes closed-ended answers, such as questionnaires or psychological instruments. (Creswell and Creswell, 2022) focused on and discussed the core mixed methods design, including convergent mixed methods, exploratory sequential mixed methods design, explanatory sequential mixed methods design, and complex mixed methods design.

A convergent mixed methods design converges or merges qualitative and quantitative data simultaneously to provide a comprehensive understanding of the research problem. An explanatory sequential mixed methods design involves two stages: a quantitative stage followed by a qualitative stage. This design allows the quantitative data results to be explained further with the qualitative data. In the reverse sequence from the explanatory sequential design is the exploratory sequential mixed methods design, which starts with a qualitative stage and explores participants' views, then builds the analysis into a quantitative stage. A complex mixed methods design incorporates one or more core designs into a process or a framework. This method can be used within a case study framework or in different stages of an evaluation process.

Figure 3-6 shows the core forms of mixed methods design adopted in this research. It starts with the exploratory sequential mixed methods design by adopting systematic literature review and card sorting methods (qualitative), and questionnaires (quantitative) to gain a more comprehensive understanding of the participants' views and experiences. This is followed by an explanatory sequential mixed methods design that involves questionnaires as a quantitative method and card sorting as a qualitative method to provide an in-depth understanding of the main issue in the participant's grocery experience. The qualitative and quantitative methods that have been selected and used in this research will be explained in more detail in the Section 3.7.

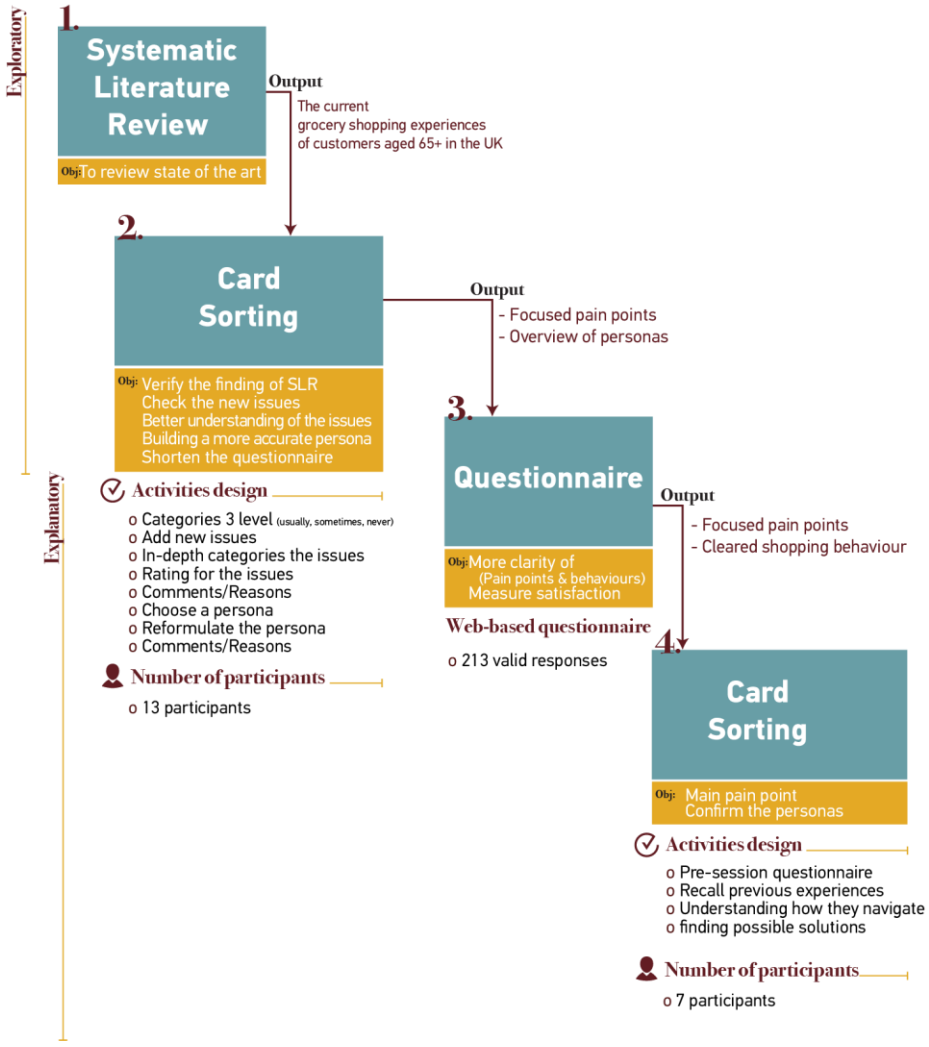


Figure 3-6 Overview of the core forms of mixed methods

3.5 Research strategy

The fourth layer of the Research Onion is the research strategy which refers to the rationale or master plan about how to conduct the research and how all of the research elements can work together to address the research questions (Saunders, Lewis and Thornhill, 2019).

As mentioned earlier in Sections 3.2 and 3.4, regarding the use of mixed methods design as part of the pragmatic worldview to better understand the research problem and answer the research questions. Triangulation refers to the practice of using mixed methods (Johnson and Onwuegbuzie, 2004; Onwuegbuzie and Leech, 2005) in order to enhance the validity and credibility of the research (Patton, 1999). Different types of triangulations have been identified (Patton, 1999; Carter *et al.*, 2014; Robson and McCartan, 2016). Therefore, method triangulation was used in this research (see Figure 3-7) to validate and discover the main pain points.

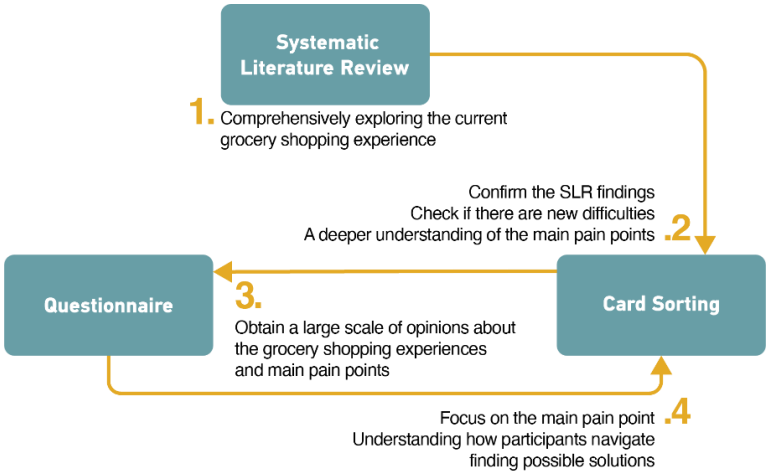


Figure 3-7 Method triangulation for this research

The main approach of this thesis is based on the Double diamond and the three diamonds diagram, illustrated in Section 3.3. Figure 3-8 shows a simple and comprehensive graphical way of representing the design strategy. Beginning with a systematic literature review for a clear and comprehensive overview of the current grocery shopping experience and identifying the major pain points. The card sorting method took these pain points for further investigation and validation. By the end of the first diamond, the main pain points in grocery shopping have been identified. A questionnaire method was adopted to obtain a large scale of opinions regarding these main pain points identified in the previous study (1st card sorting). The second diamond was completed using the 2nd card sorting method, which provided an in-depth understanding of the main pain point discovered through the questionnaire. This is followed by the third diamond with an introduction for a persona (representing the participants of this research) and provide design insights to improve supermarket service for customers aged 65+ in the UK via emerging technologies—the dashed line in Figure 3-8 shows this thesis target.

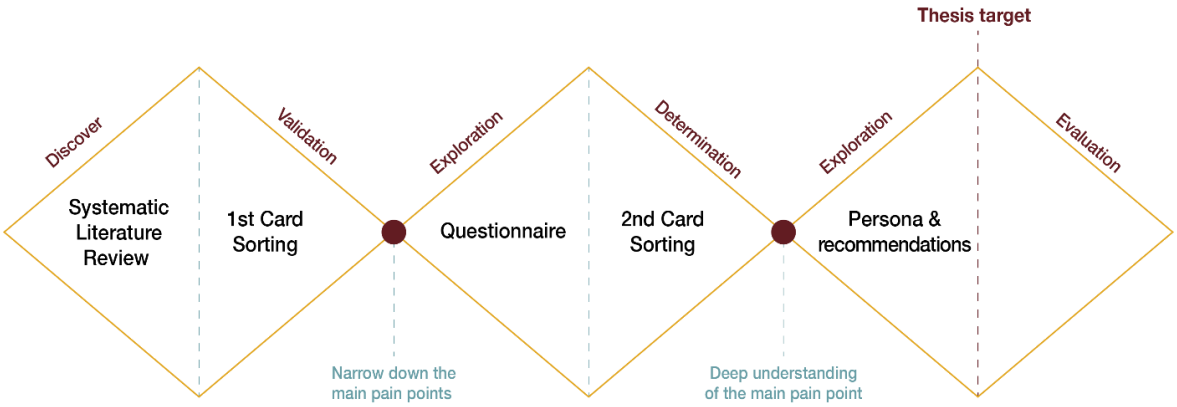


Figure 3-8 The research methodology framework

3.6 Time horizon

The fifth layer of the 'Research Onion' is the research time horizon, which can be classified into two types: cross-sectional and longitudinal (Saunders, Lewis and Thornhill, 2019). A cross-sectional time horizon means the study examines a specific point in time with different samples. Contrarily, a longitudinal time horizon investigates changes over time by collecting several points in time with the same samples (Saunders, Lewis and Thornhill, 2019). This research does not focus on identifying the changes over different periods; hence, a cross-sectional time horizon was adopted.

3.7 Data collection and analysis

The last layer of the Research Onion *Figure 3-1* is about the data collection methods and data analysis techniques used in this thesis (Saunders, Lewis and Thornhill, 2019). This section primarily discusses the methods (qualitative and quantitative) used that best fit the research philosophy and approach.

3.7.1 Systematic literature review – study 1

A Systematic Literature Review (SLR) was conducted to comprehensively explore the current grocery shopping experiences and the difficulties faced by customers aged 65 and above in the UK. This approach follows a specific and precise methodology by identifying, selecting, analysing, integrating and reporting on existing articles, giving a clear and comprehensive overview and understanding of the issues around a topic (Snyder, 2019). In addition, it helps to limit bias, and provides transparent, reliable and accurate conclusions (Palmatier, Houston and Hulland, 2018). Thus, SLR was considered an appropriate approach for study 1, Section 4.2.

There have been some efforts made to develop SLR guidelines related to different fields of research, such as (Tranfield, Denyer and Smart, 2003) and (Durach, Kembro and Wieland, 2017) in the field of management; (Davis *et al.*, 2014) in the social sciences, and (Palmatier, Houston and Hulland, 2018) in marketing. By interpreting and understanding the main phases in these guidelines, the SLR can be divided into three stages: preparation/planning, conducting, and reporting the findings.

3.7.1.1 Preparation/planning

The Centre for Reviews and Dissemination and Akers (2009) suggests making sure that there is no existing research that addresses the same research question to be addressed before conducting the SLR. After that, it is necessary to develop manageable keywords to answer the research

questions, ensuring that these are broad enough to cover the research questions and precise enough to reduce the number of irrelevant papers for answering the research questions. These recommendations are adopted and explained in more detail in Section 4.2.1.

3.7.1.2 Conducting

There are no set rules or a specific number of databases for conducting a SLR, especially in multidisciplinary research; however, there are some factors that support choosing appropriate sources, for instance, the research question and its field, the time, and resources' accessibility (Peters *et al.*, 2015). There are many fields related to this research, such as Ageing, Gerontology, Design, Management, Marketing, Health Sciences, Social Sciences and Computer Science, Section 4.2.2 shows the databases that have been used in this research. Therefore, clear criteria for inclusion and exclusion were set based on the research question before conducting research. Also, it is suggested that a pilot search be conducted before conducting the main research to confirm, test and verify the results and protocol, as illustrated in Section 4.2.2.

3.7.1.3 Reporting the findings

There are several ways of reporting the findings, and the PRISMA flowchart from Moher *et al*(2015) is one of the most appropriate ways to report the results due to its clarity. The flowchart includes four phases: identification, screening, assessing of eligibility, and lastly, what is included. The PRISMA flow was adopted in Section 4.2.3 for reporting the findings for this research with some modifications to reflect the specific search process. Then the papers were analysed, and their results were carried out for validation in the next study (card sorting - Chapter 5).

3.7.2 Card sorting – study 2 & 4

Card sorting method has been employed to investigate deeply the grocery shopping experience of customers aged 65 and above in the UK and determine if there are other difficulties they currently face. This method is a commonly used technique in User-Centred Design (UXD) and participatory design approaches (Muller, Wildman and White, 1993) to understand users' mental model of information architecture (Service Design Tools, 2019). This allows the research participants to group individual cards based on criteria that make sense to them (Nielsen, 1994). Some early uses of this approach were by (Muller, 1992) and (Tudor *et al.*, 1993). Their techniques used the metaphor of a card game as the vehicle for collaboration and communication among participants and designers, based on people's familiarity with playing card games (Tudor *et al.*, 1993). This area of techniques is based on (Muller, Wildman and White, 1993), and is appropriate in the early

stages of research, in addition to allowing the participants to engage in design activities (see Figure 3-9). More details about card sorting research design can be found in Chapter 5 Section 5.3 and Chapter 7 Section 7.3.

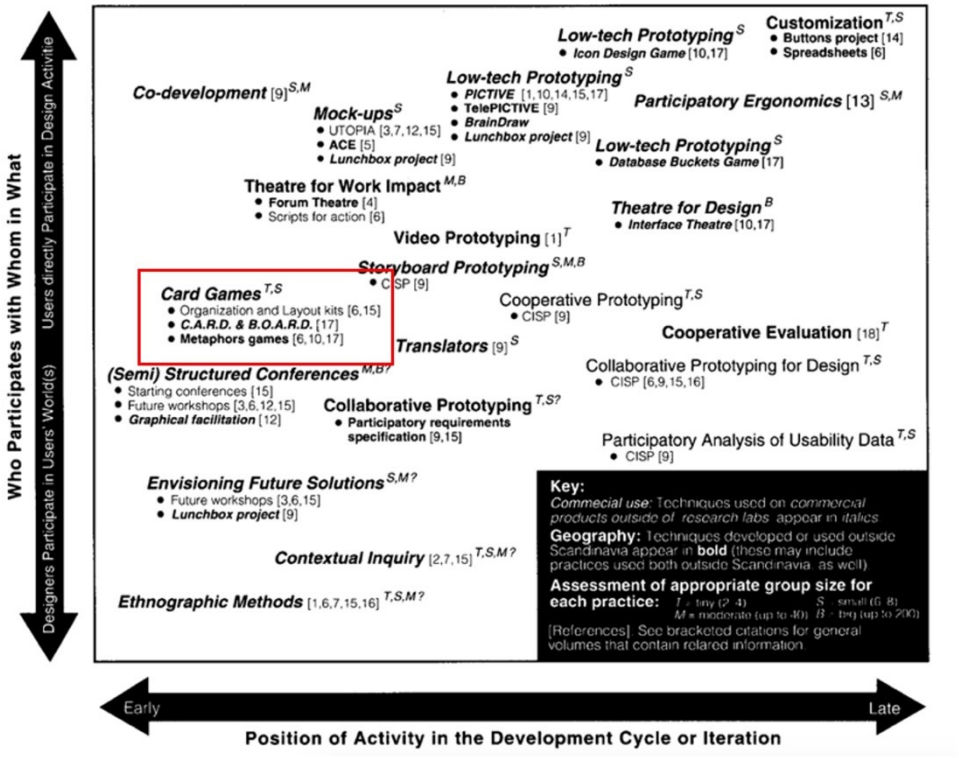


Figure 3-9 The taxonomy of Participatory design Practices (Muller, Wildman and White, 1993)

There are different ways to carry out card sorting, and these are as follows:

3.7.2.1 Open card sorting vs. closed card sorting

Open card sorting is where the participants can create as many categories as they need and give each category any name they want (Baxter et al., 2015; Spencer, 2009). Closed card sorting is where participants are given a set of predetermined category names and a set of cards and are asked to place the cards in those pre-existing categories (Baxter et al., 2015; Spencer, 2009). The main advantages of open card sorting are that participants have more flexibility in expressing how items are grouped, and researchers will obtain additional data about the participants' vernacular (Baxter et al., 2015b; Goodman et al., 2012; Spencer, 2009). Therefore, open card sorting can be useful in the early stages of research, such as the concept stage. However, open card sorting takes a longer time to conduct and analyse than closed card sorting. In comparison, closed card sorting may be more appropriate for improving an existing product or service (Baxter et al., 2015; Goodman et al., 2012; Sherwin, 2018; Spencer, 2009). Since this research is based on the

predefined categories found in the previous study (Section 4.2.4 and 6.4.6), closed card sorting is considered suitable, as clarified in Section 5.3 and 7.3.

3.7.2.2 Paper card sorting vs. digital card sorting

The traditional form of card sorting is paper card sorting (Baxter et al., 2015), which were used in Study 4, Chapter 7, Section 7.3. The advantage of paper card sorting is that it does not require a learning curve for the study participants, and it is relatively easier to manipulate. The disadvantage of paper card sorting is that it takes longer to enter the data and analyse (Baxter et al., 2015; Spencer, 2009). Digital card sorting uses web-based tools or software through which participants can sort cards into groups, used in Study 2, Section 5.3. Digital card sorting is generally easier for researchers because software analyses the results directly. However, the usability of the tools is one of the most prominent obstacles and difficulties currently (Baxter et al., 2015; Sherwin, 2018; Spencer, 2009).

3.7.2.3 Online "remote" card sorting vs. in-person card sorting

In digital card sorting, several tools may help carry the sorting activities online or remotely (Baxter et al., 2015). The main advantage of online card sorting is that participants can participate from anywhere with an internet connection, giving researchers the ability to obtain a geographical diversity of participants at the lowest cost (Baxter et al., 2015). However, the disadvantages of online card sorting are that participants may face some difficulties sorting cards if the researcher is not in the same place. In addition, it may be difficult for the researcher to capture the body language or think-aloud data of the participants (Baxter et al., 2015). Due to the Coronavirus (COVID-19) study 2 (Chapter 5) adopted online card sorting to ensure the safety of the participants, as clarified in Section 5.3.

3.7.2.4 Team card sorting vs. individual card sorting

Team card sorting is where a group of participants cooperate in sorting the cards. This approach may benefit the researcher in understanding the meaning behind the card sorting by observing the discussion among the participants in each group (Spencer, 2009). However, the disadvantages of team card sorting are that group behaviour, when one member is dominant, may influence the decision of the rest of the group (Baxter et al., 2015a; Spencer, 2009). Also, some participants may turn the sorting into a race to finish before the other groups (Baxter et al., 2015). Individual card sorting has the advantage of attaining a greater number of responses and is easier to coordinate than teams. However, researchers will have limited opportunities for observation because there is no discussion as in teams (Baxter et al., 2015). In addition, it is possible to run a hybrid approach

between team and individual card sorting, which works quite well (Baxter et al., 2015a; Spencer, 2009). Individual card sorting was adopted in both studies Chapter 5 and Chapter 7, to obtain more profound and more extensive data about their grocery shopping experiences.

3.7.2.5 Moderated card sorting vs. unmoderated card sorting

Moderated card sorting is characterised by the fact that the researcher can communicate with the participants and ask them about a specific card or the reason for sorting the cards in a certain way, in addition to the fact that the researcher can support the participants with any difficulties they face or clarify some cards and others (Sherwin, 2018). Unmoderated card sorting is generally faster and less expensive than moderated card sorting. However, since there is no direct communication between the researcher and the participant, the researcher will gain fewer insights into why the participant sorts the cards in a certain way (Sherwin, 2018). Unmoderated card sorting may be helpful as a supplement to moderated card sorting (Baxter, Courage and Caine, 2015a; Sherwin, 2018). Since Study 2-Chapter 5 and Study 4-Chapter 7 aim to obtain a deeper understanding of the participants' grocery shopping experiences, moderated card sorting was adopted.

3.7.2.6 Number of participants for card sorting

Choosing how many participants will be in a card sorting activity depends on what will be tested and achieved (Spencer, 2009b; Baxter, Courage and Caine, 2015a). Tullis and Wood (2004) conducted a study of 168 participants, and it was reported that the number between 15 and 20 participants gives a correlation of about 0.90 in card sorting. Also, Tullis and Wood (2004) suggest that 20 to 30 participants lead to about 0.95 correlation in card sorting. Nielsen (2004) recommends card sorting with 15 participants to achieve a comfortable place with the results. In addition, Nielsen(2004) found that if time is limited or the target group is hard to recruit, a card sorting activity with 12 participants gives good results. Baxter, Courage and Caine (2015) suggest doing card sorting with between six to eight participants, then analysing the data, and adding additional participants to see if there are differences or not in the data; if there are no big differences, there is no need to recruit more participants. According to Tullis and Wood's (2004) study, 10 participants give a correlation of 0.80 in open card sorting. However, these numbers are based on open card sorting, so they are assumed to be lower in closed card sorting due to the limited number of categories. Study 2-Chapter 5 recruited 13 participants and Study 4-Chapter 7 recruited 7 participants, which is considered appropriate as shown in Section 5.4.1 and 7.4.1.

3.7.2.7 Number of cards in card sorting

Several factors affect how many cards are supposed to be included in a card sorting activity. Individual card sorting is often faster than team card sorting, along with the difficulty of the content and participants' ability to sort it (Spencer, 2009). Baxter, Courage and Caine (2015) suggest that the number of cards should be 90 cards or less to obtain good results. Additionally, Baxter, Courage and Caine (2015) found some studies that used 500 cards, which worked successfully; however, Baxter, Courage and Caine (2015) do not suggest using this number of cards because it takes longer and overwhelms the participants. Spencer (2009) states that up to 200 cards could be used in some circumstances and claim that less than 30 cards are insufficient. Also, Spencer (2009) recommends that 30 to 100 cards be used in card sorting to get the best results, which was adopted in Section 5.3.2.

3.7.2.8 Running a pilot session

Baxter, Courage and Caine (2015) and Spencer (2009) suggest running a pilot card sorting session if possible before finalising the protocol for the main card sorting session. This will help find typos, identify confusing terms and definitions, and help to evaluate the clarity of sorting and questions. It can be useful to know how long participants need to complete the sorting and the session, as well as to determine if any things have been missed or if there is duplicated content. Spencer (2009) recommends that the first piloting session is the researcher doing it by themself. The second piloting session with another person (maybe from the team or the target group), and the test should include everything, even the introduction. These recommendations were embraced, and pilot sessions were conducted for the two card sorting studies, as presented in Section 5.3.3 and 7.3.3.

3.7.2.9 Analysis card sorting

There are different types of cards sorting analysis. Spencer (2009) divided card sorting analysis into two broad types: exploratory and statistical. Goodman, Kuniavsky and Moed (2012) divided it into qualitative and quantitative analysis. The main methods of exploratory and qualitative analysis can be listed as follows: analyse groups, analyse card placement, analyse participant comments and simple summary, which provides rich information and deeper understanding of the sorting process (Baxter et al., 2015; Goodman et al., 2012; Spencer, 2009). On the other hand, statistical and quantitative analysis methods can be listed as follows: by percentage, K-means cluster analysis, hierarchical cluster analysis, multidimensional scaling, similarity matrix and using specialised program or statistics package or spreadsheet (e.g. Syntagm’s SynCaps, NIST’s WebCAT,

R, SPSS, Excel, etc.). The statistical and quantitative analysis is particularly useful to spot patterns and identify differences between participants. However, these methods of analysis do not explain why a pattern exists. Spencer (2009) suggests combining exploratory and statistical techniques and does not recommended using statistical techniques as the only analysis method because of some methodological issues. The card sorting analysis can be found in Section 5.4 for Study 2-Chapter 5 and Section 7.4 for Study 4-Chapter 7.

3.7.3 Questionnaire – study 3

Questionnaire was conducted to obtain a large number of opinions about the main pain points found in card Sorting (Study 2 - Chapter 5). This method is widely used as a data collection instrument in several research fields, such as Social, Behavioural and Health Sciences, which overlap with this research (Denzin, 2017). In addition, questionnaire as a method has become even more important than it was fifteen years ago (Neuman, 2013; Willem and Irmtraud, 2014; Paul *et al.*, 2019). Questionnaires are appropriate data collection tools for self-reported beliefs, attitudes, opinions, behaviours, satisfaction, expectations, or characteristics (Willem and Irmtraud, 2014). Also, they are useful for explanatory research (Neuman, 2013; Willem and Irmtraud, 2014). Generally speaking, a questionnaire is used to obtain a large scale of opinions (Willem and Irmtraud, 2014). There is no general agreement on a specific number for questionnaires to be valid, but there are important factors that indicate the minimum number required, which involves statistical power analysis, and this should be included as a design characteristic, an estimate of the size effect, and the degree of certainty (O'Dwyer and Bernauer, 2014).

The main advantages of using questionnaires are they are cheap and less time consuming than other methods, and participants can express themselves freely and honestly (Neuman, 2013; Willem and Irmtraud, 2014). More importantly, the use of questionnaires can avoid some problems related to other methods, since it can be designed in advance and tested before sending it out (Miller and Brewer, 2003a; Neuman, 2013; Stanton, Young and Catherine, 2014; Willem and Irmtraud, 2014; Paul *et al.*, 2019).

On the other hand, questionnaires have some disadvantages, such as they may lack validity since the researcher and the participant do not communicate with each other at the same time to clarify or confirm some matters, so participants might interpret the questions in different ways (Miller and Brewer, 2003). In addition, a questionnaire may not provide rich data for analysis compared to some other methods (Miller and Brewer, 2003; Stanton et al., 2014). However, these issues can be overcome by a pilot study and using other methods with questionnaires to support the results.

It can be concluded that taking into account the current situation in the world with the Coronavirus (COVID-19) (WHO, 2020) during the period of this thesis, a self-administered web-based questionnaire is the most appropriate and effective data collection tool at this time. Even though this approach may miss access to customers aged 65 and over who do not have internet access, this group is not among the target group covered in this research, especially since it includes some technology aspects.

3.7.3.1 Questionnaire planning and design

In order to achieve accurate and good quality results from the questionnaire, it needs to be carefully designed in line with the research questions and objectives (Oppenheim, 1992; Brace, 2008). Importantly, to save time and resources, the questionnaire should focus only on the questions related to the aim of the research and not include questions that may be interesting but not directly relevant to the research (Brace, 2008). There are many ways to arrange questions; Brace (2008) suggests starting with behaviour before attitude questions to enable the participants to assess their behavioural position and then to justify their behaviour through their attitudes. Also, behavioural questions are generally easier to answer since they relate to facts and only require recall. Classification questions such as gender and age are usually asked at the end of the study because they are usually disconnected from the core of the study and could disrupt the flow of the questions (Brace, 2008). A rating scale is one of the classical methods used for measuring attitude (Oppenheim, 1992; Brace, 2008). The main objective of the rating scale is to distinguish the difference between the most important factors of service and less important factors. The rating scale is recommended to be balanced, unless for a good reason, and developed by experienced researchers, with between five and 10 points considered the general agreement for the number of points on a rating scale; however, many researchers consider seven points as an optimal number for the scale (Brace, 2008). Regarding everyday objects like grocery shopping, it is useful to provide a "neither agree nor disagree" option, and it may replace the "don't know or non-applicable" options for participants who cannot leave the question blank. The questionnaire design can be found in Section 6.3.2.

3.7.3.2 Questionnaire sample size

It is essential to obtain statistical validity in qualitative methods. Therefore, the required sample size should be calculated before distributing the questionnaire. In this research, the target group is people aged 65 and over in the UK responsible for grocery shopping. However, it is impossible to recruit all this target group to participate in this research. Therefore, a representative sample is determined.

Banerjee et al.(2009) described two types of error. The first is a type of error called alpha (α) -*also known as type I error*- and the second is a type of error called beta (β) -*also known as type II error*-. The error (α) is when a researcher rejects a null hypothesis that is true in the population (false-positive). The error (β) is when the null hypothesis is false in the population, but the researcher fails to reject it (false-negative). In order to calculate the minimum required sample size for the questionnaire, G* Power software was used. G*Power is a helpful tool for researchers to compute statistical power analyses for different types of tests. The suggestion from G* Power for the minimum required sample size was 80 based on the configuration in Table 3-2 to perform a one-way Analysis of Variance (ANOVA) test on the questionnaire, as shown in Section 6.4.6.2.

Table 3-2 The minimum required sample size according to G*Power software

Statistical Test	**ANOVA (one-way)**
Effect size (f)	0.5 (medium)
Error probability (α)	0.05
Power (1 – β error probability)	0.95
Number of groups	5
Minimum required sample	80

3.7.3.3 Piloting the questionnaire

Oppenheim (1992) and Brace (2008) advise carrying out a pilot session for the questionnaire before it goes live. No matter how clear the questions are in the researcher's eyes, the questionnaire is rarely at its best on the first attempt (Brace, 2008). Oppenheim (1992) and Brace(2008) mention several benefits of carrying out a pilot session for the questionnaire: question-wording and clarity; that is, do participants understand the questions and are they able to answer them, in addition to ensuring the flow of questions and the time required to complete the questionnaire. Moreover, it useful to get an initial idea about the analysis of the results and whether the questions and analysis are appropriate for the research aim and objectives. Also, to check the size, colours and contrast of the questionnaire for participants. The questionnaire was piloted, as illustrated in Section 6.3.3.

3.7.3.4 Questionnaire Analysis

The statistical analysis aims to enable the researcher to make sense of a data set regarding the research questions (O'Dwyer and Bernauer, 2014). As tempting as it may be to start analysing and

looking at relationships between variables right away, it is a good practice to look at variables in general to get a sense of what data is there (Muijs, 2011). Usually, descriptive analyses are conducted first, regardless of whether the study's objective is descriptive, explanatory, or predictive (O'Dwyer and Bernauer, 2014). Descriptive analysis is used to describe and summarise data and to detect patterns in the data that are not directly obvious by examining raw data alone (Muijs, 2011; O'Dwyer and Bernauer, 2014), which have been used in various places in Section 6.4. Different ways can be used to conduct descriptive analyses, such as frequency distributions, measures of central tendency, and correlations.

Frequency distributions are used to summarise categorical or continuous data. It can be presented in different forms, such as tables or a visual summary, like a pie chart or histograms (Muijs, 2011; O'Dwyer and Bernauer, 2014), shown in Section 6.4. Measures of central tendency are single values that describe the typical score in a data set distribution, and the mean, mode, and median are the most common forms for that (Muijs, 2011; O'Dwyer and Bernauer, 2014). The Pearson correlation coefficient (r) is the most common way of analysing the relationship between two continuous variables (Muijs, 2011), which has been used in the Section 6.4.3.

Several tests have been developed to analyse the data statistically. One-Way Analysis of Variance (ANOVA) is a powerful method using the mean to test the statistically significant difference between two or more groups (O'Dwyer and Bernauer, 2014; Miller and Brewer, 2003). In the ANOVA test, the variable being measured is called the dependent variable, and the independent variable is the variable which is expected to influence the dependent variable (Miller and Brewer, 2003). However, the ANOVA test is considered an omnibus test, which does not specify which groups are different (O'Dwyer and Bernauer, 2014). Thus, a post hoc test has to be performed to determine which groups are significantly different (O'Dwyer and Bernauer, 2014). Tukey's honestly significant difference test (Tukey's HSD) is the most common and popular post hoc test technique (Nanda *et al.*, 2021), which was used in Section 6.4.6.2.

3.8 Research ethics

It is essential to ensure that this thesis complies with the ethical requirements for conducting research at the University of Southampton before carrying out the cards sorting sessions and distributing the web-based questionnaire to participants. Thus, ethical approval form and "combined participant information sheet and consent form for anonymous online surveys for adult participants" form were submitted to the University of Southampton research ethics committee. The Ethics Research Governance Online (ERGO) committee at Southampton

University granted the approval for this thesis under reference number (**Ethics/ERGO Number: 62401**). The ethics materials can be found in Appendix A and D.

3.9 Participants and Sampling Strategy

Since this study adopts user-centred design and inclusive design approaches, it aims to recruit people aged 65 and over in the UK, who were responsible for doing grocery shopping in physical stores before the Covid-19 lockdown. Thus, prior to the recruitment process and conducting the research, ethical approval was obtained from the University of Southampton research ethics committee under reference number (Ethics/ERGO Number: 62401). Several strategies were used to recruit participants. First, participants were recruited through posters placed in different places in Southampton and Winchester where people aged 65 and over normally gather, such as grocery stores and supermarkets (Waitrose, M&S, Sainsbury's, and ASDA etc.); cafes such as Muse in Portswood Road, and places of worship such as mosques and churches. In addition, posters were sent by mail in cooperation with non-profit organisations such as Communicare in Southampton, along with sending emails through third-party organisations such as U3A, Age UK, and Nuffield Council on Bioethics. Also, a snowball approach was used by asking participants if they could suggest someone or share the poster with people they think are suitable for the research.

3.10 Conclusion

To conclude, this chapter adopted the Research Onion to guide the research methodology for an effective design procedure. Thus, this thesis chose appropriate methods, as shown in Figure 3-10, regarding research philosophy, research approach, methodological choice, research strategy, time horizon, and data collection and analysis.

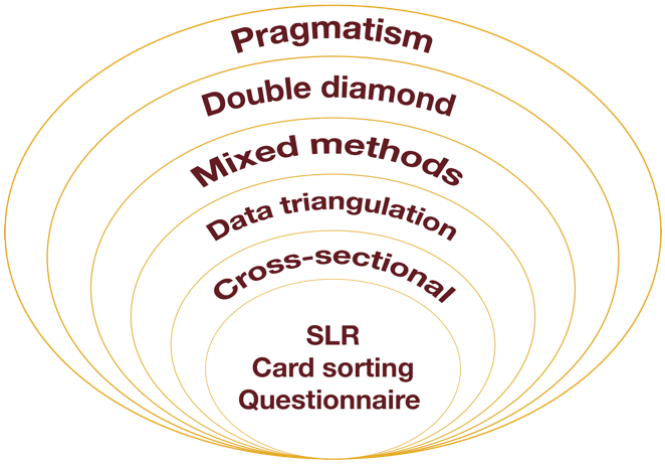


Figure 3-10 The Research Onion for this thesis

After comparing several research philosophical paradigms, including postpositivism, constructivism, transformative and pragmatism. The pragmatic approach was found to be the most appropriate philosophical paradigm for this thesis. Since this research relies on collecting data about the participants' views and perceptions. The primary approach of this thesis is based on the double diamond and the three diamonds diagram since this thesis requires the researcher to go up and down according to the need of the research. The mixed methods and method triangulation were adopted to understand better the research problem, including systematic literature review, card sorting methods (qualitative) and questionnaires (quantitative), which fit with the pragmatic approach used in this thesis. The cross-sectional time horizon was used because this thesis does not focus on identifying the changes over different periods.

Chapter 4 Study 1: A systematic literature review of current grocery shopping experience of customers aged 65+ in the UK

4.1 Introduction

This study intends to answer part of this thesis's first research question by comprehensively exploring the current grocery shopping experience and the difficulties faced by customers aged 65 and above in the UK by discovering existing literature. In order to achieve this objective, this study reviews published journal articles available on several databases using a Systematic Literature Review (SLR) process, which has been considered appropriate as this approach gives a clear and comprehensive overview and understanding of the issues around a topic, especially where the topic is interdisciplinary in nature such this study (Snyder, 2019). Systematic literature reviews follow a specific and precise methodology by identifying, selecting, analysing, integrating, and reporting existing articles, which have several advantages such as limit bias, transparent and reliable and accurate conclusions. Also, it is useful for both academics and practitioners (Palmatier, Houston and Hulland, 2018).

4.2 The systematic literature review stages

Before conducting the systematic review, it was ensured that there was no current research addressing the same question by checking different databases and academic search engines such as Scopus, PROSPERO, and Google Scholar etc. After that, by following the systematic literature review guidelines and recommendations from (Cearley *et al.*, 2017), (Levay and Craven, 2019), (Centre For Reviews And Dissemination, 2009) and (Moher *et al.*, 2015) the review has been divided into three stages: preparation/planning, conducting and reporting the findings as explained in Section 3.7.1.

4.2.1 Preparation/planning

As discussed in Section 3.7.1.1, before conducting the SLR, it was ensured that there no current research has addressed the same question, by checking different databases and academic search engines such as Scopus, PROSPERO, and Google Scholar. After that, to achieve the aim of this study, manageable keywords were developed. At the same time, it was ensured that it is broad

enough to cover the research questions, and precise enough to reduce the number of irrelevant papers to address the research aim. The keywords were identified through the literature review phase and related to the topic, in addition to consulting the supervisory team on this research. The keywords for the searches included words related to the target group (*senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") and the context (supermarket* OR grocer* OR "brick-and-mortar"*).

4.2.2 Conducting

Since there are no set rules or a specific number of databases to perform the SLR, especially for multidisciplinary research such this research as mentioned in Section 3.7.1.2. Accordingly, the searches were conducted using the following databases: Scopus, Web of Science Core Collection, EBSCO (PsycINFO) and ProQuest (its 109 databases, e.g. ProQuest Central, ABI/INFORM Collection and MEDLINE — *Appendix B.2 for the full list*), to obtain comprehensive coverage of research-related fields, including, Gerontology, Design, Management, Marketing, Health Sciences, Social Sciences and Computer Science. The search was conducted using the keywords based on titles and abstracts, with no date limitations, and search filters were used to obtain high-quality results (Levay and Craven, 2019) (see *Appendix B.1-B.4* for each database and its filters). Studies were selected based on three inclusion criteria. 1- Types of participants: Since there is no generally agreed basis for the definition of 'older people'. This research included articles in which participants are aged 60 years and above or clearly provided the outcomes on older people to cover most of the possible articles. 2- context: articles that address the issues related to a physical medium/large supermarket in the UK market. 3- Quality and access: articles are from peer-reviewed publication forums and written in English. Also, articles that have open access via personal or academic accounts.

Before undertaking a full search of all databases, a pilot search using the keywords and the inclusion criteria was performed on one of the databases, and the results appeared appropriate.

4.2.2.1 Citation searching

After completing the first search, it was realized that there is a gap in publication, especially between the key papers, specifically between (Hare, Kirk and Lang, 2001b) and (Angell *et al.*, 2012b). Therefore, citation searching was used as a supplementary for the systematic reviews to find out the issue and identify missing keywords (Wright, Golder and Rodriguez-Lopez, 2014; Linder *et al.*, 2015). As a result, it was found that "*food shopping*" is missing among the keywords in the first search. Therefore, it was searched again with the same previous databases and the

same inclusion criteria. The keywords for second searches included (*"food shopping"*) AND (*senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year"*). In addition to (*consumer* OR customer**) based on the advice of the supervisory team.

4.2.3 Reporting the findings

The initial search generated a total of 55344 citations in the first search and 1149 citations in the second, of which 1376 articles in the first and 237 articles in the second appeared to meet the inclusion criteria and were published in the period 1971–2020.

The PRISMA flowchart from Moher *et al* (2015) was adopted with some modifications to reflect the searching process Figure 4-1 represents the first search and Figure 4-2 the second search. The review includes four phases: identification, screening, assessing of eligibility, and lastly what is included. The 15 keywords combinations were firstly searched in Scopus followed by the rest of the databases. The results were exported to Endnote software and XLS format for data management.

Figure 4-1 First SLR research using PRISMA flowchart adopted from Moher *et al.*(2009)

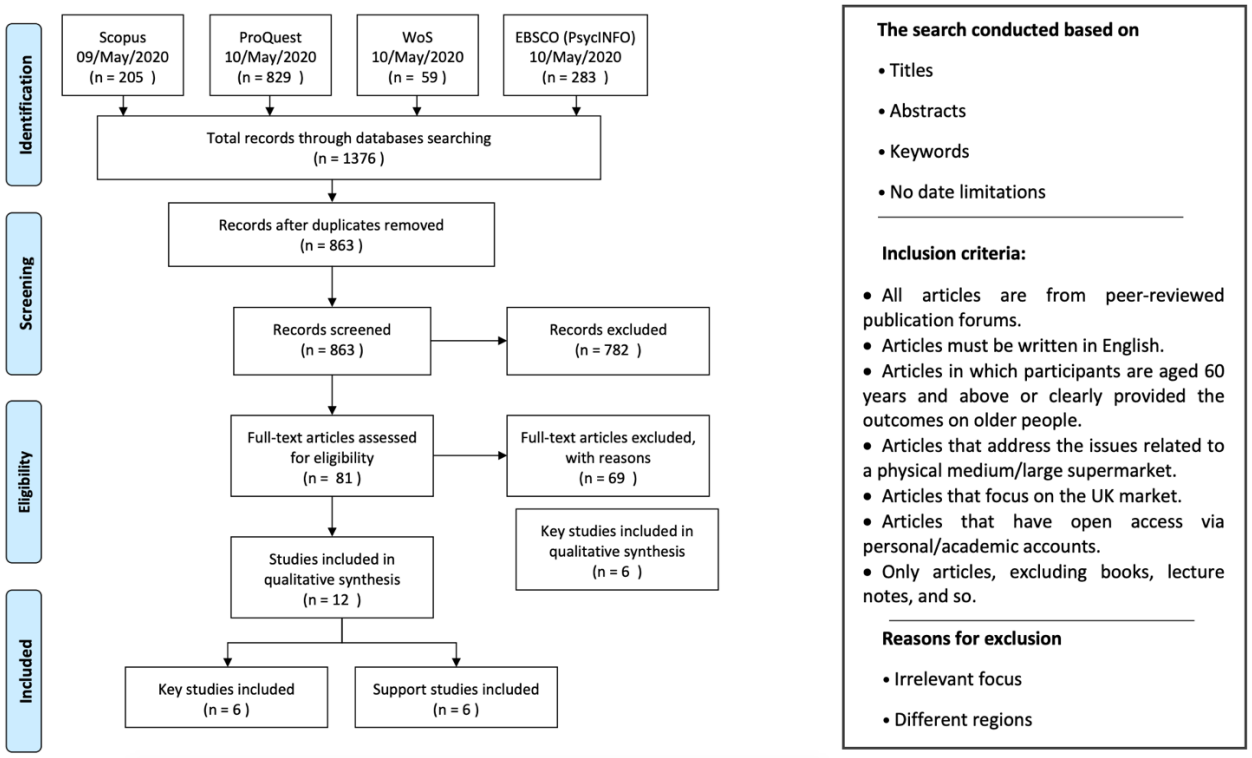
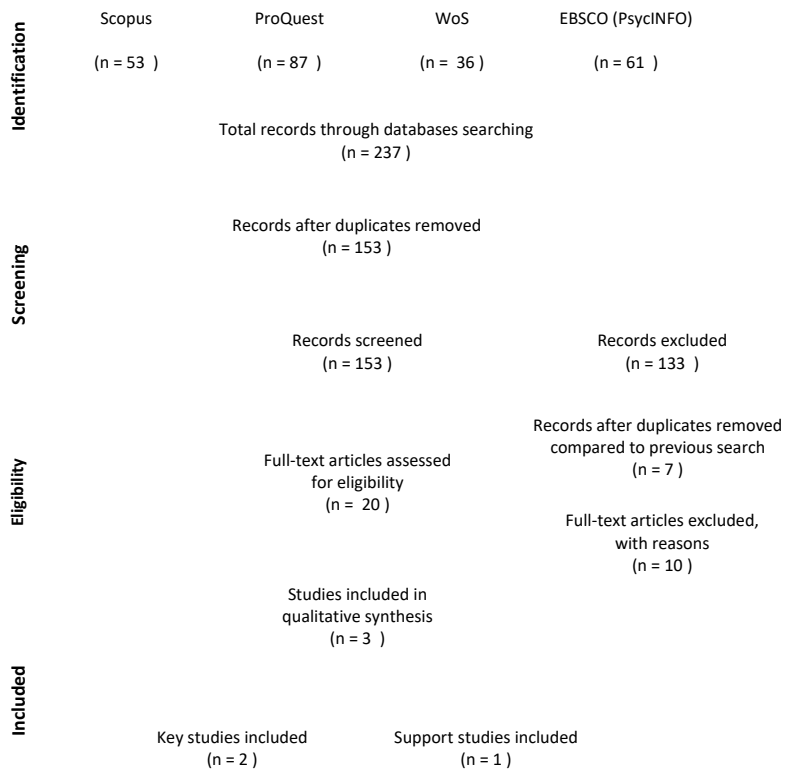


Figure 4-2 Second SLR research using PRISMA flowchart adopted from Moher *et al.*(2009)



4.2.3.1 First SLR search

As of May 2020, this process identified 1376 records. The total records were reduced to 863 after duplicates have been removed in the phase of identification. The remaining 863 records were screened based on titles, abstracts, and keywords against the inclusion criteria. Some papers lacked sufficient data in these sections, so it was moved to the next phase to check their eligibility by full text assessed against the inclusion criteria. The screening process resulted in 12 eligible full-text records included in the final analysis. —*Appendix B.1-B.4* for each database and its filters.

4.2.3.2 Second SLR search

As of June 2020, this process identified 237 records. The total records were reduced to 153 after duplicates have been removed in the phase of identification. The remaining 153 records were screened based on titles, abstracts, and keywords against the inclusion criteria. Any of the papers that were missing enough data in the titles, abstracts, or keywords sections were transferred to the next phase to check their eligibility by full text evaluated against the inclusion criteria. The screening process resulted in 3 eligible full-text records included in the final analysis. —Appendix B.5-B.8 for each database and its filters.

4.2.3.3 Reasons for exclusion

The most common reasons for exclusion were an irrelevant focus concerning the healthy lifestyles of older people, and if they use grocery shopping as one example of their main activities. Also, some papers have focused on different regions, for example the USA, Canada, and Australia.

After a closer examination of the 15 full texts, eight were selected as key papers, which are those focusing mainly on the grocery shopping experience of older people in physical stores, with the rest of the papers as support.

4.2.4 Finding and data Extraction

4.2.4.1 Descriptive statistics

Statistics help provide a better understanding of the research milieu of the field. The results suggest that the number of publications has grown in recent years Figure 4-3. This indicates the increasing importance of this target group and field. Table 4-1 presents journal-wise publications. The most common journals publishing research in this area focus on retail management: Journal of Retailing and Consumer Services (4 papers), International Journal of Retail and Distribution Management (2 papers) and International Review of Retail, Distribution and Consumer Research (two papers). In terms of research design, all the key papers in the current SLR use an empirical research approach, as shown in Table 4-2.

4.2.4.2 An overview of the current grocery shopping journey

Based on the complexity of the shopping experience, it is useful to view the shopping experience as a journey (Lemon and Verhoef, 2016). Thus, the data were extracted from the papers as follows: pre-purchase stage, purchase stage, and post-purchase stage, for a comprehensive view of the experience, its touchpoints, and their relationship to each other. Table 4-3 and Table 4-4 shows the results, besides highlighting whether the results of the experience were satisfactory or unsatisfactory.

Figure 4-3 Number of publications about the grocery shopping experience of customers aged 65+ in the UK (1985-2020).

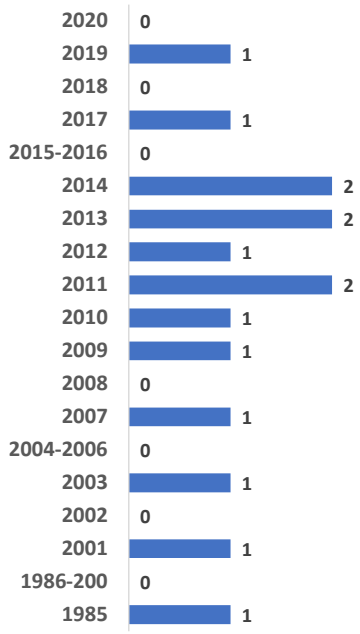


Table 4-1 The journals in which papers about the grocery shopping experience of customers aged 65+ in the UK appeared

Journal	Journals' focus	No. of papers	Recourse
Journal of Retailing and Consumer Services	Retailing Services studies Consumer behaviour Policy and managerial decisions	4	(Angell *et al.*, 2014) (Omar, Tjandra and Ensor, 2014) (Angell *et al.*, 2012) (Meneely, Strugnell and Burns, 2009)
International Journal of Retail and Distribution Management	Understanding the relationship between production and consumer	2	(Hare, 2003) (Hare, Kirk and Lang, 2001)
International Review of Retail, Distribution and Consumer Research	Strategic and operational applications for retail. Statements and analyses of retail managerial applications. Distribution industries.	2	(Teller and Gittenberger, 2011) (Bromley and Matthews, 2007)
Ageing and Society	Understanding of human ageing and the circumstances of older people in their social and cultural contexts.	1	(Venn *et al.*, 2017)
Environment and Planning A	Concerned with wide ranges of topics centred around regional and urban restructuring, inequality, globalization, and uneven development.	1	(Bailey *et al.*, 2010)

Journal of Consumer Behaviour	Consumer behaviour Marketing Consumer attitudes Relationship marketing	1	(Shukla, Banerjee and Adidam, 2013)
Journal of Design Research	Expertise in design Design learning strategies and design pedagogy Design as a social process Gaming and simulation in design Designing user interfaces The role of visual techniques in the design process Design tools Sustainability	1	(Lim *et al*., 2019)
Journal of Enterprise Information Management	Combination of theoretical and practical outcomes that useful to academics, managers, consultants, and students operating within an information-intelligence business-driven enterprise.	1	(Yin, Pei and Ranchhod, 2013)
Public Health Nutrition	Understanding the causes of, and approaches and solutions to, nutrition-related public health achievements, situations and problems around the world.	1	(Thompson *et al.*, 2011)
Transactions of the institute of British geographers	Geographical research	1	(Guy, 1985)

Table 4-2 The research methods used in the included papers

	Recourse	Research design	Research method
Main	(Lim *et al.*, 2019)	Research triangulation Empirical investigations	Ethnographic interviews Creative workshop Non-participant observation
	(Angell *et al.*, 2012)	Qualitative multiple methods	Semi-structured interviews Non-participatory observations
	(Angell *et al.*, 2014)	Mixed method	Interviews Self-completion survey
	(Yin, Pei and Ranchhod, 2013)	Mixed method	Ethnographic approach Semi-structured interviews
	(Meneely, Strugnell and Burns, 2009)	Mixed method	Focus groups Questionnaire

	(Omar, Tjandra and Ensor, 2014)	Quantitative	Questionnaires
	(Hare, 2003)	Quantitative	Interviews using a structured questionnaire
	(Hare, Kirk and Lang, 2001)	Qualitative	Critical incident technique through interviews
Support	(Bromley and Matthews, 2007)	Multi- method	Interview survey In-depth interviews Focus group Escorted shopping trips
	(Venn *et al.*, 2017)	Qualitative	In-depth interviews
	(Thompson *et al.*, 2011)	Qualitative	Observations
	(Bailey *et al.*, 2010)	Qualitative	Nationwide biographical survey Oral histories
	(Shukla, Banerjee and Adidam, 2013)	Quantitative	Self-administered structured questionnaire survey
	(Teller and Gittenberger, 2011)	Quantitative	Interviews using a standardised questionnaire
	(Guy, 1985)	Quantitative	Survey

Table 4-3 The main stages in the older people's shopping journey in the main papers

Recourse		Main papers							
		(Lim *et al.* , 2019)	(Angell *et al.* , 2014)	(Omar, Tjandra and Ensor, 2014)	(Yin, Pei and Ranchhod, 2013)	(Angell *et al.* , 2012)	(Meneely, Strugnell and Burns, 2009)	(Hare, 2003)	(Hare, Kirk and Lang, 2001)
Pre-Purchase stage									
External influence	Satisfactory	✓	–	–	–	–	–	–	–
	Unsatisfactory	✓	–	–	–	–	–	–	–
Location and access to the stores	Majority satisfactory	✓	✓	✓	✓	✓	✓	✓	✓
	Unsatisfactory	✓	✓	✓	✓	✓	✓	✓	✓
Purchase stage									
Physical environment	Satisfactory	✓	✓	–	✓	✓	✓	✓	✓
	Majority unsatisfactory	✓	✓	–	✓	✓	✓	✓	✓
Store atmosphere	Satisfactory	✓	✓	–	✓	✓	✓	✓	✓
	Unsatisfactory	✓	✓	–	✓	✓	✓	✓	✓
Products	Satisfactory	✓	✓	✓	✓	✓	✓	✓	✓
	Majority unsatisfactory	✓	✓	✓	✓	✓	✓	✓	✓
Pricing & promotions	Satisfactory	✓	✓	✓	✓	✓	✓	✓	✓
	Unsatisfactory	✓	✓	✓	✓	✓	✓	✓	✓
Staff	Majority satisfactory	✓	✓	✓	✓	✓	✓	✓	✓
	Unsatisfactory	✓	✓	✓	✓	✓	✓	✓	✓
Shoppers	Satisfactory	✓	✓	–	–	✓	✓	✓	✓
	Unsatisfactory	✓	✓	–	–	✓	✓	–	✓
Checkout	Satisfactory	✓	✓	✓	✓	✓	✓	✓	✓
	Majority unsatisfactory	✓	✓	✓	✓	✓	✓	–	✓
Additional services/facilities	Majority satisfactory	✓	✓	–	–	✓	✓	✓	✓
	Unsatisfactory	✓	✓	–	–	✓	✓	✓	✓
Post-Purchase stage									
Products/service	Satisfactory	✓	✓	–	✓	✓	✓	✓	✓
	Majority unsatisfactory	✓	✓	–	✓	✓	✓	✓	✓

Table 4-4 The main stages in the older people's shopping journey in the support papers

Recourse		Support papers						
		(Venn *et al.* , 2017)	(Shukla, Banerjee and Adidam, 2013)	(Thompson *et al.* , 2011)	(Teller and Gittenberger, 2011)	(Bailey *et al.* , 2010)	(Bromley and Matthews, 2007)	(Guy, 1985)
Pre-Purchase stage								
External influence	Satisfactory	–	–	–	–	–	–	–
	Unsatisfactory	–	–	–	–	–	–	–
Location and access to the stores	Majority satisfactory	–	–	✓	–	✓	✓	✓
	Unsatisfactory	–	–	✓	–	✓	✓	✓
Purchase stage								
Physical environment	Satisfactory	–	–	–	–	–	–	–
	Majority unsatisfactory	–	–	–	✓	–	–	–
Store atmosphere	Satisfactory	–	–	–	–	–	–	–
	Unsatisfactory	–	–	–	–	–	–	–
Products	Satisfactory	✓	–	✓	✓	✓	–	✓
	Majority unsatisfactory	✓	–	✓	✓	✓	–	✓
Pricing & promotions	Satisfactory	✓	✓	–	✓	✓	–	✓
	Unsatisfactory	✓	–	–	✓	✓	–	✓
Staff	Majority satisfactory	–	–	–	–	–	✓	–
	Unsatisfactory	–	–	–	–	–	✓	–
Shoppers	Satisfactory	–	–	–	–	–	–	–
	Unsatisfactory	–	–	–	–	–	–	–
Checkout	Satisfactory	–	–	–	–	–	–	–
	Majority unsatisfactory	–	–	–	–	–	–	–
Additional services/facilities	Majority satisfactory	–	–	–	–	–	✓	–
	Unsatisfactory	–	–	–	–	–	✓	–
Post-Purchase stage								
Products/service	Satisfactory	–	–	–	–	–	–	–
	Majority unsatisfactory	–	–	–	–	–	–	–

4.2.4.3 Findings

In order to achieve the aim of this study, the findings have been divided into three stages (pre-purchase stage, purchase stage and post-purchase stage) based on their occurrence in the shopping journey. The main stages and substages are:

4.2.4.3.1 Pre-Purchase stage

4.2.4.3.1.1 External influence (*Weather*)

The weather, such as if it is raining or sunny, has an influence on the shopping journey, either positively or negatively, especially for older people who often use public transportation or walk to the grocery store. This is in addition to the emotional factor such as enjoying the sunset and trees, and so on (Lim et al., 2019).

4.2.4.3.1.2 Location and access to the stores (*Distance to stores, Opening times, Parking facilities*)

The majority of these factors are satisfactory. Older people often choose to shop at a supermarket near them, especially considering their preference for walking to the store as a physical activity (Angell et al., 2012, 2014; Bailey et al., 2010; Bromley and Matthews, 2007; Guy, 1985; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Thompson et al., 2011; Yin et al., 2013). In addition to being considered as an emotional factor, such as the happiness in walking with a partner to the supermarket or enjoy watching a clear sky or the sunset (Lim et al., 2019). Generally speaking, the majority who accessed the supermarket by car found the parking to be adequate (Angell et al., 2012, 2014; Bromley and Matthews, 2007; Guy, 1985; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014). However, there are some issues reported regarding dealing with parking machines (Angell et al., 2012, 2014; Lim et al., 2019).

4.2.4.3.2 Purchase stage

4.2.4.3.2.1 Physical environment (*Trolleys/baskets, Store layout, Signage, Aisles, Shelves and freezers, In-store seating, Store size, Accessibility*)

The majority of these factors are unsatisfactory. Trolleys can be considered as an aid for older people by supporting them when they are walking around the store (Meneely et al., 2009; Yin et al., 2013). In contrast, there are issues with the design of trolleys, such as their depth, and the

need to handle the trolley and their own shopping basket (Angell et al., 2012, 2014; Lim et al., 2019; Teller and Gittenberger, 2011; Yin et al., 2013) Also, dealing with the lock and the need for £1 and returning the trolley to its place (Hare et al., 2001; Yin et al., 2013). In addition, older people may have difficulty finding their way around the store due to confusing layout and poor signage (Angell et al., 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Yin et al., 2013). The width and tidiness of the aisles are also important, especially for older customers with mobility issues (Angell et al., 2012, 2014; Hare et al., 2001; Lim et al., 2019; Yin et al., 2013). The design of shelves and freezers in terms of height, depth, and placement of products in them presents some difficulties for this group (Angell et al., 2012, 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Teller and Gittenberger, 2011; Yin et al., 2013). Store size is also seen in a negative way, especially with a lack of in-store seating (Angell et al., 2012, 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Teller and Gittenberger, 2011; Yin et al., 2013). Accessibility appears to have been an issue in previous research (Hare et al., 2001), but in more recent research (Bromley and Matthews, 2007; Hare, 2003), it appears positive.

4.2.4.3.2.2 Store atmosphere (*Cleanliness, Tidiness, Lighting, Sounds, Temperature, Smells, Overcrowding*)

Store atmosphere influences older people's shopping experience. Older people generally report feeling the standard of hygiene and atmosphere is good (Angell et al., 2012, 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009). However, overcrowding is a negative factor, especially at the weekend, or for older customers with reduced mobility or impaired movement (Angell et al., 2012; Lim et al., 2019; Meneely et al., 2009) Also, this group can face some issues with some products or packaging on the ground blocking their way (Angell et al., 2014; Yin et al., 2013). Older people with eyesight concerns found that lighting has an impact on their shopping journey (Angell et al., 2012, 2014).

4.2.4.3.2.3 Products (*Quality, Variety, Labels, Locating, Portability, Size/Portion, Branded, Freshness/Expiry date, Availability*)

The majority of these factors are unsatisfactory. The main factors are unclear labels, including the size, font type, colour, and contrast (Angell et al., 2012, 2014; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Teller and Gittenberger, 2011; Venn et al., 2017; Yin et al., 2013). Also, supermarkets moving the products around the store makes it difficult for older people to find the product as they expect, in addition to products' poor and inconsistent location (Angell et al., 2014; Bailey et al., 2010; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Teller and Gittenberger, 2011; Yin et al., 2013). Product size and

portion can be considered unsuitable for small households (one or two people), which represents the majority of this group (Angell et al., 2012, 2014; Guy, 1985; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Yin et al., 2013). For older customers who use public transportation or walk to the store, portability is an important factor in their shopping journey (Angell et al., 2012; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Thompson et al., 2011; Yin et al., 2013). In addition, availability and lack of products for older people with dietary requirements (Angell et al., 2012, 2014; Hare, 2003; Lim et al., 2019; Omar et al., 2014; Thompson et al., 2011). However, in general, the products' quality and variety are deemed positive factors (Lim et al., 2019).

4.2.4.3.2.4 Pricing and promotions (*Price Vs Quantity, Multi-buy promotions, 3 for 2 promotions, Money off discounts, End of aisle display, Reduced to clear items, Loyalty cards discount*)

The majority of these factors are unsatisfactory. The broad problem with the pricing and promotions is that they are not designed for the size of a small household, which in the case of older people is usually one or two people. For example, unfairness in prices and sizes, as large size products are often cheaper than smaller ones, in addition to multi-buy promotions and 3 for 2 promotions, which leads to food waste (Angell et al., 2012, 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Teller and Gittenberger, 2011; Venn et al., 2017; Yin et al., 2013). On the other hand, money off and loyalty card discounts are considered positive factors for older people (Angell et al., 2012, 2014; Bailey et al., 2010; Guy, 1985; Hare et al., 2001; Meneely et al., 2009; Omar et al., 2014; Shukla et al., 2013; Teller and Gittenberger, 2011; Venn et al., 2017). Also, older people might take advantage of the saving in these promotions, but this depends on the kind of products and if they need them (Omar et al., 2014).

4.2.4.3.2.5 Staff (*Availability, Friendly, Helpful, Knowledgeable, Polite, Complaints handling*)

The majority of these factors are satisfactory. Supermarket staff are generally friendly, helpful, and knowledgeable and usually handling the complaints well, which has a positive impact on the grocery shopping experience of older people (Angell et al., 2012, 2014; Bromley and Matthews, 2007; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014). However, lack of staff and being unable to take the customer to the exact location of items are considered negative factors (Angell et al., 2012, 2014; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Yin et al., 2013).

4.2.4.3.2.6 Shoppers (*Friendly, Helpful, Likeminded*)

The majority of these factors are satisfactory. Older customers expressed a positive feeling about other shoppers' attitudes in general, because they are usually friendly, helpful, and likeminded (Angell et al., 2012, 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009). However, older customers described feeling a burden when they need to ask for assistance from other shoppers (Meneely et al., 2009).

4.2.4.3.2.7 Checkout (*Friendliness at the till, Queuing, checkout*)

The majority of these factors are unsatisfactory. Long queues, difficulties in dealing with self-checkout and packaging are considered the main negative influence on the grocery shopping experience of older people (Angell et al., 2012, 2014; Hare, 2003; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Yin et al., 2013). On the other hand, older people enjoy the friendliness and socialising through encounters at the checkout with the staff (Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Yin et al., 2013).

4.2.4.3.2.8 Additional services/facilities (*Toilets, Café, Home delivery, Post office, Non-food items*)

The majority of these factors are satisfactory. Additional services and facilities such as toilets, café, home delivery, post office and non-food items are considered a positive influence on the grocery shopping experience of older people because it allows for convenience and socialising (Angell et al., 2012, 2014; Bromley and Matthews, 2007; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009). However, the cost of home delivery is considered high (Hare et al., 2001).

4.2.4.3.3 Post-Purchase stage

4.2.4.3.3.1 Products/service (*Carrying the bags, Unpacking the products, Returns policy*)

The majority of these factors are unsatisfactory. For older shoppers who use public transportation or walk to the store, poor packaging and carrying bags are seen as an issue for them (Angell et al., 2012, 2014; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Yin et al., 2013). Also, older people would like returns policies to be easier, faster and less embarrassing (Angell et al., 2012, 2014; Hare, 2003).

Table 4-5 shows the findings from the current review on older people's grocery shopping experiences. In addition to highlighting the positive and negative factors, it also shows the papers on which these points are based.

4.2.4.4 Findings analysis

Since this research aims to investigate aged 65+ customers' grocery shopping experience in the UK to identify the main pain point and provide design insights to improve supermarket service via emerging technologies. This step is important to understand the most prominent current issues in order to validate them later in this research and then provide design insights and recommendations for the main pain point.

As the first step, the papers were analysed using a manual method (highlighter and sticky notes) then summarize them into Excel sheet. In order to get a holistic view about the topic and the themes as a familiarisation stage. Then, NVivo 12 was used to code the papers. As a result, it was clear that the main pain points were in the purchase phase, as illustrated in *Appendix B.9*. More specifically it was related to products, as *Appendix B.10* shows and the most prominent topics related to the products were as follows: labels, quality, locating, availability, variety, size and portion, branded, freshness and expiry date and portability. Importantly, the systematic literature review considers reliable and accurate conclusions due to limit bias and transparent. However, the interpretation of the data may have some sort of biases, therefore word frequency query, word cloud and word tree were performed in NVivo 12 in order to validate the themes. As a result, by disregarding words that are considered generic such as *older, consumer, or food etc*., products appeared to be at the top, especially after the combination with merchandise in word frequency query and word cloud *Appendix B.11 and B.12.* In addition, the word tree helped validate the subthemes which mentioned earlier - *Appendix B.13*. In summary, the solution for these issues may be divided between policymakers, managers, business, marketers, and designers depends on the issue. More importantly, these issues it should be validated in the next stage of this research before providing design insights and recommendation.

4.3 Conclusion

This chapter has provided a systematic review of the literature relating to the current grocery shopping experience of older people in the UK. Firstly, it was clear that there was a lack of research in this area, especially in the UK, compared to some countries such as the United States. Data were extracted into three stages, pre-purchase stage, purchase stage and post-purchase stage. The majority of the positive factors were in the following touchpoints, location and access to the stores, staff, similar type of shoppers and additional services or facilities. On the other hand, these factors were mostly negative as the following, physical environment, products, pricing and promotions, checkout and products and service in the post-purchase stage.

Table 4-5 The findings from the Systematic Literature Review (SLR)

Pre-Purchase stage	
External influence	**Positive/ Negative factors**
Weather	Depends on the weather *(Good/bad weather, etc)*
	Recourse
	(Lim *et al.*, 2019)
Location and access to the stores	**Positive factors**
	To be relatively close to home or provides a free bus service
Distance to stores	Physical activity/emotional connection *(Walk, going with partner, socialise, enjoy nature, sunset, trees, etc)*
Opening times	Long opening times and a specific time for older people
Parking facilities	Parking availability
	Negative factors
	Difficulties with parking machine
	Parking facilities for people with disabilities not near the entrance
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Omar, Tjandra and Ensor, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001), (Thompson *et al.*, 2011), (Bailey *et al.*, 2010), (Bromley and Matthews, 2007), (Guy, 1985)

Purchase stage	
Physical environment	**Positive factors**
Trolleys/baskets	Trolleys/baskets *(As an aid)*
Store layout	Accessibility *(Wheelchair, lift, etc)*
Signage	**Negative factors**
Aisles	Trolleys/baskets *(Design 'Control, Load/Unload', need for £1, dealing with lock, return it)*
Shelves and freezers	Confusing and difficult layout
In-store seating	Poor signage
Store size	Not enough room, especially for people with mobility impairments
Accessibility	Shelves and freezers *(Too high/Low, far inside, deep)*
	Lack of in-store seating *(Especially in the large-size stores)*
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001), (Teller and Gittenberger, 2011)

Store atmosphere	**Positive factors**
Cleanliness	Generally, older people felt the hygiene and atmosphere standard was high
Tidiness	**Negative factors**
Lighting	Overcrowding is one of the main issues for older people *(E.g. Weekends)*
Sounds	The store lighting *(Especially for older people with eyesight concerns)*
Temperature	Products/packaging on the ground blocking their way
Smells	**Recourse**
Overcrowded	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001)
Products	**Positive factors**
Quality	Quality *(Value for money)*
Variety	Acceptable range and variety of products
Labels	**Negative factors**
Locating	Unclear label *(Size, font, colour, materials, ingredients, special requirements, etc)*
Portability	Moving the products around the store
Size/Portion	Poor, inconsistent and illogical location for the products
Branded	Products are mostly not suitable for one or two people

Freshness/Expiry date	Availability of products especially for older people with dietary requirements
Availability	**Recourse**
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Omar, Tjandra and Ensor, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001), (Venn *et al.*, 2017), (Thompson *et al.*, 2011), (Teller and Gittenberger, 2011), (Bailey *et al.*, 2010), (Guy, 1985)
Pricing & promotions	**Positive factors**
Price Vs Quantity	Money off discounts would benefit everyone
Multi-buy promotions	Loyalty cards discount and related to the rewards scheme
3 for 2 promotions	End of aisle display would reduce their effort to search for their favourite brands
Money off discounts	**Negative factors**
End of aisle display	Unfairness in prices and sizes
Reduced to clear items	Multi-buy '3 for 2' promotions are wasting the food and money, unless the items they need are included in the promotion
Loyalty cards discount	Reduced to clear items seen to be low quality
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Omar, Tjandra and Ensor, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001), (Venn *et al.*, 2017), (Shukla, Banerjee and Adidam, 2013), (Teller and Gittenberger, 2011), (Bailey *et al.*, 2010), (Guy, 1985)

Staff	**Positive factors**
Availability	Staff attitude in general
Friendly	Complaints handling and customer service
Helpful	**Negative factors**
Knowledgeable	Lack of staff
Polite	Staff unable to take customers to the exact location of items
Complaints handling	Impersonal service provided by staff
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Omar, Tjandra and Ensor, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001), (Bromley and Matthews, 2007)
Shoppers	**Positive factors**
Friendly	Positive attitudes from other shoppers in general
Helpful	Older people prefer like-minded shoppers for socialising
Likeminded	**Negative factors**
	Older people feel they are being a burden when they ask for assistance from other shoppers
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001)

Checkout	**Positive factors**
Friendliness at the till	Socialising at the till
Queuing	**Negative factors**
Self-checkout	Long and slow queues
	Some difficulties in dealing with self-checkout and packaging
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Omar, Tjandra and Ensor, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001)
Additional services/facilities	**Positive factors**
Toilets	Generally seen to be an advantage *to take a rest or socialise etc*
Café	**Negative factors**
Home delivery	High cost of home delivery
Post office	**Recourse**
Non-food items	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Bromley and Matthews, 2007), (Hare, 2003), (Hare, Kirk and Lang, 2001)

Post-Purchase stage	
Products/service	**Negative factors**
Carrying the bags	Difficulty carrying bags, *especially for those who use public transport or walk*
Unpacking the products	Poor packaging
Returns policy	Returns policy to be easier, faster and less embarrassing
	Recourse
	(Lim *et al.*, 2019), (Angell *et al.*, 2014), (Yin, Pei and Ranchhod, 2013), (Angell *et al.*, 2012), (Meneely, Strugnell and Burns, 2009), (Hare, 2003), (Hare, Kirk and Lang, 2001)

Chapter 5 Study 2: Using the card sorting method to explore the current grocery shopping experience of customers aged 65+ in the UK

5.1 Introduction

This chapter aims to validate the findings of Study 1 (Chapter 4: SLR) and find out if there are other difficulties in the grocery shopping experience of customers aged 65 and above in the UK using the card sorting method. This is in order to narrow down the main pain points in the grocery shopping experience of customers aged 65 and above in the UK, and to prepare it for a more in-depth understanding in the next study (Chapter 6: the questionnaire). 13 participants were recruited for this study, and it was discovered that the main pain points are labelling, store layout and products, promotions, checkouts, and store environment. These pain points could be solved through policymakers, managers, businesses, marketers, or designers.

5.2 Card sorting method

It is particularly useful at this stage of the thesis to include customers aged 65 and over in the UK into the design process and "co-design" (see Section 2.2.3) through the card sorting method (see Section 3.7.2) to achieve a deeper understanding of the main pain points that customers aged 65 and over in the UK are facing in their current grocery shopping experiences, and different types of personas that might represent their shopping behaviour. Also, to narrow down the customer journey to the main pain points ready to focus on them in the next study (Chapter 6: the questionnaire). In addition, to check if there are new issues in the current grocery shopping experience.

5.3 Research design

As mentioned above, since the second objective of this thesis is to map out the current grocery shopping experience of customers aged 65 and over in the UK, it is useful to include customers aged 65 and over in the design process to obtain the best results and to know the aspects that are relevant and important to their needs (co-design) and their shopping patterns. The card sorting method is one of the most appropriate methods for this study to determine how important

different aspects of the grocery shopping journey are to the participants, and how they set priorities for various shopping aspects (touchpoints), as mentioned in Section 3.7.2. Also, to find out if there are any other difficulties they are currently facing. By considering the focus of this study, which is to validate the main pain points in the grocery shopping journey based on the results of the systematic literature review in Chapter 4, closed card sorting is considered suitable because it is based on the predefined categories found in (the SLR: Chapter 4), as discussed in Section 3.7.2.1. Also, it is essential to take into account the current situation in the world regarding the Coronavirus (COVID-19) (WHO, 2020) during the period of this study; therefore, online card sorting (explained in Section 3.7.2.3) was considered the most appropriate method at this time in order to ensure the safety of the participants and to follow government guidelines. Hence, online card sorting was adopted, and a digital card sorting (justified in Section 3.7.2.2) was used through the Miro website and Microsoft Teams. In order to obtain deeper and more extensive data about their grocery shopping experiences, a moderated and individual card sorting system was used, as explained in Sections 3.7.2.4 and 3.7.2.5. The materials used in the study are in Appendix C.

5.3.1 Participants & Sampling Strategy

The study aimed to recruit customers aged 65 and above who did their grocery shopping at a physical store in the UK before the pandemic (COVID-19) or during it. The same procedure described in Section **Error! Reference source not found.** was followed for this study. Ethical approval for this study was obtained from the University of Southampton research ethics committee prior to starting it (Ethics/ERGO Number: 62401), the ethics materials can be found in Appendix A. The research was carried out between February 23rd and the 5th of May 2021. As a result, 13 participants were recruited. Most of the participants discovered information about the study through posters or non-profit organisations, such as Southampton U3A and Communicare in Southampton. Communicare helped distribute 420 physical posters by mail through their monthly package to its members, and 350 emails to volunteers via its newsletter. Figure 5-1 shows the posters placed in a grocery store; Figure 5-2 shows the poster in a coffee shop and Figure 5-3 shows the poster placed on an information board at a place of worship.

Figure 5-1 The study posters placed in a grocery store

Figure 5-2 The study posters placed in a coffee shop

Figure 5-3 The study poster placed on an information board at a place of worship

5.3.2 Procedure

Online, digital, individual, moderated, and closed card sorting was conducted for around an hour with each participant using the Miro website as the main place for the activities, along with Microsoft Teams at the same time to clarify and support the participants completing the activities and to help if there were any technical issues. A consent form was obtained from the participants prior to the session. Before the session, the participants received a Microsoft Teams meeting link and some files related to the session and what it included, in addition to a Q&A file on how to use Miro and Microsoft Teams. The session was audio recorded using the built-in recording feature on Microsoft Teams and the screen was recorded on the Miro website.

The session was divided into the following: first, appreciation and thanks were conveyed to the participant, then an explanation about the study in general, and asking the participant if they had any questions or concerns before starting the session. Next, questions about the participants' shopping behaviour were asked to obtain a general perspective of the participant's shopping behaviour, which included which stores do they use for shopping and which are considered their main ones; also, distance to the store, frequency of their shopping, average spending on grocery shopping, the form of travel to the store, and shopping style (alone or with someone else, etc.) as shown in Figure 5-4. This was followed by an open-ended question about the participant's style of preparing for their grocery shopping journey, starting from home and preparing the shopping list

until returning home and unpackaging their purchases. The goal of this open-ended question was to make the participant feel comfortable talking to the researcher and recalling their last grocery shopping experience (Creswell and Creswell, 2022).

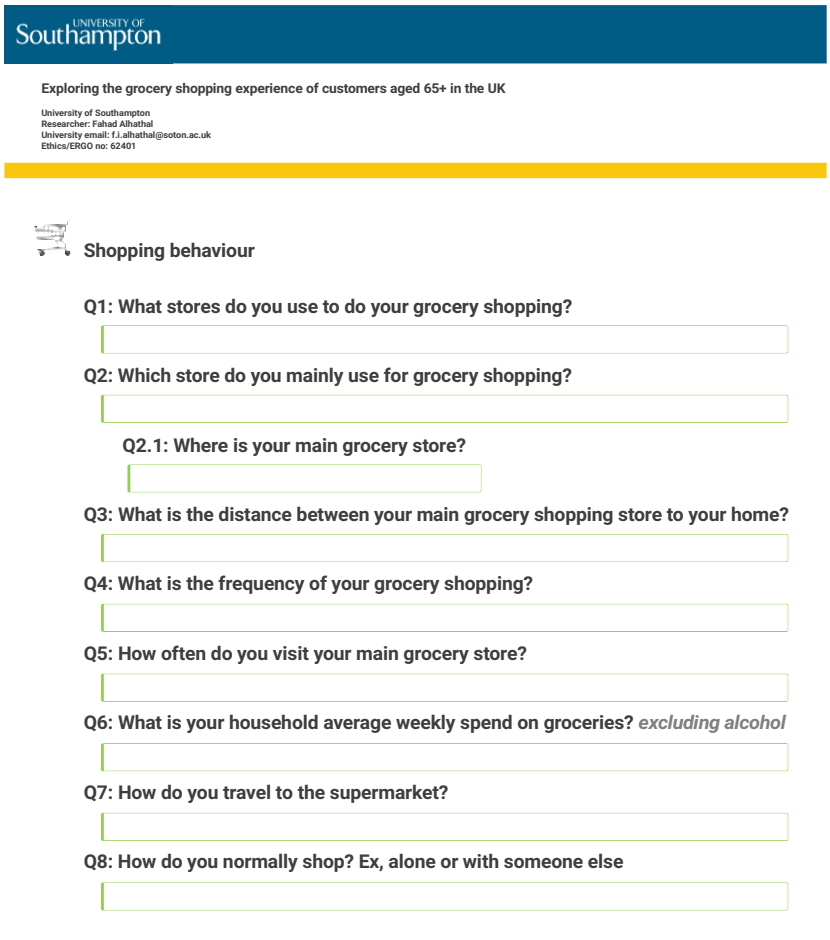


Figure 5-4 The first part of the card sorting activities which focuses on the participant's shopping behaviour

Then, the session moved to the main activity, where each touchpoint was written on a single card of the same size totalling 58 cards, as shown in Figure 5-5. The participants sorted these cards under three sections based on their experience at their main grocery store, and each card represents a touchpoint. The sections are as follows: 1- never/rarely have an issue with, 2- sometimes have an issue with and 3-usually/frequently have an issue with.

Weather	Distance to store	Opening times	Locating of products
Accessibility	Cleanliness of the store	Tidiness of the store	Reduced to clear items
Products portability	Products Size/Portion	Products of traditional brands	Friendliness at the till
Loyalty cards discount	Staff availability	Friendly staff	Products labels
Self-checkout	Additional services/facilities	Toilets	End of aisle display
Parking availability	Parking machine	Trolleys/baskets	Queuing at the checkout
Store lighting	Sounds in the store	Store temperature	Variety of products
Supermarket brands Products	Products freshness/expiry date	Products availability	Money off discounts
Helpful staff	Knowledgeable staff	Polite staff	Likeminded shoppers
Café	Home delivery	Post office	Returns policy
Store layout	Signage	Aisles	Store size
Smells in the store	Overcrowded in the store	Products quality	In-store seating
price vs quantity of products	Multi-buy promotions	3 for 2 promotions	Shelves and freezers
Complaints handling	Friendly shoppers	Helpful shoppers	Unpacking the products at home
Non-food items availability	Carrying the bags after shopping		

Figure 5-5 All pain points *(touchpoints)* identified in Study 1 - the SLR are written on a separate card

The participant was then asked to add a new card representing a difficulty they currently face at their main grocery store, which was not previously mentioned, to make sure that there were no new issues that had not been noted. A discussion then took place with the participant about the cards that were placed in the "sometimes or usually/frequently have an issue with" section, and if there were new cards, to understand the issues more deeply, as illustrated in Figure 5-6.

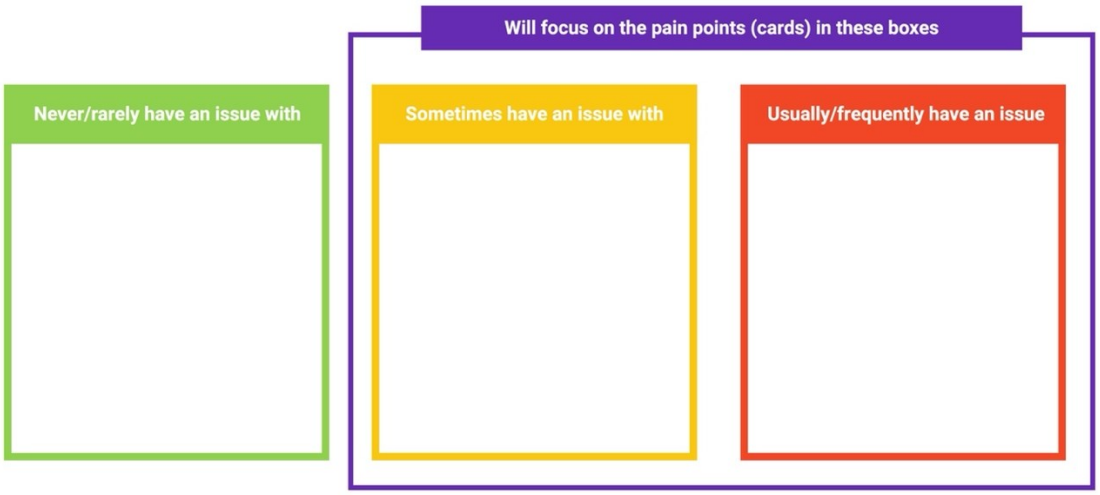


Figure 5-6 The three sections in which participants sort the cards (pain points) based on their experience, the focus of this thesis on the cards in *(sometimes have an issue)* and *(usually/frequently have an issue)*

As can be seen from Figure 5-7, the participants were asked to rate these issues from one to five based on how important they are regarding being solved for them at their main grocery store, where one is very important to be solved and five is not at all important to be solved. Another discussion was then initiated with the participant to understand why they chose this arrangement.

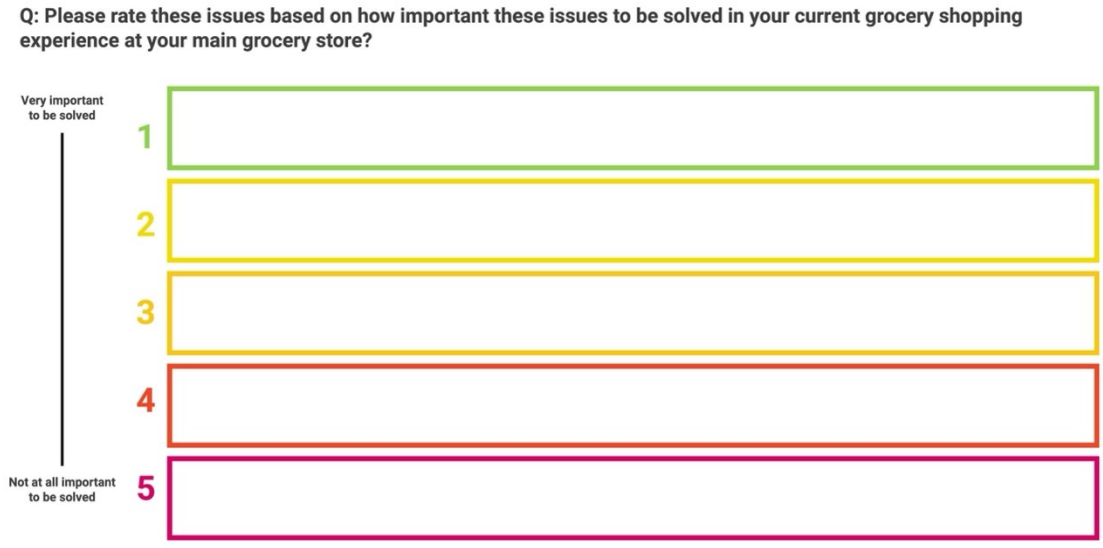


Figure 5-7 A ranking scale for the pain points (cards) that were placed in the *(sometimes have an issue)* and *(usually/frequently have an issue)* boxes, where 1 is *very important to be solved*, and 5 is *not at all important to be solved*

Moving on to the demographic's questions allowed an understanding of each participant's characteristics, which includes age, gender and number of people in each household. Followed by

finding out how well the participant deals with technology, as shown in Figure 5-8. The final step involved asking the participant to choose a persona that is most likely to describe their grocery shopping behaviour, based on the classification by Angell *et al.*(2014b), and allowing them to modify or add what they would like. Finally, the participants were thanked for their time and any questions they had were answered, before asking them if they could share the poster with people they think are suitable for this study.

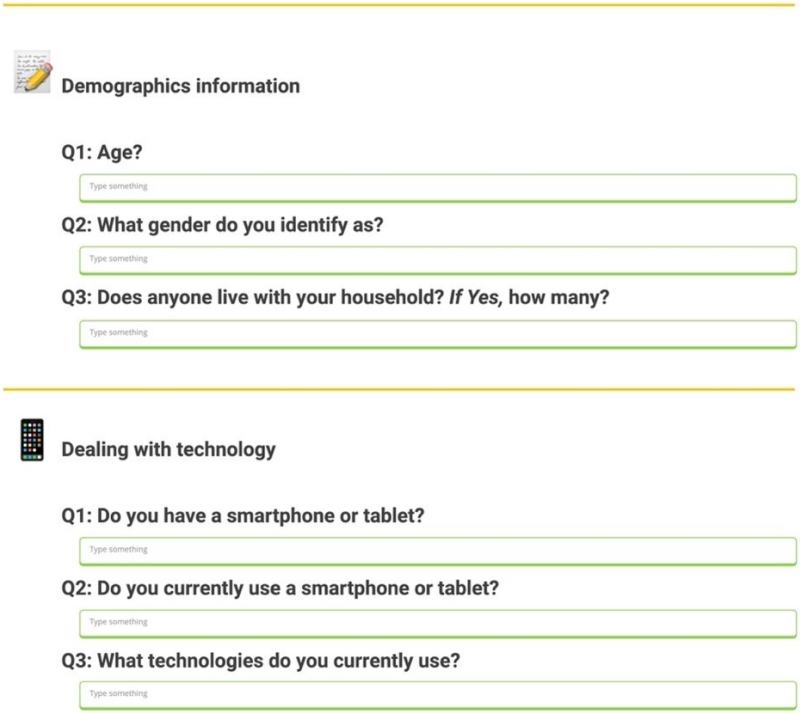


Figure 5-8 The demographic and level of technology questions for the participants

5.3.3 Piloting

As previously illustrated in Section 3.7.2.8 on the benefits of the piloting session, two piloting sessions were conducted before the start of the full study. These provided an opportunity to check and refine the stages and cards, as suggested by Baxter, Courage and Caine (2015) and Spencer (2009). Minor modifications to the stages and cards were made. The modifications involved adding three questions, namely, the name of the main store, and shopping preparation and style, which made the sessions smoother and more engaging. In addition, the "checkout" card was deleted because it was considered generic, especially when taking into account that most of the touchpoints on the checkout were presented in other cards. The main lesson learnt was to keep the control of moving the cards for the researcher to give participants opportunities to

think-aloud and not be concerned with technical issues and how to place the cards in the right place.

5.4 Results and discussion

The objective of this study is to validate the findings of Study 1 (Chapter 4) and find out if there are other difficulties in the grocery shopping experience of customers aged 65 and above in the UK, therefore, the results and discussion have been divided in this section accordingly.

5.4.1 Participants' background

In total, 13 people participated in the card sorting. Their ages range from 65 to 75, eight females and five males, and they shop in different types of supermarkets. Table 5-1 shows the details for each participant. The number of participants is considered appropriate, as discussed in section 3.7.2.6, based on the findings of several researchers (Nielsen, 2004; Tullis and Wood, 2004b; Baxter, Courage and Caine, 2015a). A possible explanation for the gender imbalance between participants might be what (Mortimer and Clarke, 2011) describe, which is that male shoppers consider supermarket shopping less important than female shoppers. In this thesis, high-cost supermarkets are Waitrose and M&S; medium-cost supermarkets are Sainsbury's, Tesco, Asda, Morrisons and The Co-operative, and Low-cost supermarkets are Aldi, Lidl and Iceland, based on the categorisation of Lim, Giacomin and Nickpour (Lim, Giacomin and Nickpour, 2018)

Table 5-1 Overview of participants' data

Participants' code	Gender	Age	Supermarket's type
P1.1	Male	69	High-cost
P1.2	Female	74	Low-cost
P1.3	Male	65	Medium-cost
P1.4	Male	69	Medium-cost
P1.5	Male	74	Medium-cost
P1.6	Female	72	Medium-cost
P1.7	Female	75	Medium-cost
P1.8	Female	70	Medium-cost
P1.9	Female	71	Visit all of them equally
P1.10	Female	68	Medium-cost
P1.11	Male	71	High-cost
P1.12	Female	73	High-cost
P1.13	Female	70	Medium-cost

5.4.2 Validating the main pain points identified in the SLR

The main objective of this study is to validate the main pain points in the current grocery shopping experience of customers aged 65 and above in the UK based on the findings of the SLR (Section 4.2.4). Also, to find out if there are other difficulties currently being faced. Therefore, the results have been analysed using exploratory and statistical techniques, as (Spencer, 2009a) suggested, which has been discussed in Section 3.7.2.9, to obtain a deeper understanding of the issue. Accordingly, the results have been divided into three parts: pre-purchase stage, purchase stage and post-purchase stage.

5.4.2.1 Pre-purchase stage

This study confirms that the weather influences the shopping journey. Interestingly, one participant mentioned that she prefers to go to a specific grocery store when it is raining because it is less crowded with customers, which clearly reflects the impact of the weather on shoppers. This finding was also reported by (Lim *et al.*, 2019a).

In this study, the majority of the participants indicated no issues with the location, access to stores and parking availability, which was reported previously in several studies (Guy, 1985; Hare, Kirk and Lang, 2001b; Hare, 2003b; Bromley and Matthews, 2007; Meneely, Strugnell and Burns, 2009a; Bailey *et al.*, 2010; Thompson *et al.*, 2011; Angell *et al.*, 2012b, 2014b; Yin, Pei and Ranchhod, 2013a; Omar, Tjandra and Ensor, 2014b; Lim *et al.*, 2019a). However, this study has been unable to prove that there are difficulties in dealing with parking machines, as reported by others (Angell *et al.*, 2012b, 2014b; Lim *et al.*, 2019a). A possible explanation for this might be that most stores have made parking free, as participants P1.2, P1.7, and P1.11 mentioned.

5.4.2.2 Purchase stage

The results of the purchase stage are in line with those of previous studies (Guy, 1985; Hare, Kirk and Lang, 2001b; Hare, 2003b; Bromley and Matthews, 2007; Meneely, Strugnell and Burns, 2009a; Bailey *et al.*, 2010; Teller and Gittenberger, 2011; Thompson *et al.*, 2011; Angell *et al.*, 2012b, 2014b; Shukla, Banerjee and Adidam, 2013; Yin, Pei and Ranchhod, 2013a; Omar, Tjandra and Ensor, 2014b; Venn *et al.*, 2017; Lim *et al.*, 2019a) regarding physical environment, store atmosphere, products, pricing and promotions, staff, shoppers, checkout and additional services and facilities.

Some touchpoints stood out as the main pain points, shown in Table 5-2, where participants considered them to "sometimes or usually have an issue with". They are as follows: staff

availability, multi-buy promotions, 3 for 2 promotions, product labels, location of products, products availability and tidiness of the store, queuing at the checkout, friendly shoppers, signage, sounds in the store, knowledgeable staff, store layout, home delivery, overcrowded in the store, shelves and freezers, products' freshness/expiry dates, toilets and product size/portion.

Interestingly, when participants were asked to rate the issues where one is very important to be solved and five is not at all important to be solved, as presented in *Appendix C.2*, it can be observed that "staff availability" was not considered the most important touchpoint to be solved, and that is because generally, participants are looking for staff to do something else, such as check stock, reach a product, look where products are, and so on. Table 5-3 shows the MEDIAN and MODE for the "staff availability" is three. In addition, promotions like "multi-buy" or "3 for 2" have a low Median and Mode (Table 5-3), which is because shoppers can avoid these promotions, but the main issue is these promotions can lead to food wastage (as mentioned by P1.4 and P1.8) unless they need it (as mentioned by P1.5); also, the need to find enough space to store items in the house (mentioned by P1.8), and the difficulty in carrying many products for shoppers who walk or use public transportation. However, these promotions currently seem to disappear based on the participants' current experience.

There are some touchpoints that appear to be interrelated with each other, such as staff availability, locating of products, product availability, signage, knowledgeable staff, store layout and shelves and freezers. Also, product labels and product freshness/expiry dates. The detailed sorting and rating of the pain points based on each participant can be found in *Appendix C.3.*

5.4.2.3 Post-Purchase stage

The findings for products and service in the post-purchase stage broadly support the work of: (Hare, Kirk and Lang, 2001b; Hare, 2003b; Meneely, Strugnell and Burns, 2009a; Angell *et al.*, 2012b, 2014b; Yin, Pei and Ranchhod, 2013a; Lim *et al.*, 2019a), regarding carrying bags, unpacking products and better returns policy.

Table 5-2 Overview of the pain points based on the results of the first card sorting

Touchpoint	Total (out of 13)
Staff availability	9
Multi-buy promotions	7
Products labels	7
3 for 2 promotions	6
Locating of products	6
Products availability	6
Tidiness of the store	6
Queuing at the checkout	5

Friendly shoppers	5
Signage	5
Sounds in the store	5
Knowledgeable staff	5
Store layout	4
Home delivery	4
Overcrowded in the store	4
Shelves and freezers	4
Products freshness/expiry date	4
Toilets	4
Products Size/Portion	4

Table 5-3 The MEDIAN, MODE and AVERAGE for the main pain points.

Touchpoint	MEDIAN	MODE	AVERAGE	NO. OF PARTICIPANTS
Staff availability	3	3	3.44	9
Multi-buy promotions	3	5	3.29	7
Product labels	3	1	2.43	7
3 for 2 promotions	4	4	3.33	6
Locating of products	3	3	3.00	6
Products availability	2.5	2	2.50	6
Tidiness of the store	2	2	2.67	6
Queuing at the checkout	3	4	2.80	5
Friendly shoppers	4	4	4.20	5
Signage	2	2	2.40	5
Sounds in the store	2	2	2.20	5
Knowledgeable staff	4	4	3.60	5
Store layout	1.5	1	1.75	4
Home delivery	3.5	-	3.25	4
Overcrowded in the store	2	2	2.25	4

Shelves and freezers	2.5	3	2.50	4
Products freshness/expiry date	1	1	1.00	4
Toilets	4	4	4.33	4
Products Size/Portion	1.5	1	2.00	4

5.4.3 Findings based on supermarket type

As shown in Table 5-4, there is a clear distinction between the results if analysed based on the type of supermarket. In the case of high-cost supermarkets, interestingly, "staff availability" is not issue at all. The main issues for shoppers who shop at high-cost supermarkets are "toilets" by three participants out of three, followed by "non-food items availability", such as clothes as noted by participant P1.1, and "sounds in the store" by two participants out of three, especially regarding the announcements for COVID guidelines, as clothes as reported by participant P1.11. Regarding medium-cost supermarkets, the main issue is "staff availability" according to seven participants out of eight, followed by "multi-buy promotions" and "product labels" by six participants out of eight. As for low-cost supermarkets, "staff availability" remains an issue. Therefore, these differences must be taken into account when designing a solution for this target group. In addition, the data has been analysed based on gender and personas, but no significant results have appeared.

Table 5-4 The results based on supermarket type

High-cost supermarkets		Medium-cost supermarkets		Low-cost supermarkets	
Touchpoint	**Total (3)**	**Touchpoint**	**Total (8)**	**Touchpoint**	**Total (1)**
Toilets	3	Staff availability	7	Staff availability	1
Non-food items availability	2	Multi-buy promotions	6	Home delivery	1
Sounds in the store	2	Products labels	6	Toilets	1
Multi-buy promotions	1	3 for 2 promotions	5	Variety of products	1
3 for 2 promotions	1	Locating of products	5	Café	1
Product labels	1	Tidiness of the store	5	Packaging - a lot of plastic	1

Locating of products	1	Products availability	4	Products of traditional brands	1
Products availability	1	Friendly shoppers	4	Lack of refill services	1
Queuing at the checkout	1	Signage	4		
Knowledgeable staff	1	Knowledgeable staff	4		
price vs quantity of products	1	Shelves and freezers	4		
Self-checkout	1	Products Size/Portion	4		
Overcrowded in the store	1	Queuing at the checkout	3		
Parking availability	1	Store layout	3		
		Sounds in the store	3		
		Helpful shoppers	3		
		Home delivery	3		
		Products freshness/expiry date	3		
		Overcrowded in the store	2		
		End of aisle display	2		
		Trolleys /basket	2		

5.4.4 Dealing with technology

Since this study aims to investigate aged 65+ customers' grocery shopping experience in the UK and provide design insights to improve supermarket service via emerging technologies, it is important to know the level of technology and the smart devices they use. The current study found that all participants have either mobile phones, tablets or laptops and use them daily. What stood out is that three participants (P1.4, P1.9 and P1.12) appear to be tech-savvy, and they use several technologies such as digital and interactive speakers (Amazon Alexa, Sonos), smart car, smart TV, and Amazon Fire TV Stick.

5.4.5 Suggestions for future work

Based on the results of this study, it appears that there may be a slight shift in the shopping behaviour of customers aged 65 and above in the UK, especially after the COVID-19 pandemic. A slight difference was observed in the frequency of shopping for some customers, in addition to the emergence of a new type of shopping by combining online and offline shopping. Furthermore, sustainability seems to be an important concern, as some like to shop locally or be green shoppers. It can also be noticed that there are differences in some supermarket strategies by making the parking free or changing the style of promotions. A further study with more focus on the impact of the pandemic or the shopping behaviour of customers aged 65 and above is therefore suggested. Noticeably, the card sorting method helped participants to easily recall their grocery shopping experience and worked as a trigger for them to speak more, which appears to be easier than asking them to remember their last grocery experience because they may forget some of the issues or situations. This study provides the following insights for researchers willing to use card sorting method: starting with the invitation, it should have a clear and easy title and not be in an academic language like "card sorting study". It should provide a detailed Q&A file on how they will use the websites or applications in the session, with pictures and supporting links. It is noticeable that placing the cards under the control of the researcher made the participants more focused on the session content and caused them to "think-aloud" rather than being preoccupied with technical problems. Since the session was online, it seemed more appropriate to start with open-ended questions to make the participant feel comfortable and more open with the researcher to engage with the context of the study before beginning to sort the cards. It would be better to provide a “not applicable” option so that the participants do not have to find a place for some card if not applicable to them. However, this point did not affect the results of this study, but it would reduce the effort expected of the participant.

5.5 Conclusion

In summary, as reflected in Figure 5-9 this chapter has validated the findings of Study 1 (Chapter 4: the SLR) and has provided insights into the most recent difficulties and shopping behaviour of customers aged 65 and above in the UK using a qualitative method (card sorting 3.7.2). 13 participants were recruited for this study. As a result, various main pain points have been identified, which are staff availability, promotions, labelling, store layout and products, promotions, signage, checkouts, and store environment. These pain points can be divided into several categories, and the pain points could be solved through policymakers, managers, businesses, marketers, or designers. However, since this thesis aims to focus on the main pain point of customers through design using emerging technologies, it will focus only on the issues

related to that in the next stages of this thesis, namely labelling, store layout and products, and checkouts. Thus, the chapter that follows presents a quantitative method (questionnaire: Chapter 6) used to obtain a large scale of opinions about these pain points.

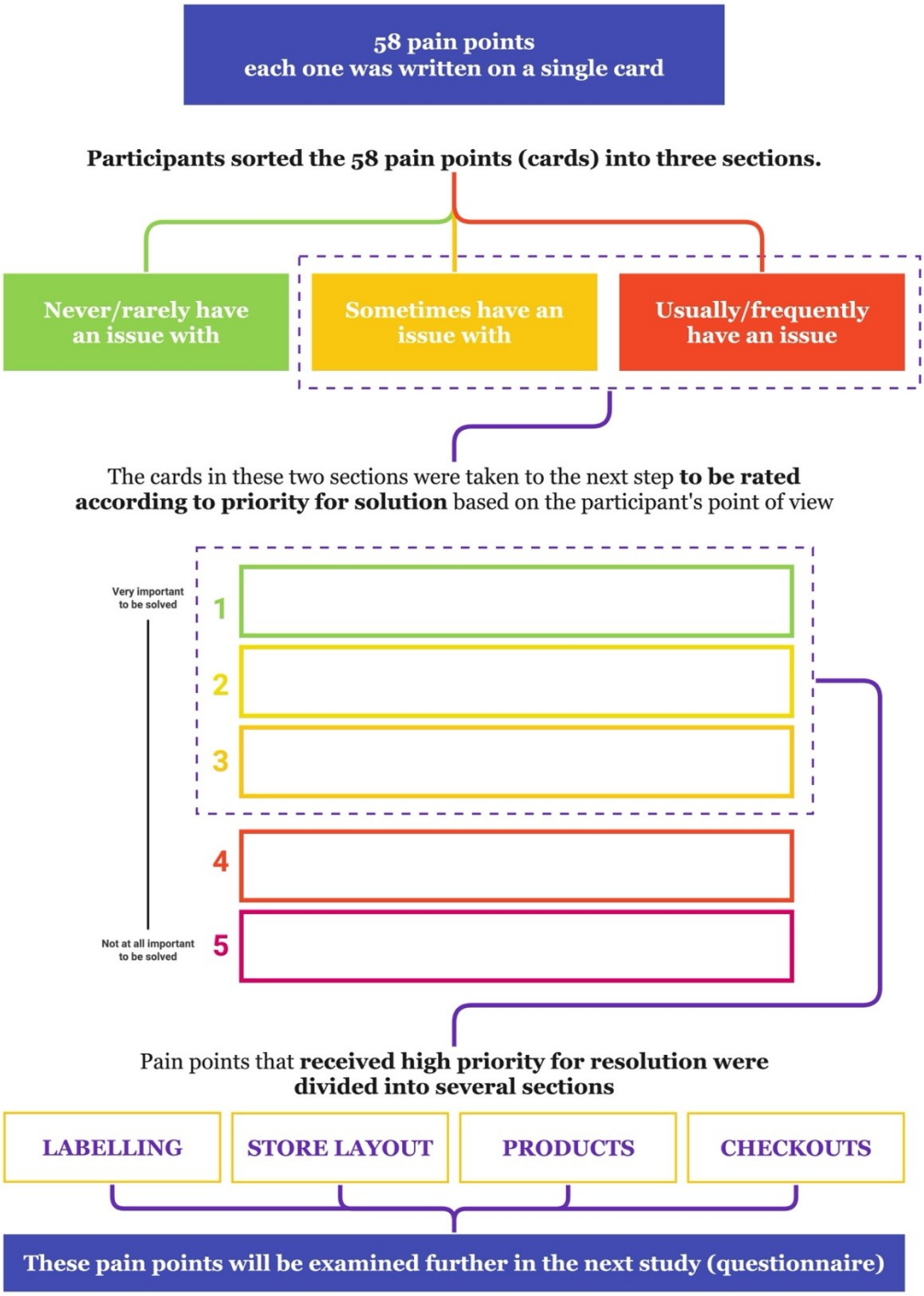


Figure 5-9 The decision-making process in determining which pain points will be examined in the following study (Questionnaire)

Chapter 6 Study 3: Using a questionnaire to expand the knowledge of the current grocery shopping experience of customers aged 65+ in the UK

6.1 Introduction

This chapter presents the data from the adoption of a quantitative method (a self-administered web-based questionnaire). The self-administered web-based questionnaire is the second part of the triangulation approach explained in section **Error! Reference source not found.**. This method was selected to obtain a large number of opinions about the main pain points found in Study 2 (Chapter 5: card Sorting). The questionnaire was divided into five sections: shopping behaviour, main pain points, understanding how participants deal with technology, overall grocery shopping satisfaction, and demographic information. Several techniques were used to design the questionnaire, such as a rating scales and multiple-choice questions, so as to better understand older customers' grocery shopping behaviours, attitudes, the importance and satisfaction of the main factors found in the previous study (Chapter 5: card Sorting).

6.2 Questionnaire method

In order to obtain a large number of opinions to validate the knowledge gained from Study 2: Card sorting (see Chapter 5), a self-administered web-based questionnaire was adopted to achieve this objective. As explained in Section 3.7.3, a self-administered web-based questionnaire is particularly useful for self-reported behaviours, attitudes, opinions, and satisfaction. Importantly, a web-based questionnaire is useful, especially during the COVID-19 pandemic when this questionnaire was carried out.

6.3 Research design

It is beneficial to use a quantitative method to achieve the aim of this stage, which is to obtain a large number of opinions regarding the current grocery shopping experience of customers aged 65 and over in the UK (Willem and Irmtraud, 2014). Explanatory research is often used to generalise the results to the population from which the sample is selected, requiring statistical tests to establish the validity of relationships (Neuman, 2013; Willem and Irmtraud, 2014).

Therefore, the questionnaire was designed based on the results of Study 2, as presented in Chapter 5. Started with shopping behaviour then followed by the main pain points based on the results in Section 5.4. After that understanding how participants deal with technology, overall grocery shopping satisfaction, and demographic information. The questionnaire can be found in Appendix D.

6.3.1 Participants & Sampling Strategy for the Questionnaire

The study aimed to recruit customers aged 65 and above who did their grocery shopping at a physical store in the UK before the pandemic (COVID-19) or during it. The same procedure described in Section **Error! Reference source not found.** was followed. Ethical approval was obtained from the University of Southampton research ethics committee prior to administering the questionnaire (Ethics/ERGO Number: 62401), the "combined participant information sheet and consent form for anonymous online surveys for adult participants" can be found in Appendix D. Most of the participants discovered information about the study through posters or non-profit organisations, such as Reading U3A and Age UK Sunderland. Figure 6-1 shows the posters placed in a grocery store; Figure 6-2 shows them in a coffee shop and Figure 6-3 shows the posters in the Age UK Sunderland newsletter for July 2021.

Figure 6-1 The study poster placed in a grocery store

Figure 6-2 The study poster placed in a coffee shop

Figure 6-3 The study poster in the Age UK Sunderland newsletter

6.3.2 Procedure

A self-administered web-based questionnaire was designed using Microsoft Forms as it is one of the platforms recommended by the University of Southampton, which took an average of half an hour for each participant to complete. A link to the questionnaire was sent to the participants through third parties, with the poster containing main information about the research aim and data management. The questionnaire starts with a participant information sheet and consent form. The questionnaire mainly used two types of questions: multiple-choice questions to recall facts and rating scale questions to measure attitudes.

Following the recommendations illustrated in Section 3.7.3.1, the questionnaire begins with behaviour questions then attitude questions. Therefore, the first section of the questionnaire focuses on understanding the shopping behaviour of customers aged 65 and over in the UK, as shown in Figure 6-4. This includes multiple-choice questions about the main grocery store and the frequency of their grocery shopping before and after the Coronavirus (COVID-19) for factual recall to form a general idea about the type of supermarkets and their shopping style.

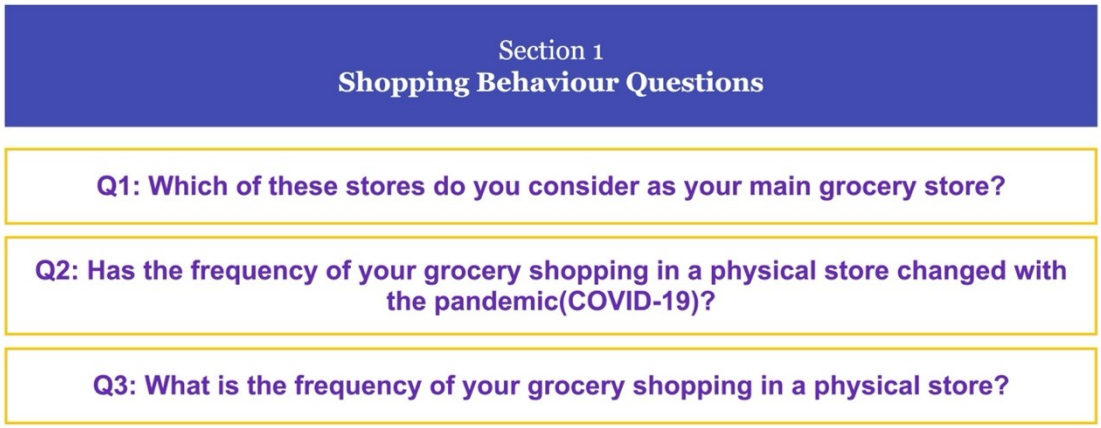


Figure 6-4 The first section of the questionnaire focuses on shopping behaviour

Figure 6-5 shows the structure of the second section of the questionnaire, which aimed at obtaining large scale opinions about the main pain points identified in Study 2, Section 5.4. The second section has been divided into several parts based on the touchpoints as follows: labelling (shelf labelling, packaging/product information), store layout and products (availability and location) and checkouts. As suggested in Section 3.7.3.1 about using a rating scale to measure attitude, a rating scale of five was used to measure each of the touchpoints. Another rating scale of seven was used at the end of each touchpoint section to measure the importance and satisfaction of each touchpoint to find out the most important touchpoint with the least satisfaction to be the focus of the following study (Chapter 7); as these numbers of points on the

rating scales is considered a general agreement between researchers. Some section has multiple-choice questions to understand some factors such as special dietary requirements, frequency of reading the information on packaging, and using self-checkouts.

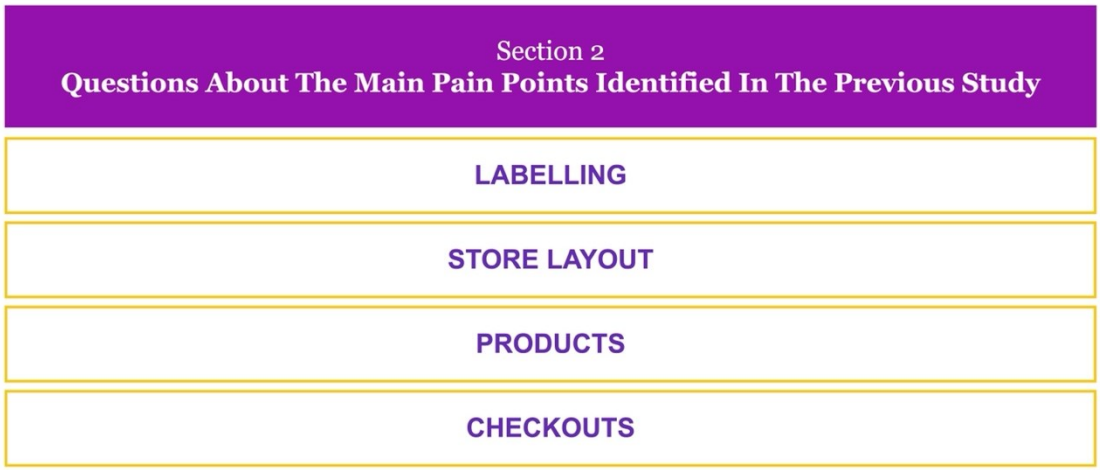


Figure 6-5 The second section of the questionnaire focuses on examine the main pain points identified in the previous study.

This is followed by a section on how participants deal with technology, using multiple-choice questions in order to consider the technology use level of the participants when providing design insights and recommendation, as shown in Figure 6-6.

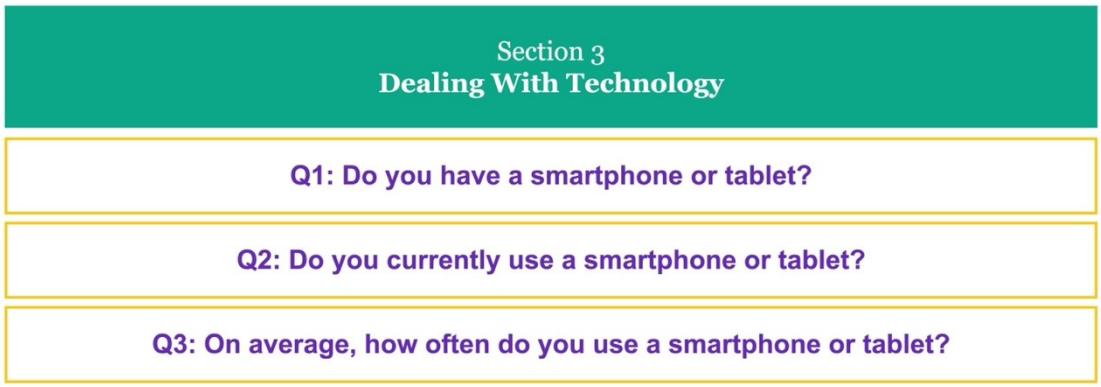


Figure 6-6 The third section of the questionnaire focuses on how participants deal with technology.

The next section is about their overall shopping satisfaction, as illustrated in Figure 6-7. The last section focuses on understanding the participants' characteristics and demographic information to help with analysis and form the persona in the following study (Chapter 8 – Section 8.4). The complete questionnaire is provided in Appendix D.

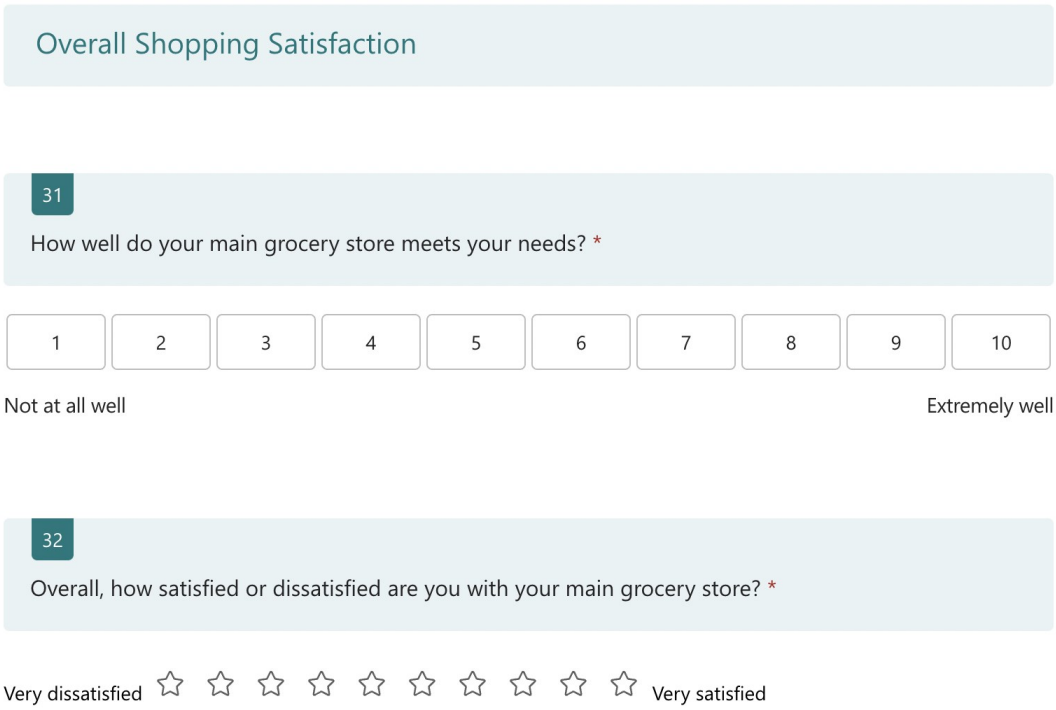


Figure 6-7 Questions about the overall shopping satisfaction

6.3.3 Piloting

As previously explained in Section 3.7.3.3 on the benefits of running a piloting session before publishing the main questionnaire, a piloting session was carried out with a 68-year-old female participant who shops at a medium-cost supermarket. The piloting session took about an hour. The piloting session included several aspects such as question-wording and clarity, colours and contrast, and was tested on different operating systems and devices such as iPhone, Samsung Galaxy and iPad to test how the questions look on different screen sizes. Minor modifications were made to the questions, such as adding the impact of the pandemic on shopping frequency and changing some questions to multiple choice instead of a single choice. Also, some modifications to the wording, especially in the personas.

6.4 Questionnaire results and discussion

This section aims to present the analysis of the questionnaire's results and discussion. The analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 28. After publishing the questionnaire, 233 valid responses were received. However, twenty responses were excluded because the respondent's main store could not be identified, such as no main

store or open markets, etc. Therefore, 213 valid responses were included in the analysis, which is considered a sufficient sample size, as explained in Section 3.7.3.2.

6.4.1 Demographic information

Four questions were used to explore the demographic information of participants. The participants' demographic information was used to cluster and analyse the participants based on several attributes: gender, age, type of main store and number of people in households. As shown in Table 6-1, 36.2% of the participants are between the ages of 70-74, 25.8% are between 65-69 and 23.9% are between 75-79 years old. One hundred thirty-seven participants used medium-cost supermarkets as the main store. 103 participants lived in one-person households, and ninety-eight lived in two-person households. 85.9% of the participants were females, and 12.7% were males. A possible explanation for the gender imbalance between participants might be what Mortimer and Clarke (2011) describe, which is that male shoppers consider supermarket shopping less important than female shoppers. Previous studies have noted a similar gender imbalance in their participants (Angell et al., 2012; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Yin et al., 2013).

Table 6-1 Demographic information of participants in the questionnaire

Gender	Frequency	Percent
Female	183	85.9%
Male	27	12.7%
Non-binary	1	0.5%
Prefer not to say	2	0.9%
Age		
65-69	55	25.8%
70-74	77	36.2%
75-79	51	23.9%
80-84	15	7%
85 and over	15	7%
Main store		
High-cost supermarkets	56	26.3%

Medium-cost supermarkets	137	64.3%
Low-cost supermarkets	20	9.4%
No. of household		
1 (Only you)	103	48.4%
2 (including you)	98	46%
3 (including you)	9	4.2%
4 and more (including you)	2	0.9%
Prefer not to say	1	0.5%

6.4.2 Shopping Frequency

Regarding the shopping frequency, 87 participants did not change their shopping frequency before and during the pandemic (COVID-19). However, 126 participants changed their shopping frequency during the pandemic as shown in *Figure 6-8*. Among the 87 participants who did not change their shopping frequency, 41 shopped once a week and 39 shopped between two to six times per week (see Table 6-2).

Figure 6-8 The change in shopping frequency in a physical store during the pandemic(COVID-19)

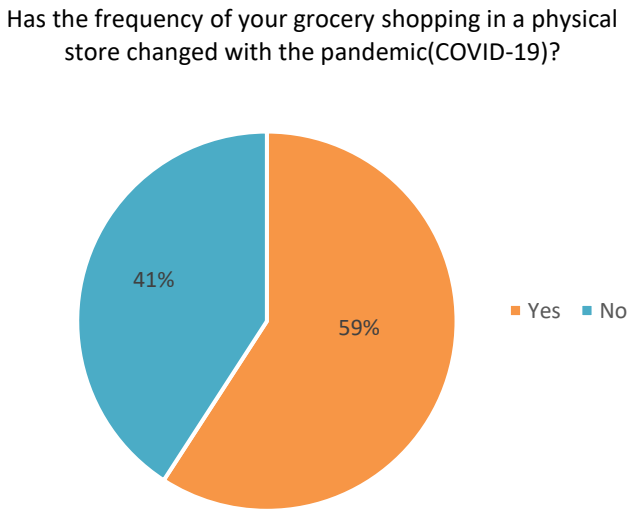


Table 6-2 The frequency of participants who did not change their shopping frequency

	Frequency	Percent

Valid	**Daily**	2	2.3%
	Between two to six times per week	39	44.8%
	Once a week	41	47.1%
	Once every two weeks	2	2.3%
	Less often	3	3.4%
	Total	87	100.0%

As shown in Table 6-3, almost 58% of participants who changed their shopping frequency were shopping '*between two to six times per week'* before the pandemic compared to nearly 13% during the pandemic. In addition, shopping '*less often*' was just under 2.5% before the pandemic compared to just over 49% during the pandemic. A further study could assess the effects of the pandemic (COVID-19) on shopping behaviour and frequency.

Table 6-3 The shopping frequency before and during the pandemic for participants who did change their shopping frequency

The shopping frequency **(Before the pandemic)**			
		Frequency	**Percent**
Valid	**Daily**	8	6.3%
	Between two to six times per week	73	57.9%
	Once a week	39	31.0%
	Once every two weeks	3	2.4%
	Less often	3	2.4%
	Total	126	100.0%
The shopping frequency **(During the pandemic)**			
Valid	**Daily**	2	1.6%
	Between two to six times per week	16	12.7%
	Once a week	31	24.6%
	Once every two weeks	15	11.9%
	Less often	62	49.2%
	Total	126	100.0%

6.4.3 The impact of meeting customers' needs on customers satisfaction

A 10-point rating scale was used to determine the correlation between meeting the customer needs and customer satisfaction. As a result, there was a significant positive correlation nearly (0.87), as shown in Table 6-4. These findings support the importance of this research in identifying pain points customers face to resolve them and enhance their experience and satisfaction. In addition to supporting businesses to succeed in this competitive market, as mentioned in Sections 1.2 and 1.6.

Table 6-4 The correlation between meeting customers' needs and customers satisfaction

Correlations

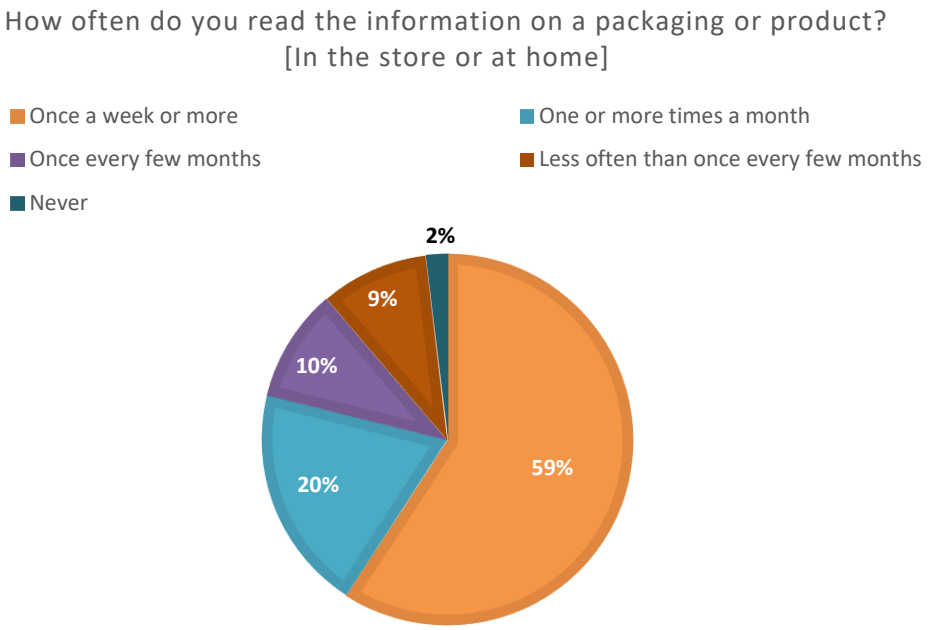
		How well do your main grocery store meets your needs?	Overall, how satisfied or dissatisfied are you with your main grocery store?
How well do your main grocery store meets your needs?	Pearson Correlation	1	.869**
	Sig. (2-tailed)		<.001
	N	213	213
Overall, how satisfied or dissatisfied are you with your main grocery store?	Pearson Correlation	.869**	1
	Sig. (2-tailed)	<.001	
	N	213	213

**. Correlation is significant at the 0.01 level (2-tailed).

6.4.4 Reading the information on packaging or product

What stands out from the responses, as shown in Figure 6-9, is that 126 participants read the information on packaging or product *once a week or more*. Also, 42 participants read it *once or more times a month*. The main element that participants read the information is the *ingredients*, followed by *cooking instructions* and then *storage instructions*. Therefore, a further study focusing on product information label design is suggested.

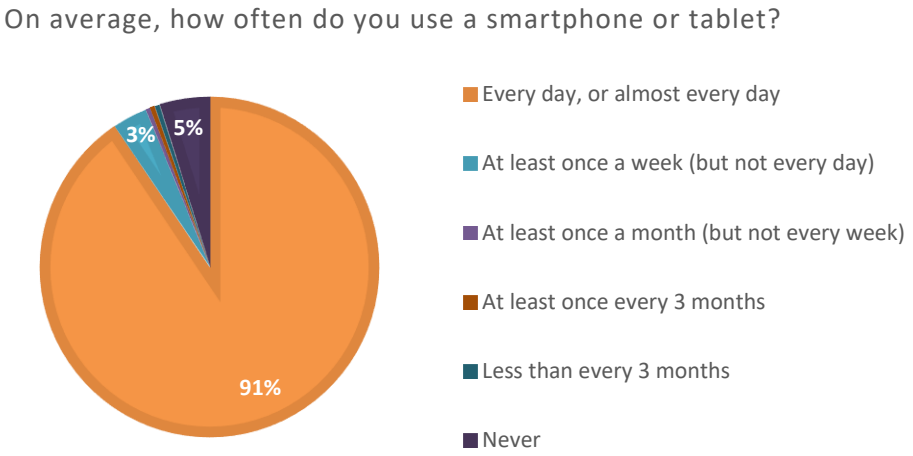
Figure 6-9 How often do participants read the information on packaging or product



6.4.5 The level of technology use

One hundred and ninety-nine participants reported they have a smartphone or tablet. Also, two hundred participants responded they currently use a smartphone or tablet. In addition, just over 90% of the respondents indicated that they use a smartphone or tablet daily (See Figure 6-10). These results support the aim of this thesis, in addition to their alignment with the recommendations made by (Yin et al., 2013) regarding the potential of technology to enhance the shopping experience.

Figure 6-10 Participants' average use of smartphones or tablets



6.4.6 The main pain points

This section aims to discuss the five main pain points, which are '*packaging/product information'*, *'shelf labels'*, '*store layout and ease of in-store navigation'*, *'products availability and location'*, and *'checkouts'* that were confirmed in Study 2: Chapter 5 based on these studies (Angell et al., 2012, 2014; Bailey et al., 2010; Bromley and Matthews, 2007; Guy, 1985; Hare, 2003; Hare et al., 2001; Lim et al., 2019; Meneely et al., 2009; Omar et al., 2014; Shukla et al., 2013; Teller and Gittenberger, 2011; Thompson et al., 2011; Venn et al., 2017; Yin et al., 2013).

6.4.6.1 Descriptive analyses of the main pain points

This section presents the descriptive and frequency analysis from the questionnaire to give an overview of the importance and satisfaction of the participants regarding the main pain points found in Study 2 (Chapter 5: card Sorting). There are two variables in the analysis of variance. First are the dependent variables, which are the variables being measured. The second variable, which affects the dependent variables, is called the independent variable (Miller and Brewer, 2003b).

Independent Variables (IVs) are three supermarket types *'high-cost, medium-cost, and low-cost'* (See Table 6-5), five age groups *'65-69, 70-74, 75-79, 80-84, and 85 and over'* (Presented in Table 6-6), four gender groups *'female, male, non-binary, and prefer not to say'* as shown in Table 6-7, five household number groups *'1 (Only you), 2 (including you), 3 (including you), 4 and more (including you), and prefer not to say'* as can be seen in Table 6-8.

Dependent Variables (DVs) are the importance and satisfaction of *'packaging/product information'*, *'shelf labels'*, *'store layout and ease of in-store navigation'*, *'products availability and location'*, and *'checkouts'*. A rating scale of seven was used to measure the importance and satisfaction of each dependent variable to determine the most important touchpoint with the least satisfaction to be the focus of the following method. The dependent variables are as follows:

DV01- How important is packaging/product information to you in-store at your main grocery store?

DV02- How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store?

DV03- How important are shelf labels to you at your main grocery store?

DV04- How satisfied or dissatisfied are you with shelf labels at your main grocery store?

DV05- How important are store layout and ease of in-store navigation to you at your main grocery store?

DV06- How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store?

DV07- How important are products availability and location to you at your main grocery store?

DV08- How satisfied or dissatisfied are you with products availability and location at your main grocery store?

DV09- How important is checkouts to you at your main grocery store?

DV10- How satisfied or dissatisfied are you with checkouts at your main grocery store?

Table 6-5 Descriptive analyses of the dependent variables based on supermarket type

Supermarket types		DV01	DV02	DV03	DV04	DV05	DV06	DV07	DV08	DV09	DV10
High-cost supermarkets	N	56	56	56	56	56	56	56	56	56	56
	Mean	5.00	5.07	4.98	4.88	5.64	5.45	5.95	5.34	5.54	5.70
	Std. Deviation	1.57	1.06	1.34	1.03	.999	1.04	.942	1.07	1.33	.913
	Minimum	1	2	1	3	3	3	3	3	3	4
	Maximum	7	7	7	7	7	7	7	7	7	7
Medium-cost supermarkets	N	137	137	137	137	137	137	137	137	137	137
	Mean	5.21	4.73	5.31	4.80	5.56	5.09	5.88	4.97	5.63	5.41
	Std. Deviation	1.31	1.11	1.35	1.09	1.14	1.13	.940	1.20	1.24	1.14
	Minimum	1	1	1	1	1	1	4	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7
Low-cost supermarkets	N	20	20	20	20	20	20	20	20	20	20
	Mean	4.95	4.90	5.80	5.20	5.60	5.20	6.00	4.85	5.60	5.55
	Std. Deviation	1.39	1.12	1.15	1.11	1.43	1.20	.918	.933	1.10	1.10
	Minimum	2	3	3	2	1	2	4	3	4	4
	Maximum	7	7	7	7	7	7	7	6	7	7
Total	N	213	213	213	213	213	213	213	213	213	213
	Mean	5.13	4.84	5.27	4.85	5.59	5.20	5.91	5.06	5.60	5.50
	Std. Deviation	1.39	1.10	1.34	1.07	1.13	1.12	.935	1.15	1.25	1.08
	Minimum	1	1	1	1	1	1	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7

Table 6-6 Descriptive analyses of the dependent variables based on age groups

What is your age		DV01	DV02	DV03	DV04	DV05	DV06	DV07	DV08	DV09	DV10
65–69	N	55	55	55	55	55	55	55	55	55	55
	Mean	5.00	4.84	5.07	4.80	5.44	5.07	5.73	4.89	5.16	5.22
	Std. Deviation	1.32	.977	1.36	1.04	1.13	1.14	1.03	1.13	1.40	1.15
	Minimum	2	2	1	2	3	2	4	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7
70–74	N	77	77	77	77	77	77	77	77	77	77
	Mean	5.19	4.70	5.43	4.79	5.68	5.18	5.92	4.99	5.70	5.53
	Std. Deviation	1.25	1.21	1.34	1.09	1.09	1.12	.984	1.25	1.16	1.08
	Minimum	2	1	1	1	1	1	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7
75–79	N	51	51	51	51	51	51	51	51	51	51
	Mean	5.12	5.10	5.16	5.00	5.73	5.33	6.04	5.24	5.80	5.63
	Std. Deviation	1.51	1.01	1.30	1.08	1.11	1.21	.848	1.18	1.22	1.04
	Minimum	1	2	1	3	3	2	4	2	3	3
	Maximum	7	7	7	7	7	7	7	7	7	7
80–84	N	15	15	15	15	15	15	15	15	15	15
	Mean	4.93	4.93	5.33	4.87	5.27	5.40	5.80	5.27	5.53	5.67
	Std. Deviation	1.58	1.03	1.54	.990	1.33	.986	.676	.704	1.06	1.05
	Minimum	1	3	3	3	1	3	5	4	4	4
	Maximum	7	7	7	7	6	7	7	6	7	7
85 and over	N	15	15	15	15	15	15	15	15	15	15
	Mean	5.53	4.53	5.53	4.87	5.53	5.07	6.20	5.20	6.07	5.73
	Std. Deviation	1.81	1.25	1.25	1.25	1.19	.884	.775	.941	1.10	.961
	Minimum	2	2	3	2	3	3	5	4	4	4
	Maximum	7	6	7	7	7	6	7	6	7	7
Total	N	213	213	213	213	213	213	213	213	213	213
	Mean	5.13	4.84	5.27	4.85	5.59	5.20	5.91	5.06	5.60	5.50
	Std. Deviation	1.39	1.10	1.34	1.07	1.13	1.12	.935	1.15	1.25	1.08
	Minimum	1	1	1	1	1	1	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7

Table 6-7 Descriptive analyses of the dependent variables based on gender

What gender do you identify as?		DV01	DV02	DV03	DV04	DV05	DV06	DV07	DV08	DV09	DV10
Female	N	183	183	183	183	183	183	183	183	183	183
	Mean	5.20	4.90	5.30	4.91	5.66	5.29	5.92	5.14	5.63	5.55
	Std. Deviation	1.39	1.06	1.34	1.05	1.13	1.07	.943	1.13	1.20	1.04
	Minimum	1	2	1	2	1	2	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7
Male	N	27	27	27	27	27	27	27	27	27	27
	Mean	4.67	4.37	5.11	4.48	5.33	4.59	6.00	4.56	5.44	5.11
	Std. Deviation	1.41	1.33	1.40	1.22	1.00	1.31	.784	1.25	1.53	1.34
	Minimum	2	1	2	1	4	1	5	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7
Non-binary	N	1	1	1	1	1	1	1	1	1	1
	Mean	4.00	5.00	4.00	5.00	4.00	6.00	4.00	5.00	3.00	6.00
	Std. Deviation	.	.	.	.	.	.	.	.	.	.
	Minimum	4	5	4	5	4	6	4	5	3	6
	Maximum	4	5	4	5	4	6	4	5	3	6
Prefer not to say	N	2	2	2	2	2	2	2	2	2	2
	Mean	5.50	5.50	6.00	5.00	3.50	4.50	5.00	4.50	6.00	5.50
	Std. Deviation	.707	.707	.000	.000	.707	.707	1.41	.707	.000	.707
	Minimum	5	5	6	5	3	4	4	4	6	5
	Maximum	6	6	6	5	4	5	6	5	6	6
Total	N	213	213	213	213	213	213	213	213	213	213
	Mean	5.13	4.84	5.27	4.85	5.59	5.20	5.91	5.06	5.60	5.50
	Std. Deviation	1.39	1.10	1.34	1.07	1.13	1.12	.935	1.15	1.25	1.08
	Minimum	1	1	1	1	1	1	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7

Table 6-8 Descriptive analyses of the dependent variables based on household number groups

Report

Number of household		DV01	DV02	DV03	DV04	DV05	DV06	DV07	DV08	DV09	DV10
1 (Only you)	N	103	103	103	103	103	103	103	103	103	103
	Mean	5.16	5.02	5.19	4.90	5.61	5.36	5.95	5.16	5.71	5.63
	Std. Deviation	1.50	1.07	1.34	1.07	1.03	.948	.879	1.12	1.23	.960
	Minimum	1	2	1	2	3	2	4	1	2	3
	Maximum	7	7	7	7	7	7	7	7	7	7
2 (including you)	N	98	98	98	98	98	98	98	98	98	98
	Mean	5.11	4.67	5.31	4.81	5.54	5.10	5.83	4.96	5.46	5.33
	Std. Deviation	1.31	1.11	1.37	1.12	1.24	1.27	.964	1.22	1.26	1.18
	Minimum	1	1	1	1	1	1	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7
3 (including you)	N	9	9	9	9	9	9	9	9	9	9
	Mean	5.11	4.56	5.78	4.89	6.11	4.67	6.78	5.22	5.89	5.67
	Std. Deviation	1.27	1.13	1.20	.782	.782	1.00	.441	.833	1.54	1.32
	Minimum	4	2	3	4	5	3	6	4	3	3
	Maximum	7	6	7	6	7	6	7	6	7	7
4 and more (including you)	N	2	2	2	2	2	2	2	2	2	2
	Mean	4.50	4.00	5.00	4.50	5.00	4.50	5.00	4.50	5.50	6.00
	Std. Deviation	.707	1.41	.000	.707	1.41	.707	1.41	.707	.707	.000
	Minimum	4	3	5	4	4	4	4	4	5	6
	Maximum	5	5	5	5	6	5	6	5	6	6
Prefer not to say	N	1	1	1	1	1	1	1	1	1	1
	Mean	6.00	6.00	6.00	5.00	4.00	4.00	4.00	4.00	6.00	6.00
	Std. Deviation	.	.	.	.	.	.	.	.	.	.
	Minimum	6	6	6	5	4	4	4	4	6	6
	Maximum	6	6	6	5	4	4	4	4	6	6
Total	N	213	213	213	213	213	213	213	213	213	213
	Mean	5.13	4.84	5.27	4.85	5.59	5.20	5.91	5.06	5.60	5.50
	Std. Deviation	1.39	1.10	1.34	1.07	1.13	1.12	.935	1.15	1.25	1.08
	Minimum	1	1	1	1	1	1	3	1	2	1
	Maximum	7	7	7	7	7	7	7	7	7	7

6.4.6.2 A One-Way Analysis of Variance (ANOVA) Test

This section aims to determine the statistical significance of the rating scales between two or more groups using the mean values (O'Dwyer and Bernauer, 2014; Miller and Brewer, 2003). Analysis of variance (ANOVA) was used as it is by far the most powerful analysis test for comparing the means of two groups or more (Miller and Brewer, 2003b), as explained in Section 3.7.3.4. The two variables in the analysis of variance are the independent variables which will expect to influence dependent variables, and the dependent variable, what happens because of the independent variable (Miller and Brewer, 2003b).

The dependent variables were firstly evaluated for normal distribution using a histogram, as shown in Figure 6-11 - Figure 6-20. Then a one-way Analysis of Variance (ANOVA) was completed to obtain the statistical significance of the variables using Statistical Package for the Social

Sciences (SPSS) version 28. Post hoc analysis was completed using a Tukey HSD test. Table 6-9 shows the ANOVA test for supermarket types, Table 6-10 for age groups, Table 6-11 for gender groups and Table 6-12 for household number groups. The rating scales for positive and negative questions have been modified to be the same style, for instance, in section *products availability and location* "It is a good idea when grocery store moves the products around the shop to give a chance to discover new products" and "It is frustrating when the grocery store moves the products around the store".

Figure 6-11 The importance of packaging/product information

Figure 6-12 The importance of shelf labels

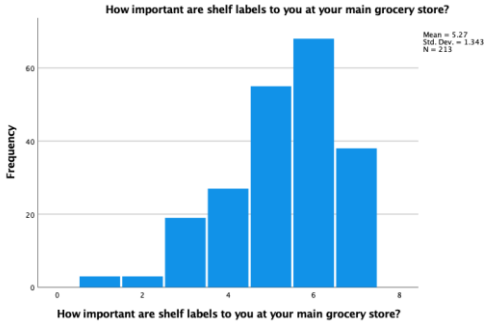


Figure 6-13 The importance of store layout and in-store navigation

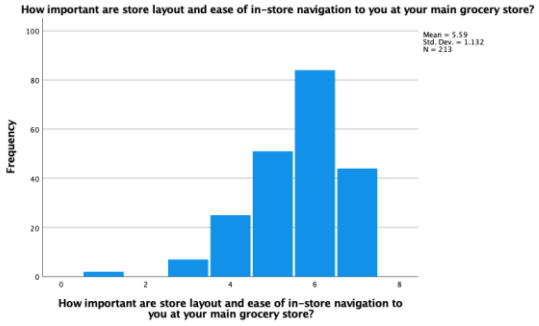


Figure 6-14 The importance of product availability and location

Figure 6-15 The importance of checkouts

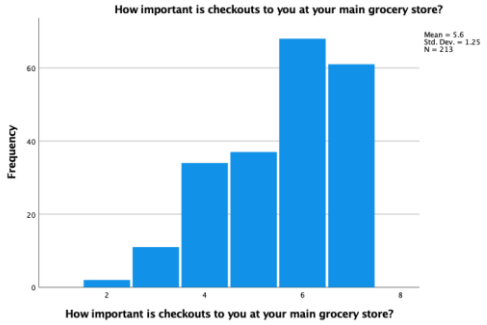


Figure 6-16 The satisfaction of packaging/product information

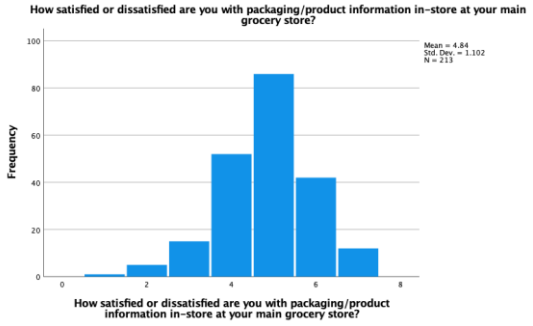


Figure 6-17 The satisfaction of shelf labels

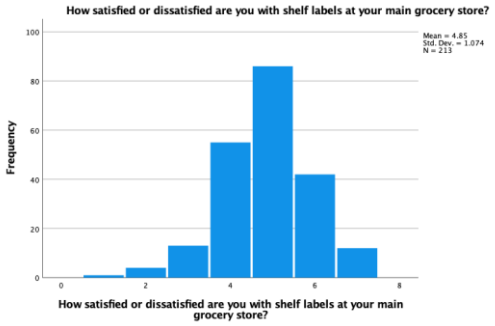


Figure 6-18 The satisfaction of store layout and in-store navigation

Figure 6-19 The satisfaction of product availability and location

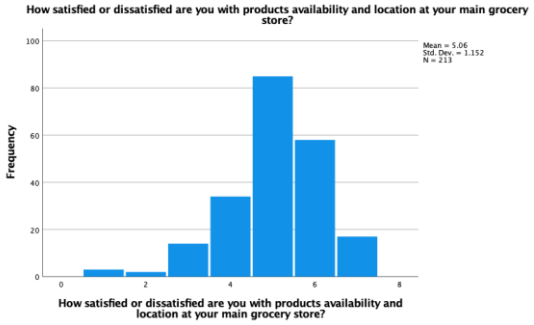


Figure 6-20 The satisfaction of checkouts

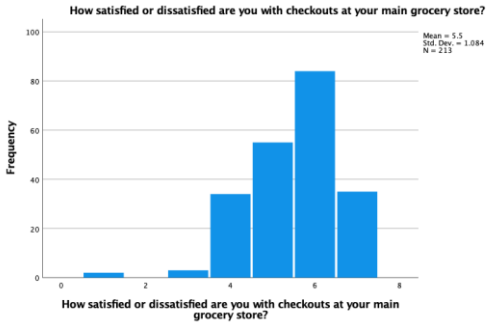


Table 6-9 ANOVA test for supermarket types

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
How important is packaging/product information to you in-store at your main grocery store?	Between Groups	2.508	2	1.254	.646	.525
	Within Groups	407.811	210	1.942		
	Total	410.319	212			
How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store?	Between Groups	4.727	2	2.364	1.966	.143
	Within Groups	252.522	210	1.202		
	Total	257.249	212			
How important are shelf labels to you at your main grocery store?	Between Groups	10.521	2	5.260	2.972	.053
	Within Groups	371.686	210	1.770		
	Total	382.207	212			
How satisfied or dissatisfied are you with shelf labels at your main grocery store?	Between Groups	2.886	2	1.443	1.254	.287
	Within Groups	241.602	210	1.150		
	Total	244.488	212			
How important are store layout and ease of in-store navigation to you at your main grocery store?	Between Groups	.263	2	.132	.102	.903
	Within Groups	271.380	210	1.292		
	Total	271.643	212			
How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store?	Between Groups	4.913	2	2.456	1.978	.141
	Within Groups	260.806	210	1.242		
	Total	265.718	212			
How important are products availability and location to you at your main grocery store?	Between Groups	.334	2	.167	.190	.827
	Within Groups	184.971	210	.881		
	Total	185.305	212			
How satisfied or dissatisfied are you with products availability and location at your main grocery store?	Between Groups	6.337	2	3.169	2.420	.091
	Within Groups	274.987	210	1.309		
	Total	281.324	212			
How important is checkouts to you at your main grocery store?	Between Groups	.337	2	.168	.107	.899
	Within Groups	330.743	210	1.575		
	Total	331.080	212			
How satisfied or dissatisfied are you with checkouts at your main grocery store?	Between Groups	3.350	2	1.675	1.430	.242
	Within Groups	245.899	210	1.171		
	Total	249.249	212			

Table 6-10 ANOVA test for age groups

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
How important is packaging/product information to you in-store at your main grocery store?	Between Groups	4.281	4	1.070	.548	.701
	Within Groups	406.039	208	1.952		
	Total	410.319	212			
How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store?	Between Groups	6.415	4	1.604	1.330	.260
	Within Groups	250.834	208	1.206		
	Total	257.249	212			
How important are shelf labels to you at your main grocery store?	Between Groups	5.829	4	1.457	.805	.523
	Within Groups	376.378	208	1.810		
	Total	382.207	212			
How satisfied or dissatisfied are you with shelf labels at your main grocery store?	Between Groups	1.546	4	.387	.331	.857
	Within Groups	242.942	208	1.168		
	Total	244.488	212			
How important are store layout and ease of in-store navigation to you at your main grocery store?	Between Groups	4.409	4	1.102	.858	.490
	Within Groups	267.234	208	1.285		
	Total	271.643	212			
How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store?	Between Groups	2.688	4	.672	.531	.713
	Within Groups	263.030	208	1.265		
	Total	265.718	212			
How important are products availability and location to you at your main grocery store?	Between Groups	4.142	4	1.036	1.189	.317
	Within Groups	181.163	208	.871		
	Total	185.305	212			
How satisfied or dissatisfied are you with products availability and location at your main grocery store?	Between Groups	4.482	4	1.120	.842	.500
	Within Groups	276.842	208	1.331		
	Total	281.324	212			
How important is checkouts to you at your main grocery store?	Between Groups	16.717	4	4.179	2.765	.029
	Within Groups	314.363	208	1.511		
	Total	331.080	212			
How satisfied or dissatisfied are you with checkouts at your main grocery store?	Between Groups	6.510	4	1.627	1.395	.237
	Within Groups	242.739	208	1.167		
	Total	249.249	212			

Table 6-11 ANOVA test for gender groups

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
How important is packaging/product information to you in-store at your main grocery store?	Between Groups	8.300	3	2.767	1.438	.233
	Within Groups	402.019	209	1.924		
	Total	410.319	212			
How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store?	Between Groups	7.425	3	2.475	2.071	.105
	Within Groups	249.824	209	1.195		
	Total	257.249	212			
How important are shelf labels to you at your main grocery store?	Between Groups	3.474	3	1.158	.639	.591
	Within Groups	378.732	209	1.812		
	Total	382.207	212			
How satisfied or dissatisfied are you with shelf labels at your main grocery store?	Between Groups	4.327	3	1.442	1.255	.291
	Within Groups	240.162	209	1.149		
	Total	244.488	212			
How important are store layout and ease of in-store navigation to you at your main grocery store?	Between Groups	13.832	3	4.611	3.738	.012
	Within Groups	257.811	209	1.234		
	Total	271.643	212			
How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store?	Between Groups	13.050	3	4.350	3.598	.014
	Within Groups	252.669	209	1.209		
	Total	265.718	212			
How important are products availability and location to you at your main grocery store?	Between Groups	5.535	3	1.845	2.145	.096
	Within Groups	179.770	209	.860		
	Total	185.305	212			
How satisfied or dissatisfied are you with products availability and location at your main grocery store?	Between Groups	8.573	3	2.858	2.190	.090
	Within Groups	272.751	209	1.305		
	Total	281.324	212			
How important is checkouts to you at your main grocery store?	Between Groups	7.943	3	2.648	1.713	.166
	Within Groups	323.137	209	1.546		
	Total	331.080	212			
How satisfied or dissatisfied are you with checkouts at your main grocery store?	Between Groups	4.825	3	1.608	1.375	.251
	Within Groups	244.423	209	1.169		
	Total	249.249	212			

Table 6-12 ANOVA test for household number groups

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
How important is packaging/product information to you in-store at your main grocery store?	Between Groups	1.650	4	.413	.210	.933
	Within Groups	408.669	208	1.965		
	Total	410.319	212			
How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store?	Between Groups	9.514	4	2.379	1.997	.096
	Within Groups	247.734	208	1.191		
	Total	257.249	212			
How important are shelf labels to you at your main grocery store?	Between Groups	3.718	4	.930	.511	.728
	Within Groups	378.488	208	1.820		
	Total	382.207	212			
How satisfied or dissatisfied are you with shelf labels at your main grocery store?	Between Groups	.754	4	.188	.161	.958
	Within Groups	243.734	208	1.172		
	Total	244.488	212			
How important are store layout and ease of in-store navigation to you at your main grocery store?	Between Groups	5.952	4	1.488	1.165	.327
	Within Groups	265.692	208	1.277		
	Total	271.643	212			
How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store?	Between Groups	8.530	4	2.132	1.725	.146
	Within Groups	257.188	208	1.236		
	Total	265.718	212			
How important are products availability and location to you at your main grocery store?	Between Groups	12.941	4	3.235	3.904	.004
	Within Groups	172.364	208	.829		
	Total	185.305	212			
How satisfied or dissatisfied are you with products availability and location at your main grocery store?	Between Groups	3.917	4	.979	.734	.570
	Within Groups	277.407	208	1.334		
	Total	281.324	212			
How important is checkouts to you at your main grocery store?	Between Groups	4.092	4	1.023	.651	.627
	Within Groups	326.988	208	1.572		
	Total	331.080	212			
How satisfied or dissatisfied are you with checkouts at your main grocery store?	Between Groups	5.717	4	1.429	1.221	.303
	Within Groups	243.532	208	1.171		
	Total	249.249	212			

The main statistically significant results noted in the data between the (age, gender, and household number) groups are the importance of checkouts (p=0.29) based on age groups (See Table 6-10*).* For the gender groups, the importance of store layout and ease of in-store navigation (p=0.12) and the satisfaction of store layout and ease of in-store navigation (p=0.14) (See Table 6-11). Also, the importance of product availability and location for household number groups (p=0.004) (See Table 6-12). However, the ANOVA test's overall results indicated no statistical significance between the groups in most of the variables. Therefore, the mean of satisfaction has

been subtracted from the mean of importance to find the main pain point. Importantly, Cronbach's alpha was used to ensure the reliability and robustness of the rating scale for the dependent variables using SPSS version 28. As a result, the Cronbach's Alpha test value is 0.75, indicating a respectable reliability level.

6.4.6.3 Determine the main pain point

Table 6-13 shows the mean for the dependent variables. As a result, *products availability and location* appeared to be the main pain point by subtracting the mean of satisfaction from the mean of importance (0.85). The *products availability and location* section examined seven factors using a 5-point rating scale ranging from *Agree strongly* to *Disagree strongly*. The seven factors are as follows: "*It is annoying when the product I want is out of stock*", "*It is easy to find an alternative product when the product I want is out of stock*", "*It is frustrating when the grocery store moves the products around the store*", "*It is confusing when I can not find a product in the expected location*", "*I often ask staff to check for a product in their back stock because they might have it but no one has time to bring it to the shelves*", "*It is a good idea when grocery store moves the products around the shop to give a chance to discover new products*", and "*It is easy to reach products on the top shelves or in the bottom of freezers*". Therefore, the store moving the products around appeared to be the main pain point by just over 91% of the participants (See Table 6-14). Followed by products being out of stock (Table 6-15), then customers cannot find a product in the expected location (Table 6-16).

Table 6-13 Descriptive statistics of the main pain points

Factor	Mean	Minimum	Maximum	N	subtract mean
How important is packaging/product information to you in-store at your main grocery store?	5.13	1	7	213	0.29
How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store?	4.84	1	7	213	
How important are shelf labels to you at your main grocery store?	5.27	1	7	213	0.42
How satisfied or dissatisfied are you with shelf labels at your main grocery store?	4.85	1	7	213	

How important are store layout and ease of in-store navigation to you at your main grocery store?	5.59	1	7	213	0.39
How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store?	5.20	1	7	213	
How important are products availability and location to you at your main grocery store?	**5.91**	**3**	**7**	**213**	**0.85**
How satisfied or dissatisfied are you with products availability and location at your main grocery store?	**5.06**	**1**	**7**	**213**	
How important is checkouts to you at your main grocery store?	5.60	2	7	213	0.10
How satisfied or dissatisfied are you with checkouts at your main grocery store?	5.50	1	7	213	
Valid N (listwise)				213	

Table 6-14 The rating scale of 'it is frustrating when the grocery store moves the products around the store'

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	107	50.2	50.2	50.2
	Agree	88	41.3	41.3	91.5
	Neither agree nor disagree	13	6.1	6.1	97.7
	Disagree	2	.9	.9	98.6
	Disagree strongly	3	1.4	1.4	100.0
	Total	213	100.0	100.0	

Table 6-15 The rating scale of 'It is annoying when the product I want is out of stock'

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	80	37.6	37.6	37.6
	Agree	109	51.2	51.2	88.7
	Neither agree nor disagree	22	10.3	10.3	99.1
	Disagree	2	.9	.9	100.0
	Total	213	100.0	100.0	

Table 6-16 The rating scale of 'It is confusing when I cannot find a product in the expected location'

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	59	27.7	27.7	27.7
	Agree	124	58.2	58.2	85.9
	Neither agree nor disagree	25	11.7	11.7	97.7
	Disagree	4	1.9	1.9	99.5
	Disagree strongly	1	.5	.5	100.0
	Total	213	100.0	100.0	

6.5 Challenges

Some challenges were faced during this study. Starting with recruitment, since the study was carried out during the summer holidays in the UK (end of July and beginning of August 2021), and the main channel for recruitment was through third parties and non-profit organisations, most of the volunteers were on holiday, which meant it took longer to communicate and cooperate in sharing this questionnaire. Most importantly, there were difficulties with using Microsoft Forms. Especially with regard to the design of the questionnaire, including colours, fonts, contrast, and ease of use. There are not many options or flexibility, and it took more time to modify the design, which created some limitations. *Appendix D.2* shows the emails that were received from participants who were annoyed by the difficulties of dealing with the website, and this stopped some participants from completing the questionnaire. This issue possibly explains why the average time to complete the questionnaire by the participants was longer than expected, as it took about half an hour on average compared to the piloting session and the expected time from Microsoft Forms, which is about 10 minutes.

6.6 Conclusion

In summary, this study set out to obtain a large number of opinions on the results found in Study 2 (Chapter 5) regarding the grocery shopping experience of customers aged 65+ in the UK. A quantitative method (a self-administered web-based questionnaire) was adopted to achieve the aim of this study. The questionnaire includes five parts: shopping behaviour, main pain points based on the results in Section 5.4, understanding of how participants deal with technology, overall grocery shopping satisfaction, and demographic information. As a result, 213 valid responses were included in the analysis. Importantly, one of the most critical factors of this study is to identify the main pain point in the grocery shopping experience to examine it in depth in the following study 3 (Chapter 7). Five pain points found in Study 2 were tested, which are *'packaging/product information'*, *'shelf labels'*, *'store layout and ease of in-store navigation'*, *'products availability and location'*, and *'checkouts'*. Using Statistical Package for the Social Sciences (SPSS) version 28, the one-way Analysis of Variance (ANOVA) was completed as it is the most suitable analysis test for the aim of this study. Thus, the main issue was around the *'products availability and location'*. More specifically, *the store moving the products around* appeared to be the main pain point for just over 91% of the participants.

Chapter 7 Study 4: Using the card sorting method to explore the products availability and location issue for customers aged 65+ in the UK

7.1 Introduction

The chapter below aims to use the in-person card sorting method to investigate deeply the main pain point that was found in the previous study Chapter 6, which is the *'products availability and location'*. Seven participants aged between 69 and 84 years were recruited for this study. This study was divided into three main sections: recall previous experiences where participants were looking for a product at their main store. Second, recall previous experiences where someone asked the participants to help find a product. Finally, obtain suggestions from the participants regarding appropriate solutions to solve the *'products availability and location'* issue.

7.2 Card sorting method

The qualitative method card sorting (Section 3.7.2) as part of the co-design process (Section 2.2.3) is a valuable and interactive tool at this stage to gain more understanding from the participants regarding the *'products availability and location'* issue and insights for providing design insights and recommendations. Therefore, customers aged 65 and over in the UK were recruited to participate in individual, in-person, paper, moderated and closed card sorting activity.

7.3 Research design

As previously stated, this thesis aims to investigate aged 65+ customers' grocery shopping experience in the UK to identify the main pain point and provide design insights to improve supermarket service via emerging technologies. Therefore, the card sorting method was considered appropriate for this research stage. Restrictions were lifted in the UK when this study was being carried out, so in-person card sorting was deemed appropriate. The card sorting was chosen to be on paper, individual, and moderated to facilitate the sorting process and obtain deeper insights from each participant. Since this study is based on exploring the results of the

previous study (Section 6.4.6), closed card sorting was considered the most suitable. The materials used in the study are in Appendix E.

7.3.1 Participants & Sampling Strategy

The target group for this study to be recruited are customers aged 65 and above who did grocery shopping at a physical store in the UK before the pandemic (COVID-19) or during it. This study followed the same approach described in Section **Error! Reference source not found.**. Ethical approval for this study was obtained from the University of Southampton research ethics committee before starting it (Ethics/ERGO Number: 62401); the ethics materials can be found in Appendix A. The study was conducted in December 2021 in a quiet public space for around an hour with each participant. As a result, seven participants were recruited. The majority of participants knew about the study through non-profit organisations, such as Hope Church Ferndown and Southampton U3A.

7.3.2 Procedure

Before the session, the participants received an email containing details about the study, the consent form and a short questionnaire about their shopping behaviour, technology use, and demographic information. After obtaining the participants' initial consent to participate in the study, a suitable date was set for the sessions. Therefore, in-person, paper, individual, moderated, and closed card sorting was conducted for around an hour with each participant in a quiet public space. On arrival at the place, participants were offered complimentary snacks (coffee, tea, fruits, and biscuits), and the consent form was received from the participants at this time. The session was audio recorded using a voice recorder and iPad Pro, and a DSLR camera captured the cards.

The session began by appreciating the participants' time and briefly explaining the study and the sorting activities. Afterwards, participants were given time if they had any questions or concerns before starting the session. Then start with warm-up questions by asking the participants for more details about their answers to the questionnaire. It was followed by the main card sorting activities, divided into three parts: first, recall previous experiences where they were looking for a product. Second, recall previous experiences where someone asked them for help to find a product. Finally, obtain some inspiration from participants regarding their navigation technique and what they think would be an appropriate solution to this issue. The cards were printed using the same size and font on A5-sized cards representing the main points identified from the questionnaire (Section 6.4.6) regarding the product's availability and location.

The first sorting activity started by asking the participants to recall previous experiences where they were looking for a product at their main and a new store. Then, based on their previous experiences, the participants were asked to sort the cards as follows:

- Product type
    - *Routine/new and main/extra.*
- Product name
- What happened?
    - *They ask staff, look around, search online before going to the store, use signage as a guide, and ask a customer.*
- Why they could not find the product?
    - *Product out of stock, product placed in the not relevant location, the store moving products around, confusing layout, and they did not see it because the product was placed too high or too low.*
- What they did as a next step*?*
    - *Look for an alternative product, leave the product for next time, go to another store, and leave the store*.

Next, the participant was asked to add any missing card. Once the participant had sorted all the cards, three rating scales of seven were used with "what happened?" cards, based on the recommendations illustrated in Section 3.7.3.1. The first rating scale about *'how often the participant uses this way'* ranges from never to always. Followed by *'how useful using this way'* ranging from not at all useful to extremely useful. Then *'how confident are the participant with this way?'* ranging from not at all confident to extremely confident. Regarding the *'why they could not find the product?'* cards, a rating scale of seven was used for *'how often has this been the reason?'* ranging from never to always.

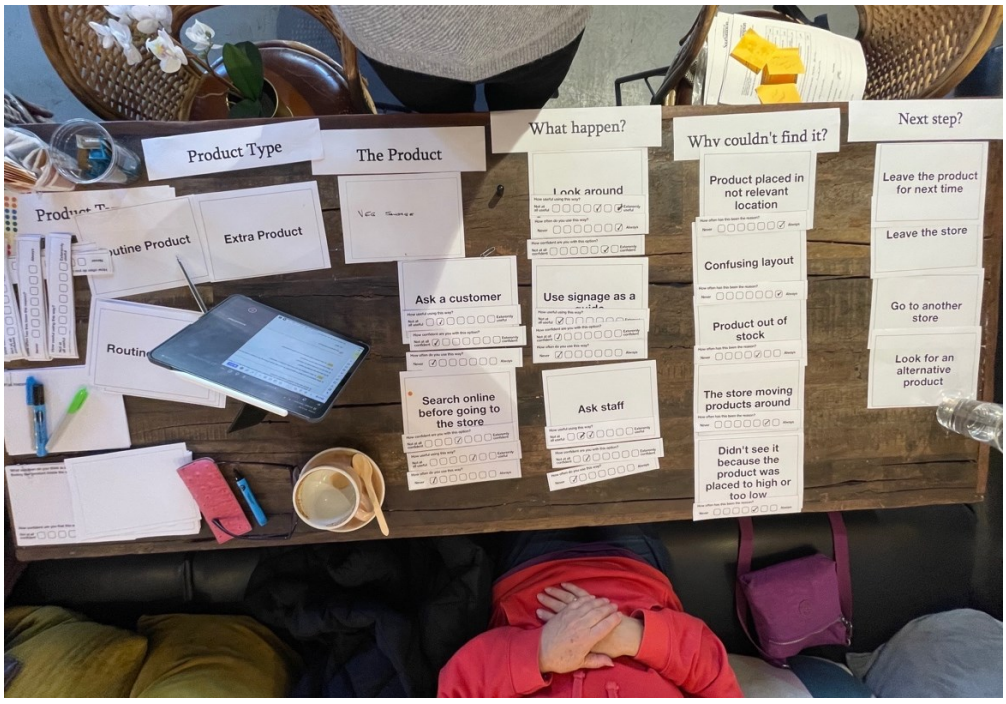
The second sorting activity is based on the participants' experience if someone has asked them about a product location. Then, the last sorting activity is about understanding how participants navigate and what are the helpful elements for navigation as well as finding possible solutions to this issue. Regarding the navigation, participants were asked to write what elements help them to navigate on an A5 card, followed by a rating scale of seven about how useful this element is, ranging from not at all useful to extremely useful. In terms of finding the possible solutions, participants were asked to write what solution they think is suitable to solve the issue of finding a product inside the store. Followed by a rating scale of seven about how confident they are that this solution is feasible, ranging from not at all confident to extremely confident. Finally, thank the

participants and ask if they have any questions to be answered. The card sorting materials and activities are provided in Appendix E.

7.3.3 Piloting

As was pointed out in Section 3.7.2.8, Baxter, Courage and Caine (2015) and Spencer (2009) mentioned the importance of running a piloting session before conducting the main card sorting study. In order to check the clarity of the stages and cards and give a chance to refine them. Accordingly, as shown in Figure 7-1 a piloting session with a participant from the target group was conducted for about an hour and a half to check the clarity of the session structuring, cards wording or any missing cards and the expected time for the session. Minor modifications to the cards were made by adding the rating scale on the cards themselves instead of making it on separate cards so as not to get distracted by too many cards. Another important point regarding conducting in-person card sorting sessions compared to online sessions. As mentioned in Section 5.3.3, the importance of keeping the control of moving the cards in an online session to the researcher to allow the participants to think aloud and not get distracted by some technical issues. However, it was clear that the in-person sessions gave them more encouragement and comfort in the sorting activities, in addition to being motivated to write or add other cards due to the limited technical challenges.

Figure 7-1 An image of the piloting session with a participant from the target group



7.4 Results and discussion

This study aims for a deeper understanding of the main pain point that was found in Study 3 (Section 6.4.6.3), which is related to the *'products availability and location'*, and to provide design insights to improve supermarket service for customers aged 65 and above in the UK. Thus, the mean was used to analyse the results. The results and discussion in this section have been divided into several categories.

7.4.1 Participants' background

In this study, seven people participated in the second card sorting, which is considered acceptable, as explained in section 3.7.2.6. The participants were aged between 69 years and 84 years and primarily use medium-cost supermarkets. In this thesis, medium-cost supermarkets are Sainsbury's, Tesco, Asda, Morrisons and The Co-operative, and low-cost supermarkets are Aldi, Lidl, and Iceland, based on the categorisation of Lim, Giacomin and Nickpour (2018). The participants were five females and two males. The gender imbalance between participants was expected, as previously clarified by Mortimer and Clarke (2011). Table 7-1 shows the details for each participant. Figure 7-2 shows an overview of the first card sorting activities.

Table 7-1 Demographic characteristics of participants in the 2nd card sorting

Participants' code	Gender	Age	Supermarket's type
P2.1	Female	81	Medium-cost
P2.2	Female	71	Medium-cost
P2.3	Female	69	Medium\low-cost
P2.4	Female	81	Medium\low-cost
P2.5	Male	84	Medium\low-cost
P2.6	Female	76	Medium-cost
P2.7	Male	72	Medium-cost

7.4.2 Shopping frequency and style

With regard to the shopping frequency and style, the results of this study are in line with the previous studies mentioned in Chapter 5 - Section 5.4.5 and Chapter 6 - Section 6.4.2. All participants mentioned that their shopping style and frequency have changed in some way, either by reducing the frequency of shopping, using Click and Collect services, or ordering online. However, the majority of participants stated that they still prefer to do their grocery shopping in-

store. Therefore, further research needs to examine more closely the effects of the pandemic (COVID-19) on shopping behaviour and frequency.

7.4.3 Product search strategies for the participants

Participants generally use similar product search strategies, regardless of the product types *'routine/new, main/extra'*. Table 7-2 shows the overall results when the participants were asked how often they use these strategies. However, there is a slight difference in the search priority based on the product type. In terms of searching for a new product, participants prefer to start with the signage to find out where the product is and use them as a guide to anticipate where the product they need is. As for a routine product, participants stated they start by looking around because they expect it is still in the same area and have an expectation of how the product will look. Table 7-3 shows the mean for the participants' search priority of the new product, and Table 7-4 shows the mean for the routine product.

Table 7-2 Overall product search strategies for the participants

How often do you	Mean
Look around	6.43
Use signage as a guide	6
Ask staff	6
Search online before going to the store	1.86
Ask a customer	1.57

Table 7-3 Product search strategies for the participants based on new products

How often do you	Mean
Use signage as a guide	6.5
Ask staff	6.5
Look around	6.25
Search online before going to the store	1.25
Ask a customer	1

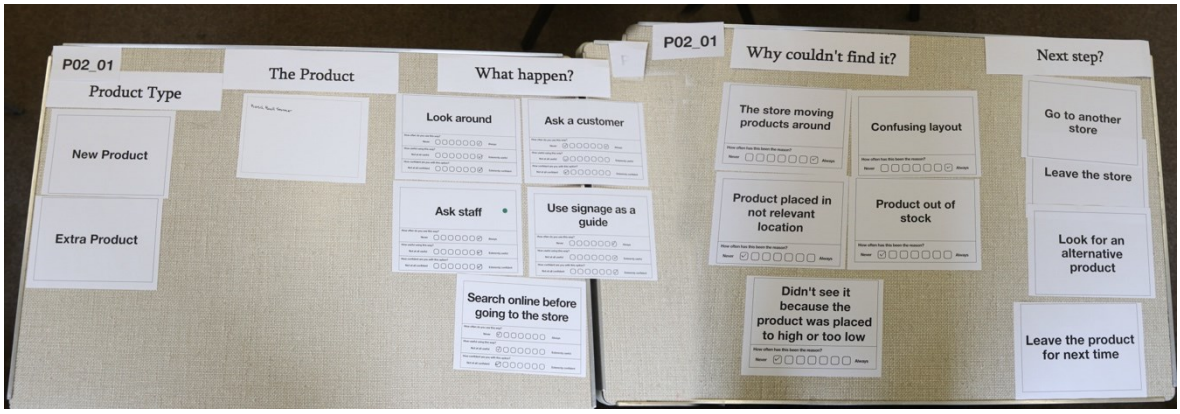
Table 7-4 Product search strategies for the participants based on routine products

How often do you	Mean
Look around	6.67
Use signage as a guide	5.33
Ask staff	5.33
Search online before going to the store	2.67

Ask a customer	2.33

Regarding the signage, the participants mentioned that there are problems related to the signage such that they are often generic and do not include everything. At the same time, some participants like P2.2, P2.3, P2.4, P2.5 and P2.7 think that it is difficult to write all products on the signage because they do not have enough space or might be confusing for customers with so much signage. Also, participant P2.2 mentioned that the signage is not clear even when she is wearing her glasses. In addition, some products are considered ambiguous, and each supermarket has a different logic in determining which category these products fall into, such as icing sugar, honey, or evaporated milk.

Figure 7-2 A participant sorting the cards based on their previous grocery shopping experience



Participants clarified that they often do not search online before going to the store because they assume the products will be there. However, there are two main issues with regard to online search, the first is that some participants such as P2.3, P2.6, and P2.7 consider it a waste of time and takes more effort. The second is that there is some doubt about the credibility of the results and their lack of clarity if the results are in their main store or elsewhere. Concerning asking customers, participants such as P2.1, P2.3, and P2.4 think they know the shop more than other customers, and some do not want to disturb customers.

It was observed that there is a strong positive correlation between the perceived usefulness of all the search strategies and confidence in using them, except for *'asking staff'*. This is in line with what was mentioned in Chapter 5 regarding staff availability issues. In addition to what participants P2.2 and P2.6 mentioned, they do not want to bother or interrupt staff during their work and feel embarrassed about it.

7.4.4 The reasons participants could not find the product

In terms of why participants could not find the product, Table 7-5 shows the results of the card sorting analysis. It is apparent from this table that the main reason is that the store moves products around with a mean of 4.86. These results confirm the findings of the previous study mentioned in Chapter 6, Section 6.4.6.3. Participant P2.1 mentioned that supermarkets move products around because they want you to look at different things, which increases their sales but not for better experiences. Also, it was noted that this issue often occurs during festive seasons such as Christmas, as was evident in the experience of participants P2.2, P2.3, P2.4, and P2.6. A confusing layout followed this with a mean of 4.14. Product out of stock was considered as the third reason. Interestingly, participant P2.6 mentioned that this issue has become quite frequent lately. This was followed by the participants did not see the product because the product was placed too high or too low, especially for people with some health issues like back pain, as mentioned by participant P2.5. Lastly, is the product placed in a not relevant location with a mean of 3.14.

Table 7-5 Main reasons the participants could not find the product

Why could not find the product?	Mean
The store moving products around	4.86
Confusing layout	4.14
Product out of stock	3.71
Did not see it because the product was placed too high or too low	3.29
Product placed in not relevant location	3.14

There is a slight difference in the results if they are divided based on the type of new or routine product, as shown in Table 7-6 and Table 7-7. The initial expectation of routine products is that they are out of stock with a mean of 4.33, and the store is moving products around for the new product with a mean of 5.5.

Table 7-6 The reasons participants could not find the product for new products

Why could not find the product?	Mean
The store moving products around	5.5
Confusing layout	4.75
Product out of stock	3.25
Product placed in not relevant location	3
Did not see it because the product was placed too high or too low	2.75

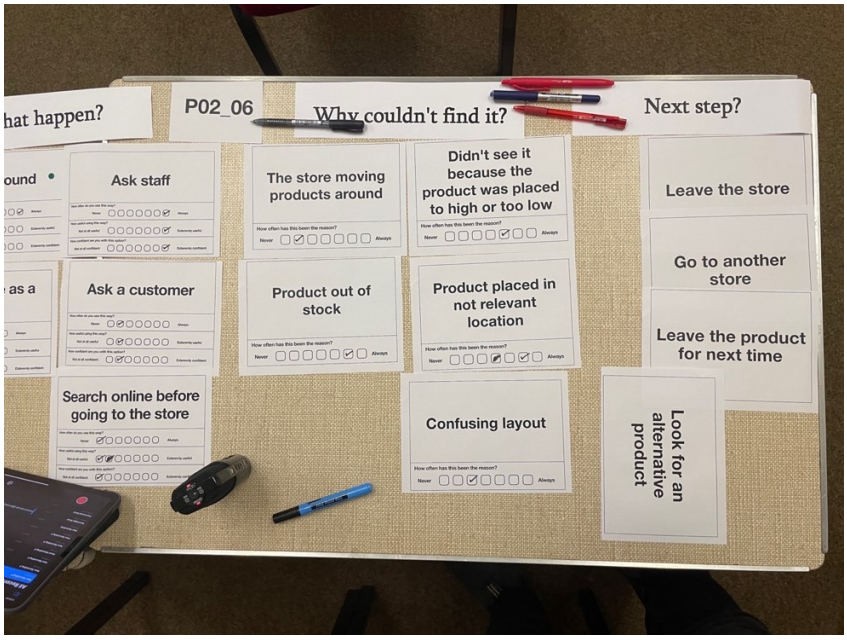
Table 7-7 The reasons participants could not find the product for routine products

Why could not find the product?	Mean
Product out of stock	4.33
The store moving products around	4
Did not see it because the product was placed too high or too low	4
Confusing layout	3.33
Product placed in not relevant location	3.33

7.4.5 The steps participants do if they could not find the product

Regarding what the participants generally do next if they cannot find the product are as follows *leave the store, look for an alternative*, *go to another store*, and *leave the product for the next time*. However, some factors may affect this sorting, such as the importance of this product and the need for it. For example, if the product is essential to a dish that will be cooked on the same day, the participants will look for an alternative or go to another store. Figure 7-3 shows some of the card sorting activities.

Figure 7-3 Part of the card sorting activities



7.4.6 The level of technology use

It is crucial to know the level of technology and the smart devices the participants use because this study aims to investigate aged 65+ customers' grocery shopping experience and provide design insights to improve supermarket service via emerging technologies. Therefore, this study found that all participants have smartphones and use them on a daily basis. In addition to other electronic devices such as laptops, tablets, smartwatches, smart TVs, and voice assistants such as Google Nest, Amazon Alexa, and Apple Siri. Four participants use several devices and apps in relation to health, such as tracking the number of steps and sleep level, and some health information related to eating and shopping, such as the Slimming World and NHS COVID-19 app. All participants use one of the types of social media platforms such as WhatsApp, Facebook, Instagram, or FaceTime to be in contact with family members, friends, work, or some social events. These findings support the direction of this research by providing design insights via emerging technologies to improve supermarket service regarding the main pain point. They are consistent with the findings mentioned in Section 6.4.5, which helped the discussion in Section 8.4.

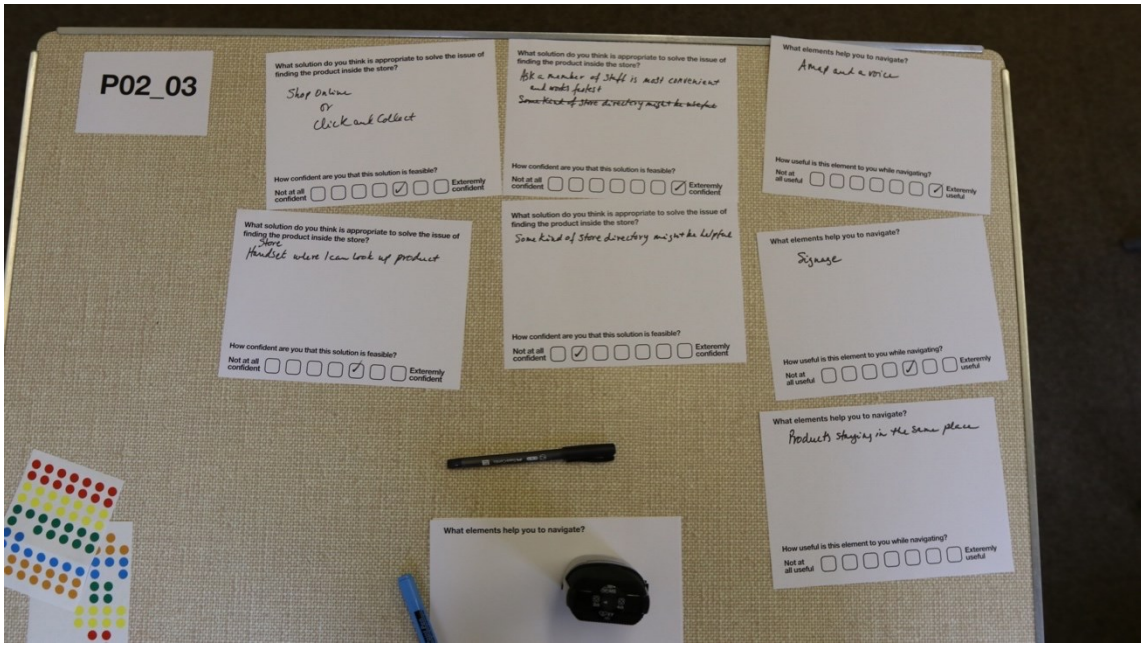
In terms of grocery shopping, more than half of the participants used the handset or self-checkout at their main grocery store. Some participants use supermarket apps for several reasons, one of which is to compare prices and then go to the store to buy it, like participant P2.2, or to check about the product availability at their store, such as participant P2.4 especially when she needs a large amount of a particular product. It was observed that participants are willing to use technology in their grocery shopping if it can add clear value and benefit to their shopping. In addition, if it is easy to learn and use, or if there is someone to help them with it, as participant P2.3 mentioned that she was convinced and learned to use the handset from a friend. Participant P2.5 mentioned that the staff in his main grocery store persuaded and explained how to use it. However, participants are still concerned about using the technology in several aspects, including security, such as putting their bank details or tracking personal data and privacy. More importantly, participants such as P2.3 mentioned that supermarkets use data for their own interests and not for the benefit of customers. In addition to the fear that technology may take over some people jobs.

7.4.7 Elements that help participants to navigate

This thesis set out to investigate aged 65+ customers' grocery shopping experience in the UK to identify the main pain point and provide design insights to improve supermarket service via emerging technologies. In addition to what was clear from the results of study 3 - Chapter 6, Section 6.4.6.3 that the problem is around the availability and location of the product. Therefore,

it is crucial to understand how the target group of this thesis prefer to navigate and what the elements that help them. Therefore, participants were asked about the elements that help them to navigate and their usefulness in the card sorting activities. Figure 7-4 shows a part of the card sorting activities concerning the navigation elements.

Figure 7-4 A participant writing some elements that help to navigation during the card sorting activity



As a result of the card sorting activities, it was found that these elements help the participants to navigate, and they are as follows: signage, landmarks, voice assistant, street names, sun and shadow, sat nav, Google maps, Apple maps, and viewing the entire map before starting to navigate. However, the participants mentioned that they have an issue with the navigation application, including sat nav, Google maps, and Apple maps. They may choose the longest or unfavourable route. Hence, most participants use a road map book such as Road Atlas, as shown in Figure 7-5.

Figure 7-5 A participant explaining how she uses the road map book for navigation

As for the navigation inside the supermarket, the participants mentioned that these items often help them navigate, as follows: signage inside and outside the aisles, signage with a picture, and features at the end of an aisle or notable product.

7.4.8 Participants' suggestions for appropriate solutions

Since the aim of this thesis is to provide design insights to improve supermarket service for customers aged 65+ in the UK via emerging technologies. Participants were asked what they thought would be appropriate to solve the product availability and location issue to gain inspiration and an understanding of the target group's expectations. Accordingly, the participants' solutions can be divided into two categories, tech and non-tech solutions.

Starting with non-tech solutions, participants suggested that supermarkets should provide a large map at the entrance showing products and aisles number relevant—moreover, a helpful store directory. Another solution is that the store should put a sign on the old shelf to show where the product is now. Lastly, participants proposed that supermarkets should increase the number of staff around the store and provide a personal shopping service. This can be explored more in future studies if it will be feasible for the supermarket from a business perspective.

Turning now to the tech solutions, the first idea is to provide screens inside the store to search for a product. However, participant P2.4 mentioned that this idea is good but may not be practical because there may be many people will be waiting to use it. Another concept that may support this idea is providing a product search option through the shopping handset. Furthermore, providing a voice assistant such as Google Assistant or Apple Siri to be on the shopping trolley or the handset. Another idea is to use lights on the shelves to indicate the product's location to the customer, in addition to a sound or vibration on the shopping trolley or the handset that increases when the customer comes closer to the product. Participant P2.7 suggested the idea of a navigation app inside the supermarket, similar to Google Maps, and could use the camera to guide the customer inside the store. However, some participants stated they have issues with the navigation apps, which often give a longer or unwanted route. Hence, it is helpful to consider this when developing a solution using this idea. It would be great to offer several suggestions and clarify the most appropriate route and why. The main items that participants mentioned that they would like to know when searching for a product are as follows: the availability in stock and the section or aisle number.

7.5 Conclusion

To conclude this chapter, this study was designed to deeply explore the issue related to the *'products availability and location'* identified in the previous study Chapter 6 as the main pain point for customers aged 65 and over in the UK. An in-person card sorting method was used, and seven participants aged between 69 and 84 years were recruited. The card sorting activities included three main activities: First, recall previous experiences where participants were looking for a product at their main store. Second, recall previous experiences where someone asked the participants to help find a product. finally, obtain some inspiration from participants regarding their navigation technique and what they think would be an appropriate solution to solve this issue.

As a result, it was discovered that participants' strategies for product search, in general, are as follows: firstly, looking around, secondly, using signage as a guide, then asking staff, searching online before going to the store, and finally, asking a customer. With regard to the reasons participants could not find the product, they are in this order: the store moved products around, confusing layout, the product was out of stock, and the participants did not see the product because it was placed too high or too low, and the product was placed in a not relevant location. As for recalling past experiences where someone asked for help, none of the participants could remember a situation that happened to them. Finally, regarding the appropriate solutions to solve

this problem from the participant's perspective, the solutions were divided into two categories, tech and non-tech solutions. Therefore, the next chapter will examine the most appropriate solution through literature reviews.

Chapter 8 Review and examine the current use of emerging technologies and provide design insights and recommendations

8.1 Introduction

At this stage, it is essential to identify the technologies currently used in the market to get an idea of the most appropriate technology that may help to solve the issue of in-store navigation in UK supermarkets. Accordingly, this chapter has been divided into two parts. The first part focuses on reviewing the technologies currently used in UK supermarkets that target and focus on customers' experiences. The second part examines the current emerging navigation-focused technologies that have been studied with older people. This is followed by the design insights and recommendations based on these analyses to improve supermarket service and enhance the in-store navigation for customers aged 65 and over in UK.

8.2 The current technologies in the UK supermarkets

Supermarkets in the UK use various technologies that help them in several aspects, such as administrative matters, stock management, and technologies to improve customer experience. For the scope of this thesis, this section will only review in-store technologies provided by supermarkets that customers use or directly affect their experience to understand the technological status of the market in the UK and how to provide design insights that fits the market. This review is divided according to the type and purpose of technologies used.

8.2.1 Using the handset or mobile apps to scan and bag

The supermarkets in the UK that have adopted handset or mobile apps to scan and pay technologies have taken different approaches to implement it, which can be listed as follows:

8.2.1.1 Sainsbury’s SmartShop

Sainsbury's offers this technology to its customers through the handset or SmartShop mobile app (Sainsbury’s, 2023). For the mobile app, the customer needs to download the app through the app store (App Store or Google Play). After registering with the loyalty card (Nectar card), the customer can use the app by scanning the QR code at the store entrance. After that, the customer

can scan and bag their items as they go. At the end of shopping, the customer goes to a dedicated SmartShop checkout, then scans the QR code on the screen and pays, as shown in Figure 8-1. For the handset, the only difference is that the customer goes to the handset wall shown in Figure 8-2, and then scans the loyalty card (Nectar card); after that, one of the handsets will light up with a green light, and the customer takes the handset and starts shopping.

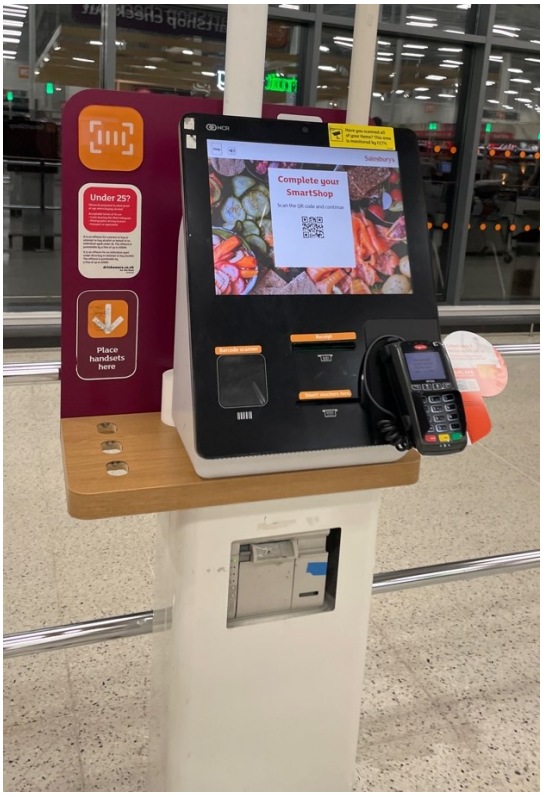


Figure 8-1 A dedicated SmartShop checkout at Sainsbury's

Figure 8-2 The handset wall at Sainsbury's

8.2.1.2 Asda Scan & Go

Asda Scan & Go can be used on a handset or mobile app (Asda, 2023). Customers can use this technology by simply registering their details through the mobile app (Scan & Go) or the screens available next to the dedicated handset wall. Next, customers can scan and bag their items as they move. When they finish shopping, customers go to a dedicated Scan & Go checkout or scan the QR code at the self-checkout area.

8.2.1.3 M&S Scan & Shop

M&S provides this technology only through the mobile app (M&S app). Customers can use the app to scan and bag their items, but with a minimum spend of 30p and a maximum of £45 (M&S, 2023). When the customers finish shopping, they can pay through the app using a registered payment method on their phone or go to the self-checkout or a dedicated Scan & Shop area and then transfer their shopping basket by scanning a QR code and then complete their transaction.

8.2.1.4 Morrisons Scan & Shop

Morrisons launched this technology as a trial for its customers through the mobile app only (Morrisons Scan & Shop). However, the trial of Scan & Shop service ended on 25/10/2021 and no longer be in use (GooglePlay, 2021).

8.2.1.5 Waitrose Quick Check

Waitrose delivers this technology to its customers through the handset or mobile app (Waitrose, 2023). For the mobile app, the customer needs to register with the app using myWaitrose card. First, the customer can start shopping by scanning the QR code at the store entrance. After that, the customer can scan the barcode on each item and pack them into their bags. At the end of shopping, the customer scans the QR code of 'End your shop' at the self-checkout area and then pays. For the handset, it is similar, but the customer needs to swipe the myWaitrose card at the Quick Check rack to get a handset.

8.2.1.6 Tesco Scan As You Shop

Tesco provides this technology only through the handset (Tesco, 2023). The customer needs to go to the designated area for handsets and scan the Clubcard; then one of the handsets will indicate green light, and the customer will take it to begin shopping. Following this, the customer can scan and bag their items as they go. When all items are scanned, the customer goes to the Scan as you Shop checkout, then scans the code at the till then pay.

8.2.2 Cashier-less or till-less technology

Some supermarkets in the UK were keen to provide an efficient, seamless and contactless shopping experience by using cashier-less technology in order to overcome the issue of queues, which was mentioned in section 4.2.4.3.2.7 and 5.4.2.2. The technologies involved in providing this experience are QR code in a mobile app, overhead cameras, deep learning technology, virtual cart and weight sensors. The UK's supermarkets adopting this technology are Amazon, Tesco, Aldi, and Sainsbury's. Amazon Fresh is Amazon's first cashier-less store, launched in March 2021 in London and has more than 20 stores to date, as shown in Figure 8-3 (AmazonFresh, 2023). Tesco trialled its first cashier-less store (GetGo) in 2019 at Welwyn Garden City headquarters, then launched its first store in October 2021, as pictured in Figure 8-4 (GetGo, 2023). Aldi and Sainsbury launched cashier-less stores Aldi SHOP&GO (ShopAndGo, 2023) and SmartShop Pick & Go (Sainsbury's, 2021) in 2021, as shown in Figure 8-5 and Figure 8-6. These supermarkets have collaborated with different technology providers such as Amazon, AiFi and Trigo.

Figure 8-3 The entrance of Amazon Fresh, where customers scan their QR barcode as they enter (HowToShop, 2023)

Figure 8-4 Customer switching to GetGo in their Tesco app and scan the QR code at the GetGo gate (GetGo, 2023)

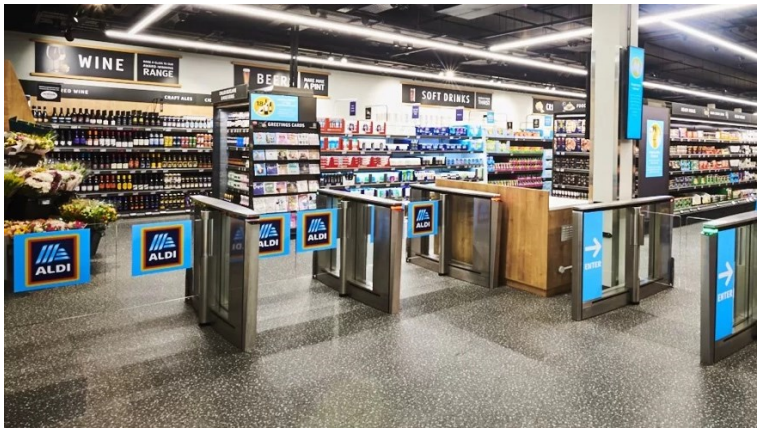


Figure 8-5 The first Aldi SHOP&GO store in Greenwich London (BBC, 2022)

Figure 8-6 SmartShop Pick & Go entrance, where customer scan the QR barcode as they enter (Sainsbury's, 2021)

8.2.3 On-shelf smart refills machine

Regarding sustainability and reducing plastic consumption and costs. Lidl becomes the first UK supermarket to introduce an on-shelf smart refill for laundry detergent. Algramo start-up designed this compact smart refill machine, shown in Figure 8-7, which increases the capacity by almost 300%, and this will be inspiring for the next generation design in this field. In addition, this service offers a lower price to customers (Moore, 2022).

Figure 8-7 Lidl on-shelf smart refill for laundry detergent (Moore, 2022)

8.2.4 Technologies introduced during the COVID-19 pandemic

During the COVID-19 pandemic, some supermarkets in the UK have implemented various technologies to improve the in-store grocery shopping experience and follow the UK's guidelines and restrictions. These technologies were divided into two parts, the first focusing on social distancing and crowd management and the second focusing on hygiene and cleaning.

8.2.4.1 Social distancing and crowd management technologies

The automated traffic light system was introduced first to the supermarkets in the UK by Aldi to manage crowds and ensure social distancing as can be seen in Figure 8-8 (Aldi Press Centre, 2020); then, it was adopted by numerous retailers such as Tesco, M&S and Co-op.

Figure 8-8 The traffic light system at Aldi entrances to control the number of shoppers in stores (Grahns, 2020)

Figure 8-9 shows Morrisons has taken a different approach by offering a quick shopping system called Speedy Shopping for customers who do small shopping 'baskets' by providing a fast shopping lane outside the stores for quick entry and a dedicated Speedy Shopper checkout area (Morrisons Corporate, 2020). The virtual queuing system has been adopted by multiple supermarkets such as Waitrose, ASDA, and Sainsbury's using Qudini or Ufirst queuing apps (Brown, 2020a, 2020b; Sainsbury's, 2020).

Figure 8-9 The queue for Morrisons Speedy Shopping (Morrisons Corporate, 2020)

8.2.4.2 Hygiene and cleaning technologies

In order to contribute to preventing the spread of COVID-19, ASDA has adopted two leading technologies. The first is autonomous cleaning robots using Tennant Company's robots to roam stores during opening hours. The robots can sense if something is blocking their way and stop or move around, allowing them to operate autonomously using Brain Corps' artificial intelligence software (Stevens, 2020). The second is a trolley wash, as shown in Figure 8-10, which was developed by The WasteCare Group. The trolley wash facility helps customers to shop safely by coating the trolleys with microparticles containing an antimicrobial solution which eliminates 99.99% of all known bacteria and takes 10 to 15 seconds (ASDA Corporate, 2020).

Figure 8-10 ASDA trolley wash facility (ASDA Corporate, 2020)

8.2.5 Loyalty app

Since customer loyalty is important to the supermarket, most supermarkets in the UK were keen to provide it electronically through mobile apps for customers to collect points and obtain prizes or coupons. Supermarkets that have apps are as follows: Waitrose (*myWaitrose*), M&S (*Sparks*), Sainsbury's (*Nectar*), Tesco (*Clubcard*), ASDA (*ASDA Rewards*), Morrisons (*My Morrisons*), The Co-operative (*Co-op: Membership Rewards*), Lidl (*Lidl Plus*), and Iceland (*Iceland Bonus Card*).

8.2.6 Summary of the current technologies in the UK supermarkets

Overall, Table 8-1 presents a summary of the current technologies used in UK supermarkets. This summary will help discuss the most appropriate technology solutions to improve supermarket service and enhance the grocery shopping experience of customers aged 65 and over in the UK in the upcoming sections.

Table 8-1 The current technologies used in UK supermarkets.

Supermarket	Scan and bag as you go	Cashier-less technology	Loyalty app
Waitrose	Handset, Mobile app	----------	myWaitrose
Marks & Spencer	Mobile app	----------	Sparks
Sainsbury's	Handset, Mobile app	Launched in 2021	Nectar
Tesco	Handset	Launched in 2021	Clubcard
Asda	Handset, Mobile app	----------	ASDA Rewards
Morrisons	Mobile app	----------	My Morrisons
The Co-operative	----------	----------	Membership Rewards
Aldi	----------	Launched in 2021	----------
Lidl	----------	----------	Lidl Plus
Iceland	----------	----------	Iceland Bonus Card
Amazon	----------	Launched in 2021	----------

8.3 The current emerging navigation-focused technologies

Having reviewed current technologies in UK supermarkets in the previous section 8.2, this section will examine the current emerging navigation-focused technologies that have been tested with older people to understand their effectiveness. Since technologies are evolving rapidly, the review primarily focused on the journal papers published during the past five years to gain an approximate view of the current technologies' status and maturity. Also, the EPI Cube, which has been discussed in Section 2.4.1 is used to guide the selection of the most appropriate technology for improving navigation inside the supermarket in the UK for customers aged 65 and over.

8.3.1 Personal Navigation Assistant (PNA)

From the literature, using mobile apps is one of the most popular approaches for Personal Navigation Assistant (PNA). Two projects included in this review are *'ALMA: An Indoor Localization and Navigation System for the Elderly*' (Comai *et al.*, 2018) and *'Indoor and Outdoor Navigation for Increasing Independence (ION4II)*' (Sili, Gira and Mayer, 2017). Portable wireless devices such as

smartphones and tablets were used as a core part of both projects. The goal of the applications on users' portable devices is to enable users to reach their destination through complex spaces easily. Both applications are tailored to the user's requirements and provide an easy-to-use and user-friendly interface; Figure 8-11 shows the ALMA system app, and Figure 8-12 shows the User Interface (UI) in Sili et al.(2017) project.

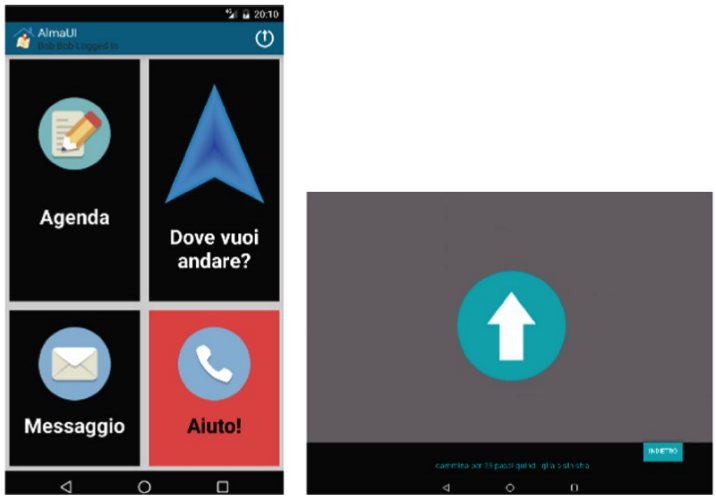


Figure 8-11 The UI of ALMA app

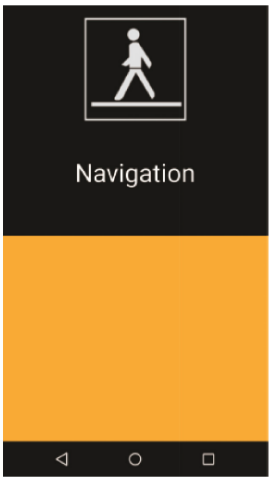


Figure 8-12 The UI of Sili et al.(2017) app

Multimodality input and output methods were used, such as touch or voice. Users can receive the navigation information in text, images, or voice to avoid their focus on the screen. Also, the system takes into account possible deviations that may occur during the user's navigation. Also, it is important to mention that both projects included participants who had never used smartphones and tablets, and the results for both projects and navigation were positive. The level of technological embodiment is low since both systems use portable external devices. Regarding behavioural interactivity, both systems fall in the middle to the lowest because users have

limitations in manipulating the environment. In terms of perceptual presence, it is considered low because when using the device, the user feels that they are “being here”.

8.3.2 Augmented Reality

Augmented Reality (AR) is illustrated by virtual elements that are superimposed on the user's real environment (Flavián, Ibáñez-Sánchez and Orús, 2019). Due to age-imposed declines in working memory capacity, AR may be especially valuable in the context of this research because it helps reduce cognitive load. There are three pieces of research in this field that are included in this analysis and will be described as follows. Peleg-Adler et al.(2018)'s research focuses on comparing the performance of the public transportation route planning task between the older and the younger participants using mobile applications, one using AR interface and the other non-AR. Ortakci et al.(2016) developed a real-time intelligent indoor navigation mobile application for fire evacuation through vocally visual elements based on the user's physical characteristics and the building conditions. Montuwy et al.(2018)'s research focuses on outdoor navigation performance using either AR glasses or bone conduction headsets. In Peleg-Adler et al.(2018)'s project, older participants declared on average better user experience using the AR interface shown in Figure 8-13, and they preferred the AR interface over the non-AR application. Also, the system in Ortakci et al.(2016) 's project was able to evacuate the older participant from the building without suffering any harm, Figure 8-14 shows screenshots of the AR navigation app.

Figure 8-13 The AR app in Peleg-Adler et al.(2018) project

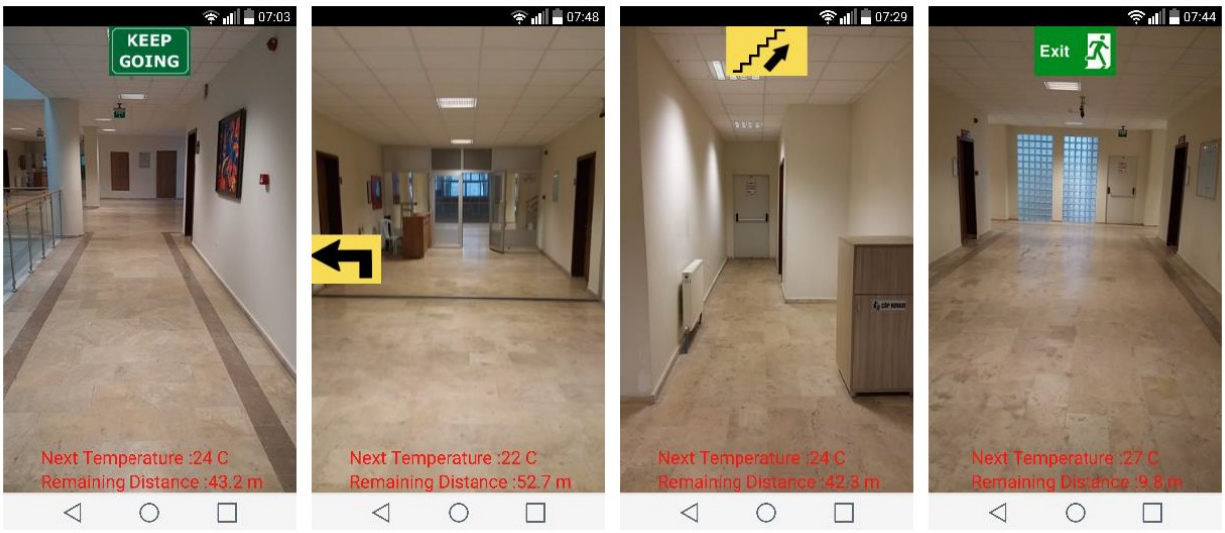


Figure 8-14 Screenshots of the mobile navigation app in Ortakci et al.(2016) project

Furthermore, in (Montuwy, Cahour and Dommes, 2018)'s project, there was no significant difference in travel time between the AR glasses and bone conduction headsets. However, the bone conduction headset provided a better navigation experience as it required less attention sharing, as presented in Figure 8-15. The psychological factor of the bone conduction headset device was critical since the old participants were familiar with it compared to the AR glasses, which made some participants feel ridiculous, as shown in Figure 8-16. (Peleg-Adler, Lanir and Korman, 2018) and (Ortakci *et al.*, 2016)'s project uses mobile phones, and (Montuwy, Cahour and Dommes, 2018)'s project uses AR glasses and bone conduction headsets, so the level of technological embodiment is low to high. Concerning behavioural interactivity, all projects fall in the middle to the lowest because users have limitations in manipulating the environment. Also, the users in all these projects feel that they are “being here”, so the perceptual presence is considered low.

Figure 8-15 Bone conduction headset in (Montuwy, Cahour and Dommes, 2018)'s project

Figure 8-16 AR glasses in (Montuwy, Cahour and Dommes, 2018)'s project

8.3.3 Virtual Reality

Virtual Reality (VR) provides an immersive sensory experience by letting users navigate and interact with a computer-generated environment (Flavián, Ibáñez-Sánchez and Orús, 2019). Two papers examined VR navigation with older adults that are included in this review. The first paper is aimed to evaluate the feasibility of an immersive VR platform for assessing spatial navigation memory in older people (Ijaz *et al.*, 2019). The second paper conducted a navigational task to determine the participant's navigation ability, focusing on three areas, namely judgment of direction, distance, and topographical orientation (Bayahya, Alhalabi and Alamri, 2022). Based on Ijaz et al. (2019)'s study, the results showed that participants in VR were more engaged with a higher level of presence, made less navigational mistakes and performed higher landmark recall scores compared to participants who used a Standard Personal Computer (SPC) setup, the VR system presented in Figure 8-17. In addition, (Bayahya, Alhalabi and Alamri, 2022) study discovered that the VR system, shown in Figure 8-18 combined with the machine learning system achieved better accuracy compared to the traditional clinical diagnosis method. The level of technological embodiment is high since it uses internal devices. Concerning behavioural interactivity, both systems fall into a high level of interactivity since the users can manipulate the environment. In terms of perceptual presence, it is considered high because when using the system, the user feels being “elsewhere”.

Figure 8-17 (left) the VR system Platform and (right) virtual environment interface (Ijaz *et al.*, 2019)

Figure 8-18 The VR system where the navigation task took place (Bayahya, Alhalabi and Alamri, 2022)

8.3.4 Wearable devices

Wearable devices have found many applications in several fields due to their future potential. Regarding the scope of this thesis, two systems included in this examination are '*A wearable system for path finding to assist elderly people in an indoor environment*' (Jahan *et al.*, 2019) which focuses on indoor navigation and '*Non-intrusive, visual-less wearable haptic stimuli navigational assistance for elderly with dementia*' (Cm *et al.*, 2020) which focuses on outdoor navigation. Both systems are worn in the abdominal area, as shown in Figure 8-19. (Jahan *et al.*, 2019)'s system provides navigation by voice and allows calling a human assistant for help when needed. (Cm *et al.*, 2020)'s solution delivers navigation using haptic rather than audio or visual signals. The results of both systems are encouraging and have achieved high overall satisfaction from the participants due to their effectiveness and efficiency in navigation. The level of technological embodiment is medium since both systems are wearable devices. Behavioural interactivity in both systems is low because users have no manipulation of the environment. In terms of perceptual presence, it is considered low because when using the device, the user feels that they are "being here".

Figure 8-19 The wearable device in (Jahan *et al.*, 2019) project

8.3.5 Self-driving wheelchair

The use of a self-driving wheelchair for the elderly and those with different abilities has been tested for indoor navigation. Self-E, which Megalingam et al(2021) proposed, is a self-driving wheelchair developed as an autonomous indoor navigation system with an integrated 2D LiDAR sensor, as illustrated in Figure 8-20. The Self-E can be controlled by the user using a smart phone or a tablet with an Android app. The users can choose different modes for the Self-E based on their needs, which are manual, fixed, and automatic. The Self-E in (Megalingam *et al.*, 2021)'s study were tested with different types of users, including three ages 57, 62 and 76 years. As a result of this study, Self-E was able to reach the required destination through hands-free navigation, which led to a comfortable experience that helped the participants to do other tasks such as reading, drinking, and others. Therefore, Self-E has a high overall satisfaction among these participants, and they would recommend it to other users. The level of technological embodiment is low because the Self-E is an external device. Since users have no manipulation of the environment, the behavioural interactivity is low. Regarding the perceptual presence, it is viewed as low because when using the Self-E, the users feel that they are “being here”.

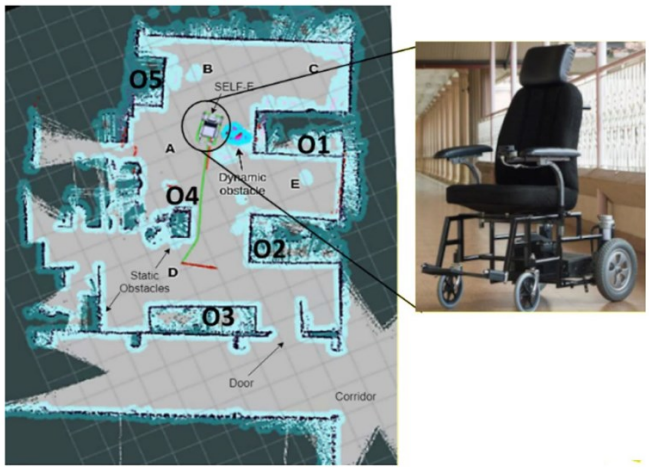


Figure 8-20 (left) The map of the lab room was created using the LiDAR sensor (right) the Self-E inside the lab (Megalingam *et al.*, 2021)

8.3.6 Summary of the current emerging navigation-focused technologies

To conclude, Table 8-2 summarises the current emerging navigation-focused technologies, which will be a starting point in identifying the appropriate technology proposed to improve supermarket service and help with the in-store navigation issue in UK supermarkets. These

technologies were analysed in more depth on three factors using the EPI Cube, which was explained in Section 2.4.1, the factors are as follows the level of technological embodiment, behavioural interactivity, and perceptual presence. The technological embodiment refers to integrating technological devices into the human body. It is divided into different ranges: First, low or no embodiment, primarily external devices, such as computers or smartphones, etc. The second is the high embodiment, mostly internal devices or have a higher degree of contact with the senses, such as wearable devices (AR and VR headsets) or implanted devices (smart contact lenses or microchips). Figure 8-21 shows the analysis of the current emerging navigation-focused technologies based on the technological embodiment.

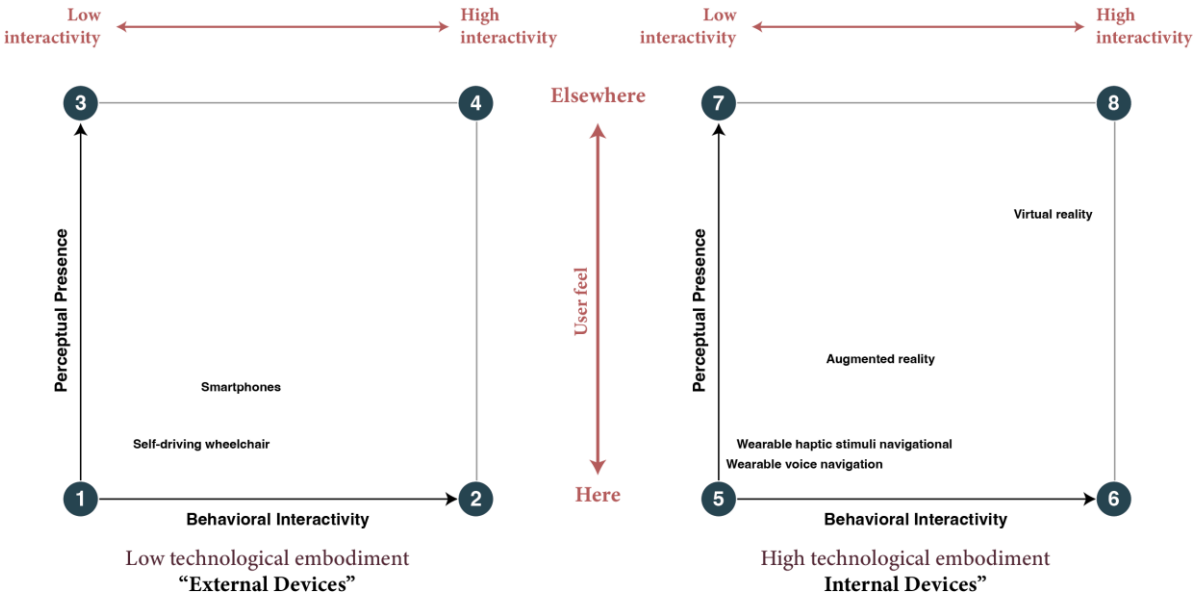


Figure 8-21 The analysis of the current emerging navigation-focused technologies based on the technological embodiment.

Behavioural interactivity is defined as the user's ability to control and modify the environment in front of them, and each device offers different levels of interactivity. Therefore, behavioural interactivity ranges from low behavioural interactivity to high interactivity (manipulating the environment). The analysis of the current emerging navigation-focused technologies based on behavioural interactivity is presented in Figure 8-22.

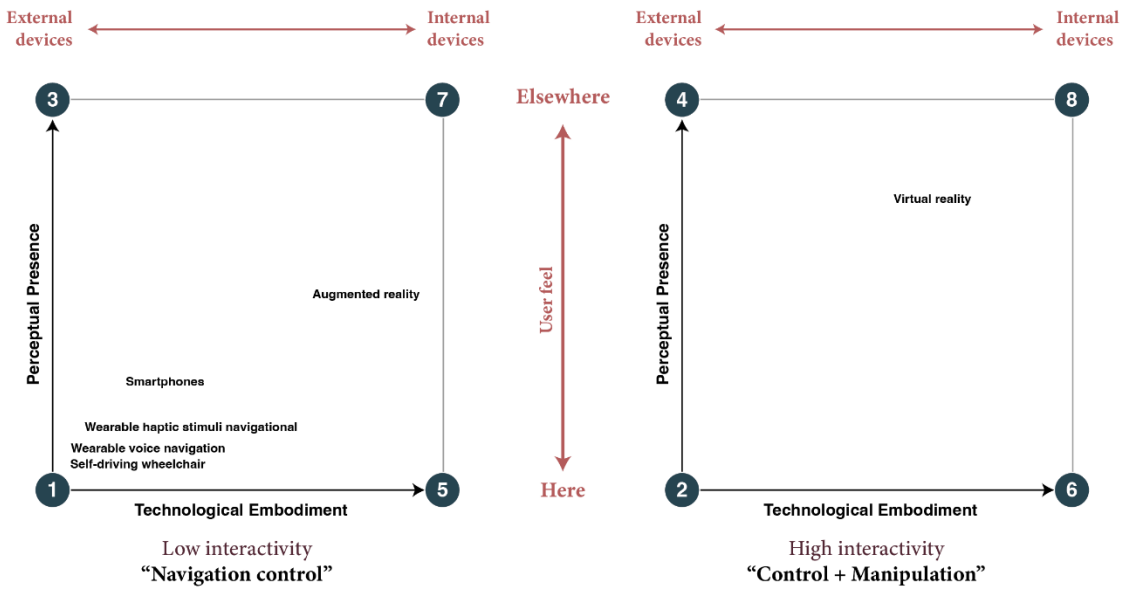


Figure 8-22 The analysis of the current emerging navigation-focused technologies based on behavioural interactivity.

Perceptual presence refers to the user's sense of being in the actual location or feeling elsewhere. Figure 8-23 provides the analysis of the current emerging navigation-focused technologies based on perceptual presence. As noticed, most of the technologies that focus on indoor navigation and target the elderly are about a low or medium level in the level of technological embodiment. Regarding behavioural interactivity and perceptual presence, most of these technologies fall into the low level (low interactivity) and (feel being here).

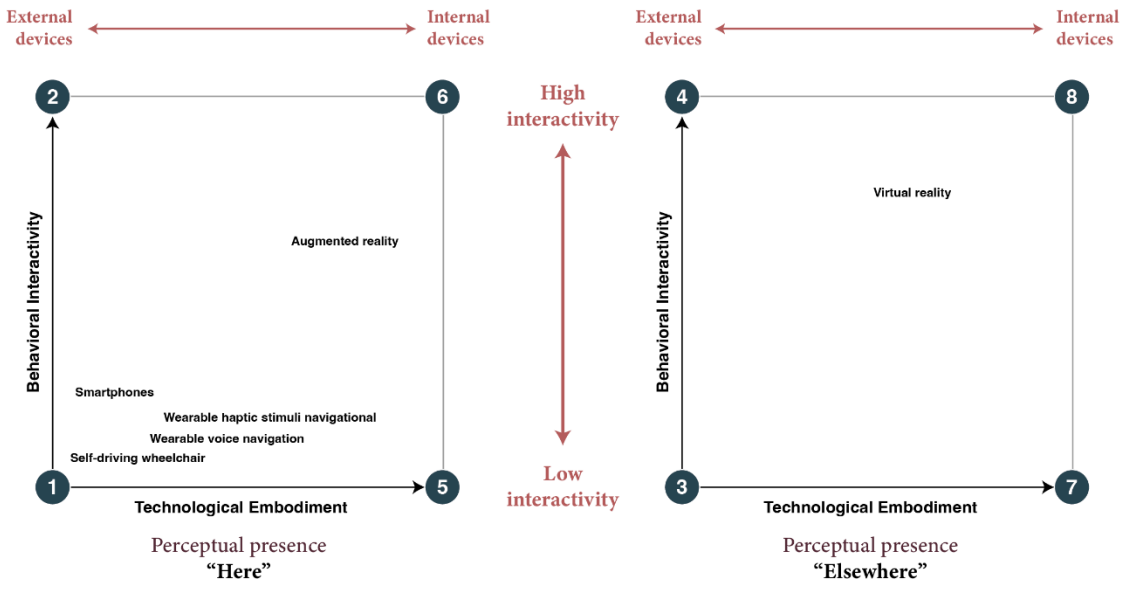


Figure 8-23 The analysis of the current emerging navigation-focused technologies based on perceptual presence.

Table 8-2 The current emerging navigation-focused technologies

Paper title	**Participants**	**Technologies used**	**Results**
ALMA: An Indoor Localization and Navigation System for the Elderly	**5 participants** 4 Females 1 Males In average 86.3 years old	* Portable wireless device(Smartphone) * low-cost/low-power Radio Frequency (RF) emitters * Video-based monitoring	The results of this study are promising for using the PNA as a navigation aid based on the beliefs of participants as well as the staff of the care facility.
Usability Matters, User Experiences of Visually Impaired Older Adults	**12 participants** 7 males 5 females Mean age of 68.67 years	* Portable wireless device(Smartphone) * ownCloud * iBeacon	Two third of the participants could use the application. The main issue was with blind participants because they require tactile feedback to be able to recognise interactive items on the phone screen.
The effects of aging on the use of handheld augmented reality in a route planning task	**22 participants** 13 females 9 males The mean is 69.6 years	* Smartphone * Augmented Reality	Older participants reported a better user experience using the AR interface and preferred the AR interface over the non-AR application.
Intelligent Mobile Indoor Navigation System for Fire Evacuation Based on Artificial Neural Network	**3 participants** one of them is a female aged 61 years	* Smartphone * Radio-Frequency Identification (RFID) * Artificial Neural Network (ANN)	The system was able to evacuate all participants from the building based on their physical characteristics without suffering any harm.

		* Sensor network capable of detecting fire * Augmented Reality	
Older Pedestrians Navigating With AR Glasses and Bone Conduction Headse	**18 participants** 10 males 8 females The mean is 68.7 years	* AR glasses * Bone conduction headset * Mobile app * Bluetooth	There was no significant difference in travel time between the bone conduction headset and AR glasses. However, the bone conduction headset provided a better navigation experience as it required less attention sharing as well as the psychological factor of this device being familiar compared to the AR glasses, which made some participants feel ridiculous.
An Immersive Virtual Reality Platform for Assessing Spatial Navigation Memory in Predementia Screening: Feasibility and Usability Study	**42 participants** The mean age is 73.22 years	* VR-CogAssess Platform * Oculus Rift head-mounted display * Joystick * Standard Personal Computer (SPC) setup	Participants in VR were more engaged with a higher level of presence, made less navigational mistakes and performed higher landmark recall scores.
Older Adults Get Lost in Virtual Reality: Visuospatial Disorder Detection in Dementia Using a Voting	**115 participants** aged higher than 50 years	* VR headset * VR controller * 3D virtual environment platform * Machine Learning Algorithms	VR system combined with the machine learning system achieved better accuracy compared to the traditional clinical diagnosis method.

Approach Based on Machine Learning Algorithms			
Non-intrusive, visual-less wearable haptic stimuli navigational assistance for elderly with dementia	**10 participants** 7 females 3 males age from 74 to 81years	* Arduino * GPS receiver * Secure Digital (SD) card module * Mini vibration motors	The results of this system were encouraging because it reduced navigation time and errors.
A Wearable System for Path Finding to Assist Elderly People in an Indoor Environment	**12 participants** 8 males 4 females	* Arduino * Infrared module * GSM module * Speaker * Keypad	The participants were pleased with the system's effectiveness and efficiency, and their overall satisfaction was high.
Self-E: a self-driving wheelchair for elders and physically challenged	**8 participants** 3 of them (57, 62, 76) years old	* Self-driving wheelchair * Tablet with an Android app * 2D LiDAR sensor	The Self-driving wheelchair reached the destinations intended by the participants, and overall satisfaction was high, and they would recommend it to other users.

8.4 Design insights and recommendations

This thesis aims to investigate aged 65+ customers' grocery shopping experience in the UK to identify the main pain point and provide design insights to improve supermarket service via emerging technologies. One of the most important ways to improve customers' experience and satisfaction is by resolving their pain points, as discussed in Section 6.4.3. Thus, in this thesis navigating in-store to find a product has been identified as the main pain point for customers over 65 in the UK, as explained in Section 4.2.4.3.2.3, 5.4.2.2, 6.4.6.3, and 7.4.4.

It is essential to understand the target customers' characteristics, goals, and technology level to choose the right technology to support them in navigating in-store. Thus, a persona was used as a starting point for selecting the appropriate technology and providing design insights, as explained in Section 2.2.1. Figure 8-24 shows the persona called Linda, that represents the target group in this thesis; it is female and lives alone because they are the majority of the participants in this study, in addition to what was mentioned in Section 5.4.1 regarding the importance of shopping for females compared to males (Mortimer and Clarke, 2011); also, the age is 72 years because it is the average age of the participants. Regarding the type of supermarket, it is a medium-cost supermarket since more than 65% of the participants shop there. In terms of her level of technology, she has a mobile phone and uses it regularly, in addition to using the handset while shopping at her supermarket. Her main pain point is in-store navigating and finding some products, especially during festive seasons, as mentioned in Section 7.4.4. In addition, she faces some other difficulties, such as: reading products label, knowing what products are under each signage, cannot compare prices between products easily due to the unclarity of the price tags, and lastly, the lack of sustainability information of the products.

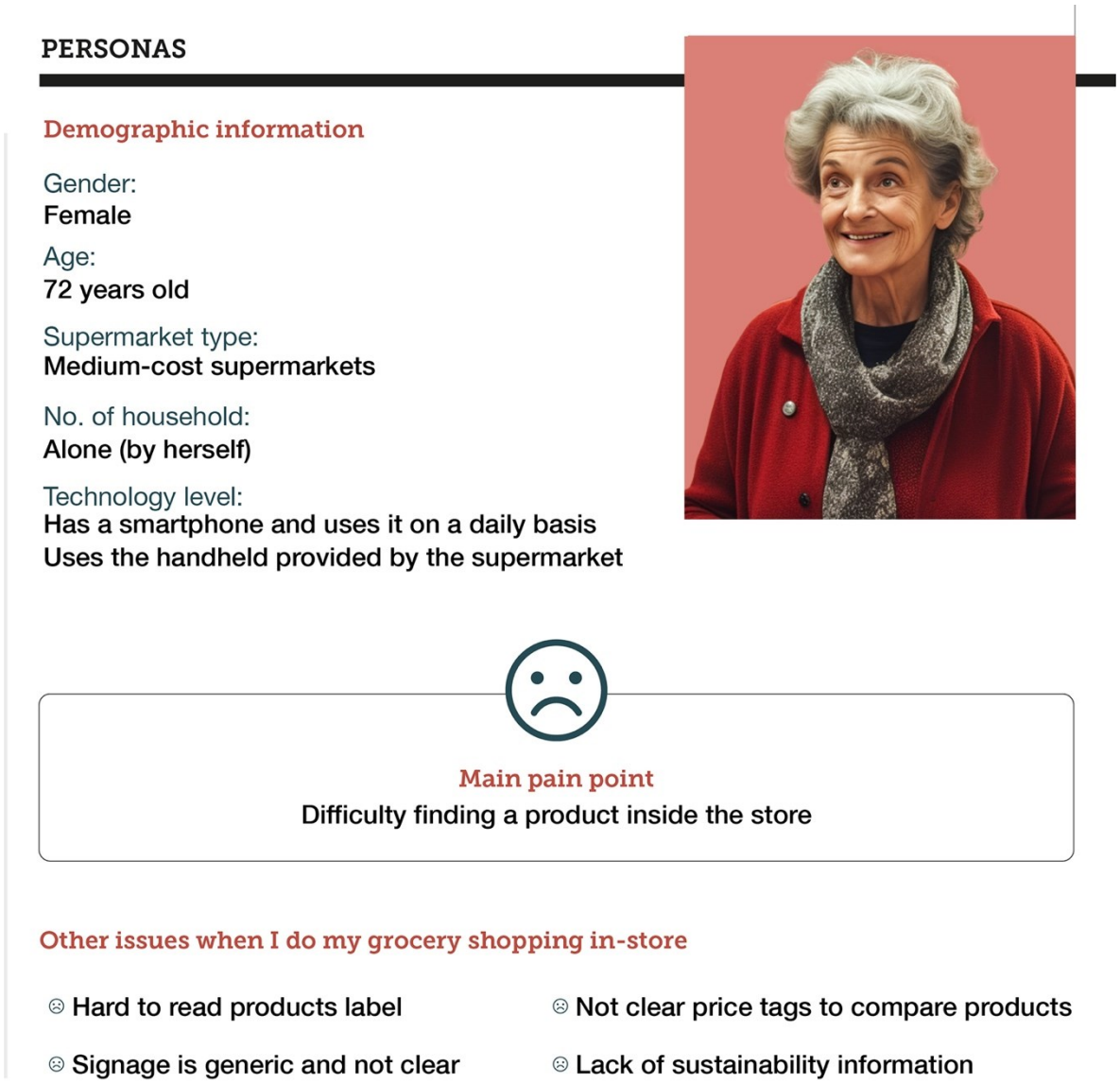


Figure 8-24 Persona represents the target user for this thesis

After understanding the target group and its characteristics, it is essential to mention that most participants expressed that they expect technology to help solve the navigation issue, as discussed in Section 7.4.8.

The retail landscape has seen a major transformation with the integration of digital technologies and their important role in improving customer services and experiences, as discussed in Section 1.4. This justifies adopting emerging technology as an essential trajectory for retailers' investment in the customer experience. The technologies available in today's market that are navigation-focused are those previously discussed in Section 8.3, which include smartphones, augmented and virtual reality, self-driving wheelchairs, wearable haptic stimuli navigational, and wearable voice navigation.

Augmented reality (AR) stands out as a key player in shaping the future of customer engagement among the technologies mentioned in Section 8.3 because it can be built within available devices

and supermarket apps. In the context of retail specifically, augmented reality has reshaped the ways retailers interact and create value for customers (Rejeb, Rejeb and Treiblmaier, 2023). Also, AR is transforming the retail experience by providing unique experiences, adding flexibility and convenience to the shopping process, and redistributing control over touchpoints in the customer journey (Henningsson *et al.*, 2020; Perannagari and Chakrabarti, 2020; Vaidyanathan and Henningsson, 2023). Notably, retailers could implement financially viable AR experiences by engaging consumers with an augmented shopping experience (Chen *et al.*, 2022). AR holds significant potential and effectiveness for enhancing both in-store and online shopping experiences via interactive features and supporting the mental intangibility of customers (Riar *et al.*, 2021). Chylinski et al.(2020)'s study indicated that different types of AR experiences can be valuable to customers and offer a different approach than current marketing approaches. In addition, Vaidyanathan and Henningsson(2023)'s study demonstrated customers' desire to use augmented reality and its potential to increase sales in retail. More importantly, technological innovation is necessary to create a novel and personalised shopping experience for customers so that retailers can stay in the current market (Chiu *et al.*, 2021).

The findings of (Romano, Sands and Pallant, 2021)'s study indicated that AR enhances and assists the customer in the pre-, during, and after-purchase stages. The expected benefits of a successful AR strategy for retailers include increased average sales, higher inventory turnover, and lower customer returns (Berman and Pollack, 2021), higher user satisfaction (Poushneh and Vasquez-Parraga, 2017; McLean and Wilson, 2019; Chiu et al., 2021; Xue, Parker and Hart, 2023), improve the customer-brand relationship and engagement (McLean and Wilson, 2019; Cuomo et al., 2020; Nikhashemi et al., 2021; Rejeb, Rejeb and Treiblmaier, 2023). However, there are concerns from customers that must be taken into account, which relate to privacy concerns of their personal information and media irritation (Poushneh, 2018; Lavoye, Mero and Tarkiainen, 2021).

Accordingly, moving on now to consider the most appropriate way to use AR technology in UK supermarkets in accordance with the target group, it is evident that almost all supermarkets have mobile applications or handsets, as shown in Table 8-1 Section 8.2.6, so this will be a suitable place to start implementation. Regarding the way of integrating the technology into the supermarkets' mobile apps or handsets, we can understand the customer's situation and needs through the analysis shown in Section 8.3.6 using the EPI Cube. The customer is already inside the supermarket, so the perceptual presence is low (feel being here) Figure 8-23; and for behavioural interactivity, there is no need to manipulate the environment (low interactivity) Figure 8-22; and since it uses external devices such as smartphones or handsets, the level of the technological embodiment is low, as shown in Figure 8-21. Therefore, the researcher believes that using AR

technology as a feature inside the existing application for supermarkets or handsets is the ideal solution for in-store navigation in terms of existing and available technologies in the UK market. In addition to the potential of AR technology in assisting in solving some other issues facing customers over 65 in the UK.

As mentioned previously in Section 8.3.2 about the effectiveness of AR for older people in navigation, other research has proven its effectiveness in enhancing grocery shopping experiences (Cruz *et al.*, 2019; Diaz-Orueta and Hopper, 2020; Rejeb, Rejeb and Keogh, 2021; Riar *et al.*, 2022; Kang *et al.*, 2023). Many recent studies such as (Akay et al., 2022; Cruz et al., 2019; Jayagoda et al., 2021; Oplenskedal et al., 2019) have shown successful results of identifying product locations in-store using AR technology. Also, it is worth mentioning that AR can help with personalising the information for the customer (Akay et al., 2022; Cruz et al., 2019; Lawo et al., 2021), which may help solve some of the grocery shopping issues discussed previously. As discussed in Section 4.2.4.3.2.3, 5.4.2.2, 6.4.4, and 7.4.3 regarding the issue with clarity of the product's labels and signage, AR can help in these aspects by customising font type and size, colour, and nutrition information tailored to the customer's needs, as demonstrated in these research (Ahn et al., 2015; Akay et al., 2022; Gutiérrez et al., 2019; Jain and Djamasbi, 2019; Jiang et al., 2018; Piumali et al., 2021; Röddiger et al., 2018; Souza-Herod and Hamam, 2021; Xu et al., 2022). Additionally, AR technology has the potential to support customers in comparing products and decision-making tasks during their grocery shopping (Álvarez Márquez and Ziegler, 2017; Gutiérrez, Verbert and Htun, 2018; Lawo *et al.*, 2021; Liu *et al.*, 2021; Rejeb, Rejeb and Keogh, 2021; Omar Álvarez Márquez *et al.*, 2023), since it is a concern for the participants as discussed in Section 4.2.4.3.2.4. Additionally, it is indicated in the Section 5.4.5 that there is a growing interest in sustainable shopping by the participants. Hence, (Herbig, Kahl and Krüger, 2018)’s research developed an AR mobile application which supports customers in making sustainable purchase decisions. Lastly, (J., Halonen and Cherukuri, 2022) presented a design framework that includes six components to be considered when developing new AR applications for older people, namely, user, interaction, device, real content, virtual content, and tracking; which can be used for future AR system development regarding enhancing the grocery shopping experience.

8.4.1 Scenario

As mentioned previously in the second Section 2.2.2 and 2.2.4 about scenarios in user-centred design and inclusive design approaches and how they help serve as essential tools for persona validation, iterative design, identifying pain points and opportunities, and concept selection. The following scenario explains how the main persona presented in Figure 8-24 would use the proposed design insights and recommendations in real-life grocery shopping situations.

Linda, an elderly woman, went to her main supermarket during the festive season. Shelves are lined with Christmas goodies, and the air is filled with the scent of holiday spices. Figure 8-25 shows Linda strolls along the aisles of her main supermarket, looking for her favourite biscuits.

Figure 8-25 Linda strolls along the aisles looking for her favourite biscuits

After scanning the usual biscuit shelves, she realizes her favourite biscuits are not on the shelves. A look of disappointment appeared on Linda's face; she looked around the aisle, hoping to find a supermarket staff who could help her, but she was all alone, as shown in Figure 8-26.

Figure 8-26 Linda could not find her favourite biscuit and there were no staff around to help

As illustrated in Figure 8-27, Linda opened the supermarket app, searched for her favourite biscuits, and discovered that the store had changed its location to put Christmas items instead of her favourite biscuits, as mentioned above in Section 7.4.4 that this issue often occurs during festive seasons.

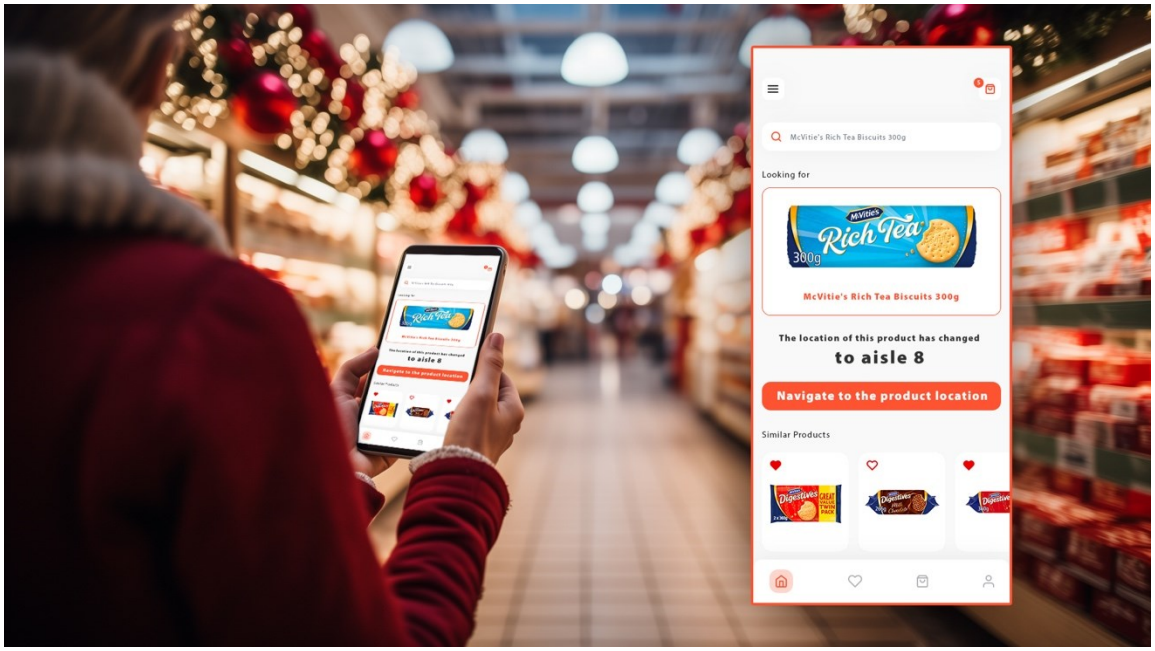


Figure 8-27 Linda discovered the new location of her favourite biscuits using the supermarket app

Then, Linda found her favourite biscuit by navigating using the Augmented Reality (AR) feature on the supermarket app, as demonstrated in Figure 8-28.

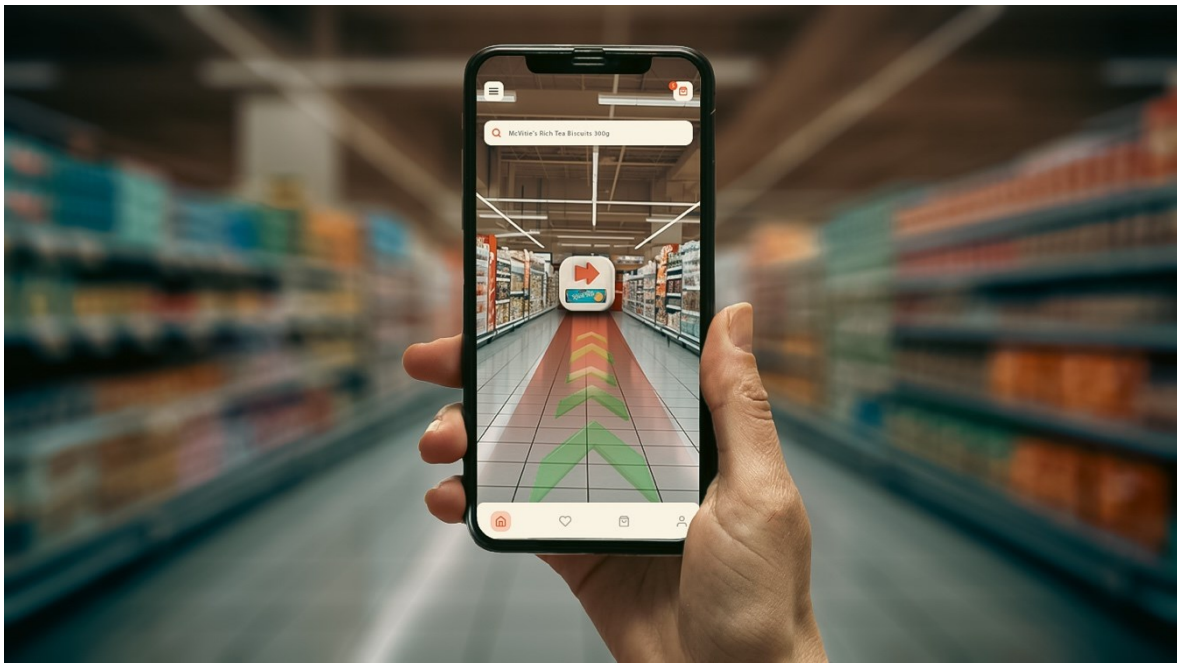


Figure 8-28 Linda navigating to the location of her favourite biscuit using the AR feature on the supermarket app

Next to her biscuits, Linda spots a new product. She reaches for it, curious about its ingredients. She could not read the label without her glasses, so she used the AR feature on the supermarket app *Figure 8-29* to show the ingredients more clearly and alert her if the product contained ingredients she did not want, as demonstrated previously in Section 6.4.4, regarding the interest of this target group in reading the product label.

Figure 8-29 Linda uses the AR feature to read the ingredients more clearly and know if the product is suitable for her

As she approached the checkout, Linda's eyes glimpsed the sight of a random aisle filled with a mixture of products. Fascinated by the variety, she decided to detour from her regular route and explore the offerings. She began to inspect the products with a discerning eye. As shown in Figure 8-30, she picked up various items, scanned the labels, compared prices and sizes, and evaluated the environmental impact of each product, as indicated previously in Section 5.4.2.2 and 7.4.6.

Figure 8-30 Linda compares two products to find out which one is right for her

The other shoppers rushed past her, so she used the AR feature on the app to make the decision faster and easier, as demonstrated in Figure 8-31.

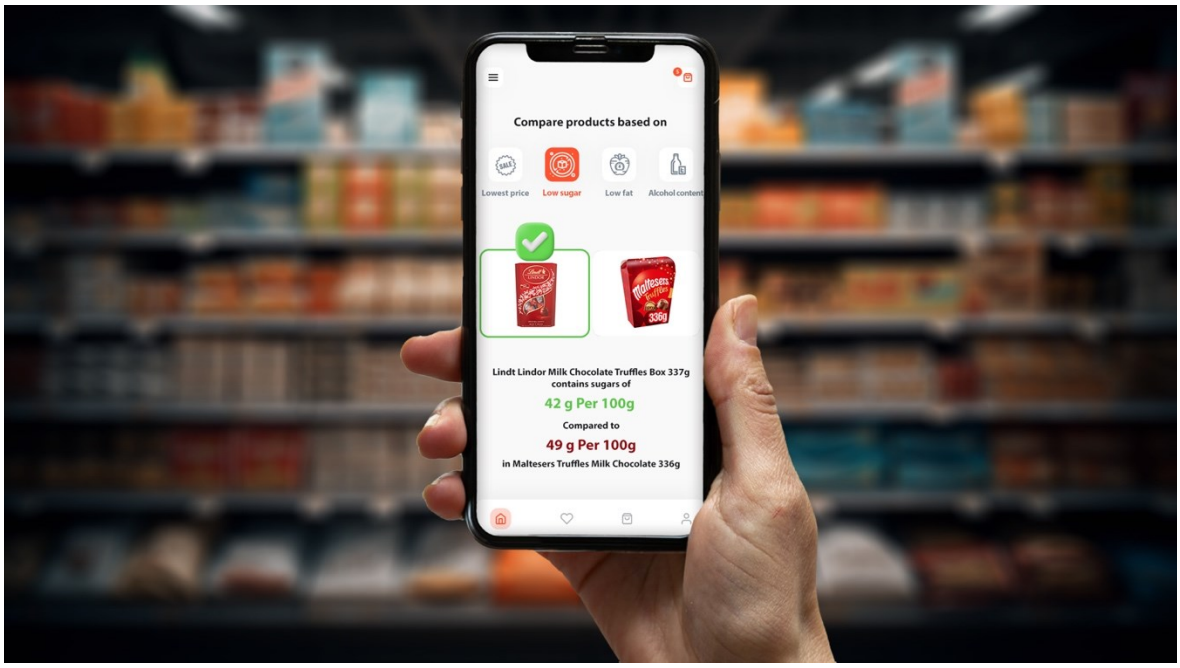


Figure 8-31 Linda used the AR feature on the app to compare the two products based on the lowest sugar content and make the decision faster and easier

After paying for her items, Linda wheeled her cart towards the exit, leaving the store with a satisfied smile, knowing that even in ordinary aisles, there is space for mindful decision making.

Figure 8-32 Linda leaving the store with a satisfied shopping experience

8.4.2 Other personas

As was pointed out above about the primary persona presenting the target group of this thesis in Figure 8-24, in this section, other personas will be presented and divided into two categories: supermarket type *(high-cost and low-cost supermarkets)* and gender *(female and male)*, which will help future researchers and retailers to know more details about characteristics and preferences of customers aged 65 years and above in the UK.

Starting with the personas based on the supermarket type, Figure 8-33 is called Dorothy and represents customers who use high-cost supermarkets, and Figure 8-34 is called Sharon and represents customers who use low-cost supermarkets. High-cost supermarket customers are typically older, live alone, and have higher shopping satisfaction at their main grocery store. Their ranking of the main pain points are as follows: first, product availability and location; second, store layout and ease of in-store navigation, followed by shelf labels, then packaging and product information in-store; and lastly, checkouts, as shown in Figure 8-33.

PERSONAS
Based on SUPERMARKET TYPE

Supermarket type:
High-cost supermarkets

Demographic information

Gender:
Female

Age:
77 years old

No. of household:
Alone (by herself)

Technology level:
Has a smartphone and uses it on a daily basis

Main pain point ranking

- Products availability and location
- Store layout and ease of in-store navigation
- Shelf labels
- Packaging/product information in-store
- Checkouts

Overall satisfaction
from their supermarket

8.46
out of 10

Figure 8-33 Dorothy represents high-cost supermarket customers

Low-cost supermarket customers typically live with their partners and have lower shopping satisfaction at their main grocery store. Their ranking of the main pain points are as follows: first, product availability and location; second, shelf labels; following, store layout and ease of in-store navigation; then checkouts; and lastly, packaging and product information in-store, as illustrated in Figure 8-34.

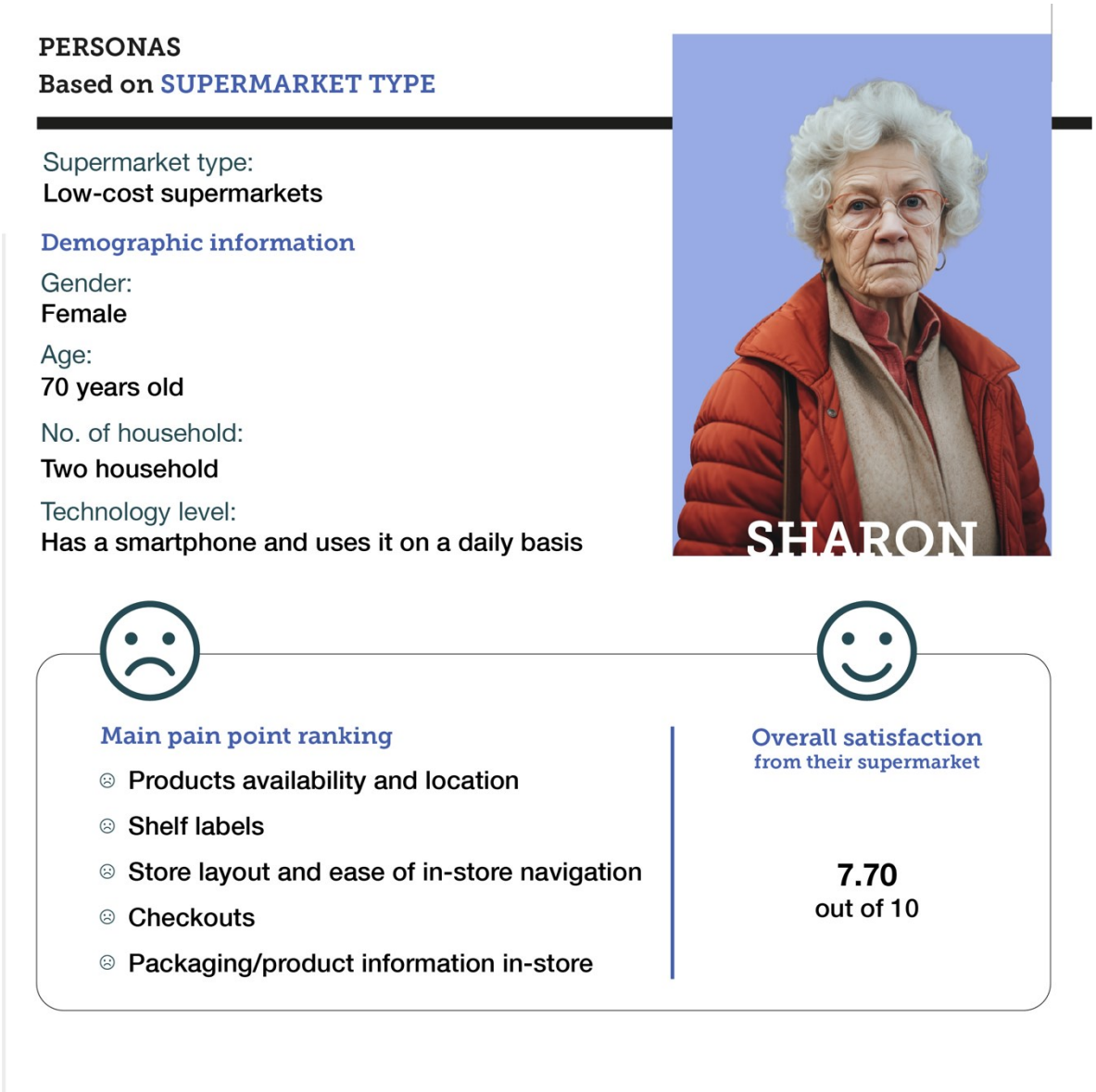


Figure 8-34 Sharon represents low-cost supermarket customers

With regard to the personas based on gender, Figure 8-35 represents female customers and is called Odette, and Figure 8-36 represents male customers and is called Edward. Female customers commonly live alone, use technology more than males, and have higher shopping satisfaction at their main grocery store. Their ranking of the main pain points are as follows:

product availability and location; second, shelf labels, followed by store layout and ease of in-store navigation, then packaging and product information in-store; and finally, checkouts, as demonstrated in Figure 8-35.

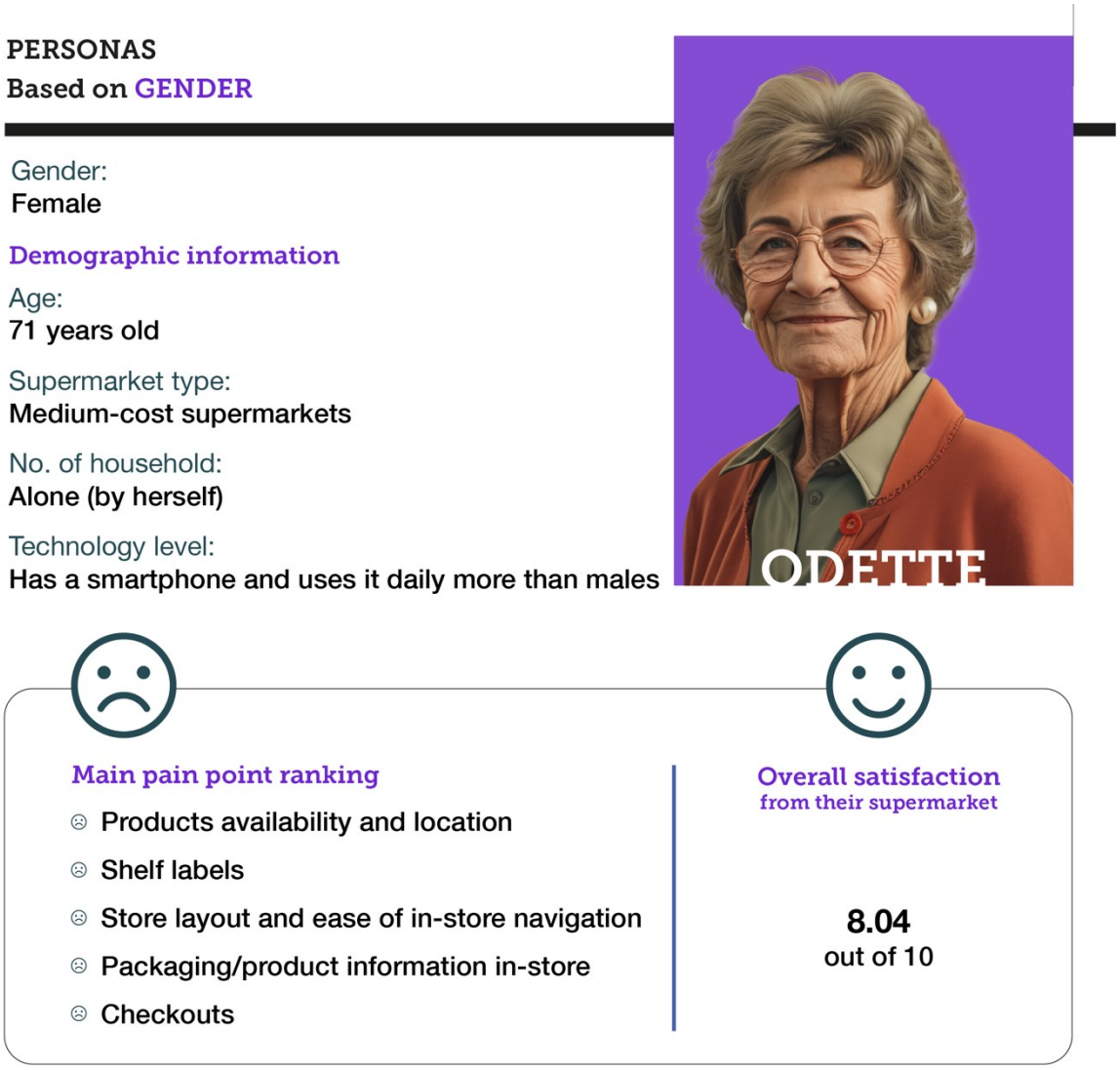


Figure 8-35 Odette represents female customers

Moving on now to consider male customers, as shown in Figure 8-36, they generally live with their partners, use technology less than females, and have lower shopping satisfaction at their main grocery store. Their ranking of the main pain points are as follows: first, product availability and location; second, store layout and ease of in-store navigation; following, shelf labels; then, checkouts; and lastly, packaging and product information in-store.

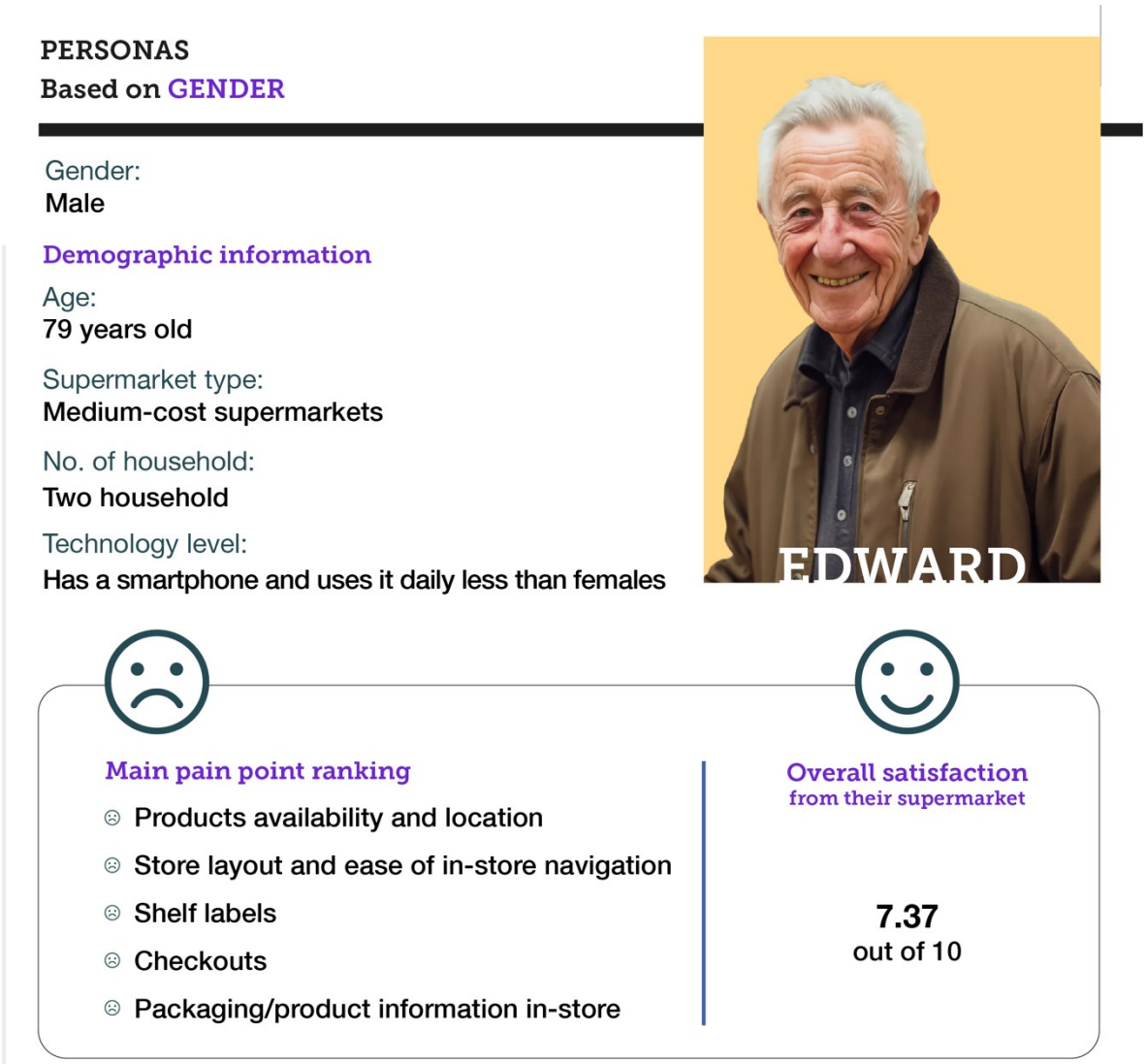


Figure 8-36 Edward represents male customers

8.5 Conclusion

To summarise, this chapter started by reviewing the existing technologies that target and focus on customers' experiences in UK supermarkets to understand the technological situation of the market and provide a suitable solution for the UK market. As a result, the current technologies on the market are the use of handsets or mobile apps, cashier-less technology, smart refills machine, and some technologies related to limiting the spread of COVID-19. As demonstrated in Chapter 6 and Chapter 7, in-store navigation to find a product is the main pain point with grocery shopping for customers aged 65 and over in the UK. The second part of this chapter focused on examining the effectiveness of navigation-focused technologies that were tested with older people. As a

result, five technologies are included in this chapter Personal Navigation Assistant (PNA), Augmented Reality (AR), Virtual Reality (VR), wearable devices, and self-driving wheelchairs.

The next section of this chapter focused on presenting the design insights and recommendations for in-store navigation for customers aged 65 and over in the UK. It began by delivering a persona representing the target segment in this thesis and its characteristics, which is a 72-year-old female who shops at a medium-cost supermarket and mainly struggles with finding products inside the store. Therefore, using AR technology as a feature inside the existing supermarket mobile application is the ideal solution for in-store navigation. Then, present a scenario demonstrating how this persona would use the proposed design insights and recommendations in real-life grocery shopping situations.

Chapter 9 Conclusion and recommendations for future work

This chapter illustrates how the research aim and objectives of this thesis were achieved (Section 9.1), then represents the contribution of this study (Section 9.2), and then discusses the limitations of this thesis and provides recommendations for future work (Section 9.3).

9.1 Research aim and objectives

Chapter 1 introduced the research gap and the scope of the study. Accordingly, the research aim and questions were presented in Chapter 2, which stated that it aimed to provide design insights to improve supermarket service for customers aged 65+ in the UK via emerging technologies by identifying the main pain point and delivering design insights and recommendations for incorporating Augmented Reality (AR) into existing supermarket apps or devices to guide customers inside the store and meet their needs. It was divided into two research questions:

RQ1. What are the main pain points of the current grocery shopping experience for customers aged 65 and over in the UK?

RQ2. What is the appropriate emerging technology to overcome the main pain point in the grocery shopping experience of customers aged 65 and over in the UK?

Thus, to contribute to the aim and answer the research questions, this research had four objectives:

9.1.1 Objective one

The first objective of this thesis was to achieve an overall understanding of the main concepts around the study area, which includes customer experience design and related design approaches, the shopping experiences and needs of older people, emerging technologies, and smart retailers in the context of supermarkets to identify boundaries and opportunities for this thesis.

Through the literature reviews, it has been shown in Chapter 1 that grocery shopping is an essential activity in older people lives as it is considered one of the Instrumental Activities of Daily Living (IADL). However, customers aged 65 and above still face some issues with their grocery

shopping that still need to be met. It is crucial to know that older people are now seen as a valuable segment to retailers as their numbers are increasing dramatically, and they are becoming wealthier and spending more compared to other age groups. Importantly, emerging technologies have shown that they have the potential to improve the customer experience. Several projects and research studies in the UK focusing on exploring the grocery shopping experience of older people were reviewed and then clarified how this thesis contributes to the existing knowledge on older customers' post-COVID grocery shopping behaviour, experience, and unmet needs, and it fills the research gap.

Chapter 2 presented the background literature relating to different design approaches that focus on people and are relevant to the research aim, such as service design, inclusive design, co-design and human\user centred design, in order to provide insights and recommendations designed collaboratively to be used by as many people as possible through delivering a real value and satisfying experience for the end-user. Also, given the importance of the customer experience to achieving a competitive advantage, the different types of experiences have been described; namely, sensory, emotional, cognitive, behavioural and social identity. In addition to clarifying some terminologies related to the customer experience, such as customer journey, service blueprinting, steps or stages and touchpoints. This was followed by the impact of emerging technologies on the customer experience, with different frameworks and tools illustrated to analyse the new realities technologies and how to integrate them strategically to improve supermarket service and the shopping experience, such as the Virtuality continuum, the Reality-Virtuality Interaction Cube, and the Embodiment-Presence-Interactivity Cube. Chapter 2 concluded with this thesis' aim, objectives, and research questions.

9.1.2 Objective two

The second objective of this thesis was to map out the current grocery shopping experience of customers aged 65 and over in the UK to identify their shopping patterns as well as customers' pain points and to check if there are new issues in the current shopping experience.

This was achieved by adopting the Research Onion to guide Chapter 3 for an effective design procedure. Thus, this thesis chose the appropriate research philosophy, which is pragmatic, because this research relies on collecting data about the participants' views and perceptions regarding their shopping experience. The mixed methods and method triangulation were adopted to understand better the research problem, including systematic literature review, card sorting methods (qualitative) and questionnaires (quantitative), which fit with the pragmatic approach used in this thesis. These methods were presented using the double diamond and the three

diamonds diagram, as shown in Figure 3-8, because this thesis requires the researcher to go up and down according to the need of the research.

This thesis has identified the shopping patterns and customers' pain points by starting with a systematic literature review (see Chapter 4) and gaining a comprehensive view of the current grocery shopping experience and the difficulties faced by customers aged 65 and above in the UK. As a result, most of the positive factors were in the following touchpoints: location and access to stores, staff, similar type of shoppers and additional services or facilities. Most of the negative factors were in the following touchpoints: physical environment, products, pricing and promotions, checkout, and products and service in the post-purchase stage (see Section 4.2.4). Also, it has become clear that there has been a lack of research on this topic, especially in the UK.

Chapter 3In order to validate these findings from (Chapter 4) and to find out if there are other difficulties in the grocery shopping experience of customers aged 65 and above in the UK, a qualitative method was used, which is an online card sorting and presented in Chapter 5. Thus, 13 people participated in the card sorting, aged range from 65 to 75 years. As a result, the main pain points were labelling, store layout and products, promotions, checkouts, and store environment, shown in Section 5.4.2.

To obtain a large scale of opinions about the main pain points found in Chapter 5 (card Sorting), Chapter 6 presented the adoption of a quantitative method, a self-administered web-based questionnaire. It included five parts illustrated in Section 6.3.2: shopping behaviour, main pain points based on the results in Section 5.4, understanding of how participants deal with technology, overall grocery shopping satisfaction, and demographic information. Accordingly, the questionnaire was distributed, and 213 valid responses were received and included in the analysis. The data were analysed using Statistical Package for the Social Sciences (SPSS) version 28, and the one-way Analysis of Variance (ANOVA). As a result, the main issue was around the '*products availability and location'*. More specifically, the store moving the products around appeared to be the main pain point.

To deeply explore the issue related to the *'products availability and location'* identified in the previous study Chapter 6 as the main pain point for customers aged 65 and over in the UK, an in-person card sorting method was used in Chapter 7, and seven participants aged between 69 and 84 years were recruited. Three main activities were included in the card sorting activities, first, recall previous experiences where participants were looking for a product at their main store. Second, recall previous experiences where someone asked the participants to help find a product. Lastly, obtain some inspiration from participants regarding their navigation technique and what

they think would be an appropriate solution to solve this issue, as described in Section 7.3. As a result, it was discovered that participants' strategies for product search, in general, are as follows: firstly, looking around, secondly, using signage as a guide, then asking staff, searching online before going to the store, and finally, asking a customer. The reasons participants could not find the product, they are in this order: the store moved products around, confusing layout, the product was out of stock, and the participants did not see the product because it was placed too high or too low, and the product was placed in a not relevant location.

9.1.3 Objective three

The third objective of this thesis was to examine the appropriate use of emerging technologies in relation to supermarkets and older people in order to identify boundaries and opportunities for using emerging technologies to provide design insights to improve supermarket service for customers aged 65+ in the UK.

The literature reviews of the technologies have been divided into two parts in Chapter 8. The first part focuses on reviewing the technologies currently used in UK supermarkets that target and focus on customers' experiences, as shown in Section 8.2. The second part examines the current emerging navigation-focused technologies that have been studied with older people, as demonstrated in Section 8.3. As a result, the current technologies on the market are the use of handsets or mobile apps, cashier-less technology, smart refills machine, and some technologies related to limiting the spread of COVID-19. Regarding the current emerging navigation-focused technologies that were tested with older people, five technologies were included, Personal Navigation Assistant (PNA), Augmented Reality (AR), Virtual Reality (VR), wearable devices, and self-driving wheelchairs.

9.1.4 Objective four

The fourth objective of this thesis was to provide design insights for incorporating Augmented Reality (AR) into existing apps or devices to improve supermarket service for customers aged 65+ in the UK.

In order to provide design insights suitable for the target group, a persona was developed, as shown in Figure 8-24, in order to understand the target customers' characteristics, goals, and technology level to choose the right technology to support them in navigating in-store. The persona that represents the target group in this thesis; was a female who lives alone, is aged 72 years, shops at a medium-cost supermarket and has a mobile phone and uses it regularly, also, using the handset at her main supermarket. Her main pain point is in-store navigating and finding some products.

Based on the understanding of this persona, as discussed in Section 8.4, the researcher believes that incorporating Augmented Reality (AR) into existing supermarket apps or devices as a feature to guide customers inside the store is the ideal solution in terms of existing and available technologies in the UK market, as illustrated in the scenario Section 8.4.1. Since, almost all supermarkets have mobile applications or handsets, as shown in Table 8-1 Section 8.2.6.

9.2 Contribution of this study

The outcomes of this thesis will contribute to and extend the knowledge of the grocery shopping experience of customers aged 65 and above in the UK and will be demonstrated in the following sections:

9.2.1 First Contribution

The first contribution of this thesis was the Systematic Literature Review (SLR) of the current grocery shopping experience of customers aged 65 and over in the UK, presented in Chapter 4. By reviewing published journal articles available on several databases and to the best of our knowledge, this is the first study in this area. As a result, fifteen papers were included in the final analysis, and data were extracted into three stages, pre-purchase stage, purchase stage and post-purchase, providing an up-to-date comprehensive view of the grocery shopping experience of customers aged 65 and over in the UK.

9.2.2 Second Contribution

The mixed methods and method triangulation findings, including systematic literature review (Chapter 4), card sorting methods (Chapter 5 and Chapter 7) and questionnaires (Chapter 6), contribute to the existing knowledge on older customers' post-COVID grocery shopping behaviour, experience, and unmet needs and fill the research gap.

9.2.3 Third Contribution

This thesis examined and analysed the current technologies in UK supermarkets (see Section 8.2) and emerging navigation-focused technologies which has been tested with older people (see Section 8.3). This led to offering design insights and recommendations for using emerging technologies to improve supermarket service for customers aged 65+ in the UK regarding in-store navigation, as shown in Section 8.4.

9.3 Research limitations

Regarding the Systematic Literature Review (SLR), first, best efforts have been made to select the keywords based on the relevant literature, but the chosen keywords might not be exhaustive. Second, the study focused specifically on the grocery shopping experience in a physical store, so these results cannot be generalized beyond that. Lastly, the SLR study is limited to and focused on the UK market only.

Concerning the participants, various methods have been adopted to recruit participants to obtain diverse participants, but it must be considered that none of the participants had any permanent disability. Also, people who do not have access to a mobile phone or the Internet do not have a way to communicate with the researcher and participate in the study. In addition to the gender imbalance in participants, which was explained earlier in Section 5.4.1. Older individuals may use different stores for their shopping, such as speciality or independent stores not been investigated in this study. This study focused on the UK market, so generalising its results beyond that is not possible.

9.4 Recommendations for future work

Several potential areas for future research emerged during the development and conduct of this thesis; these are outlined in the following sections.

9.4.1 Further studies and actions on grocery shopping experiences of customers aged 65 and over in the UK

The Systematic Literature Review (SLR) of this thesis focused on the in-store grocery shopping experience as the first study of its kind in this area, so further studies are needed. Future studies could include online shopping experience. Also, it might expand the search to cover other IADL or other sectors. Lastly, this study focused on the UK market. Thus, future studies might provide additional insights by performing a cross-regional comparison.

This study mentioned, in general, the grocery shopping behaviour and patterns change that took place because of the pandemic. Hence, further studies could consider the impact of the pandemic (COVID-19) or Brexit and the increasing demand for sustainable and organic products. Also, this study focused on investigating the main pain point "products availability and location"; therefore, further studies may deeply explore the other factors such as labelling or checkouts (see Section 6.4.6).

Additionally, it may also be interesting to investigate how to integrate customer journey and omnichannel and technology to provide a seamless and satisfying shopping experience. Finally, future studies could examine the influence of the touchpoints between each other to find the touchpoints that greatly impact the whole grocery shopping experience.

Regarding participants, future researchers could extend recruitment and include customers who have permanent disability or do not have access to a mobile phone or the Internet. Also, Future studies could examine and understand in depth the other personas mentioned in Section 8.4.2 and their grocery shopping experiences.

Retailers can take these findings and pain points and start designing solutions that align with their strategies for the future and the resources available to them to enhance customer loyalty and satisfaction. In addition, policymakers could introduce some controls and regulations that will limit the presence of these pain points and improve the quality of life for customers aged 65 and over in the UK.

9.4.2 Designing for emerging technologies

This thesis used the EPI Cube to analyse emerging technologies. Future studies can contribute by adding emerging technologies that were not present at the time of this thesis to make it a comprehensive guide for future studies that aim to enhance the grocery shopping experience for customers aged 65 and above in the UK. The EPI Cube and the analysis can be used to improve the experiences of public services for people aged 65 and above in the UK. Additionally, retailers can use it as a guide to know where to invest in emerging technologies of the future in order to improve their customers' grocery shopping experience and satisfaction.

Researchers can use the analysis in Section 8.3.6 of emerging technologies to determine which technologies might be suitable as a solution to other pain points, such as checkouts, shelf label, packaging, and product information in-store. This thesis suggested incorporating Augmented Reality (AR) into existing supermarket apps or devices to guide customers inside the store. Therefore, future studies can use the recommendations presented in Section 8.4 to develop this idea and test it with the target group.

9.4.3 Using the card sorting method to understand better and engage with older people's experiences

The thesis presents a unique approach, using a card sorting method to understand participants' grocery shopping experiences. This method has proven to positively influence participants to

recall their experiences effortlessly and accurately. The card sorting approach encourages them to speak out loud and in a more structured manner, which is often easier than asking them to recall their last grocery experience from remembering. This is because participants may forget some of the issues or situations related to their grocery shopping experience, but the card sorting method assures that all the important aspects are covered and analysed. Overall, the use of card sorting has been a valuable addition to the research methodology and has helped provide more detailed and accurate insights into participants' grocery shopping experiences, more practical advice is provided in Section 5.4.5. Therefore, future researchers can benefit from this method of research in order to obtain more information about experiences related to this research topic or public services experiences.

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Appendix A Participant Information Sheets, Consent Forms and Asking for permission to place posters

A.1 Participant Information Sheets

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Participant Information Sheet

Study Title: Enhancing the grocery shopping experience of customers aged 65+ in the UK by using emerging technologies

Researcher: Fahad Alhathal
ERGO number: 62401

You are being invited to take part in the above research study. To help you decide whether you would like to take part or not, it is important that you understand why the research is being done and what it will involve. Please read the information below carefully and ask questions if anything is not clear or you would like more information before you decide to take part in this research. You may like to discuss it with others but it is up to you to decide whether or not to take part. If you are happy to participate you will be asked to sign a consent form.

What is the research about?
My name is Fahad Alhathal. I am a PhD student at the University of Southampton - Winchester School of Art. As part of my thesis, I am conducting research into exploring the grocery shopping experience of customers aged 65+ in the UK. To enhance the grocery shopping experience by using emerging technologies. The questions will be about your current grocery shopping experience and your shopping behaviour and will not collect any names or personal details. The findings from this study will help design better solutions by using emerging technologies that supermarkets could adopt to enhance the shopping experience of customers over the age of 65 in the UK.

Why have I been asked to participate?
This study is open to any individual aged 65 and over, doing their grocery shopping at a physical store in the UK.

What will happen to me if I take part?
If you decided to take part, an invitation from Microsoft Teams and link to Miro website will send you where the study will take place. The session will be online between me and you for around 1 hour. The session will start with general questions about your shopping behaviour. Then sort and rate different touchpoints in your grocery shopping journey. Finally, demographics information (age, gender and household) and formulate a fictional character that represents your shopping style. This session will be a part of the data collection methods which will be used in this study which will last for 3 years.

This session will take place over Microsoft Teams and Miro. This session will be audio recorded using the built-in recording software on Microsoft Teams. Microsoft Teams is a third-party software. You can find the Microsoft Privacy Statement here https://privacy.microsoft.com/en-GB/privacystatement#mainnoticetoendusersmodule. And will be screen recorded on Miro is an online collaboration tool. You can find the Miro Privacy Statement here https://miro.com/legal/privacy-policy/.

Are there any benefits in my taking part?
The knowledge gained from this study will help to design a better grocery shopping experience for customer aged 65+ in the UK.

Are there any risks involved?
The study is considered low risk. It is very unlikely to cause any physical risk to the participants in this study. As described above, there are no sensitive and personal questions are included; however, some of the questions you will be asked may make you feel uncomfortable, and you can leave the study at any time you choose.

UNIVERSITY OF Southampton

What data will be collected?
The researcher will collect information about (your grocery shopping behaviour, age, gender, household and the use of technology). Will also collect information about your satisfaction and importance of different touchpoints in your current grocery shopping journey.

All data collected will be handled securely, during collection, analysis, storage and transfer using encryption and password-protected access on Microsoft OneDrive.

Will my participation be confidential?
Your participation and the information we collect about you during the course of the research will be kept strictly confidential.

Only members of the research team and responsible members of the University of Southampton may be given access to data about you for monitoring purposes and/or to carry out an audit of the study to ensure that the research is complying with applicable regulations. Individuals from regulatory authorities (people who check that we are carrying out the study correctly) may require access to your data. All of these people have a duty to keep your information, as a research participant, strictly confidential.

I will not collect your name, email address or any personal details about you. Individual results will be kept confidential within the research team/between myself and my supervisor and will not be shared with third parties. Questions on demographic details (for example your age and gender) are asked where it is helpful to analyse data. The raw data will be kept electronically with encrypted and password protected. The recordings will be transcribed and will be destroyed at the end of this study in March 2024.

Do I have to take part?
No, it is entirely up to you to decide whether or not to take part. If you decide you want to take part, you will need to sign a consent form to show you have agreed to take part.

Please contact Fahad Alhathal on **07309393133** or email: **f.i.alhathal@soton.ac.uk**

What happens if I change my mind?
You have the right to change your mind and withdraw at any time without giving a reason and without your participant rights *(or routine care if a patient)* being affected.

You can decide to leave the study at any point by sending email to f.i.alhathal@soton.ac.uk or message to 07309393133. If you withdraw from the study, we will keep the information about you that we have already obtained for the purposes of achieving the objectives of the study only.

What will happen to the results of the research?
Your personal details will remain strictly confidential. Research findings made available in any reports or publications will not include information that can directly identify you without your specific consent.

Where can I get more information?
If you wish to receive further information about the project at any stage, you may contact by email f.i.alhathal@soton.ac.uk. Or any of the supervision team Dr Yuanyuan Yin email: Y.Yin@soton.ac.uk, Dr Gary Wills email: gbw@ecs.soton.ac.uk.

What happens if there is a problem?
If you have a concern about any aspect of this study, you should speak to the researchers who will do their best to answer your questions.
If you remain unhappy or have a complaint about any aspect of this study, please contact the University of Southampton Research Integrity and Governance Manager (023 8059 5058, rgoinfo@soton.ac.uk). Or anyone of the supervision team Dr Yuanyuan Yin email: Y.Yin@soton.ac.uk, Dr Gary Wills email: gbw@ecs.soton.ac.uk.

[17/02/2021] [02] [62401]

UNIVERSITY OF Southampton

Data Protection Privacy Notice
The University of Southampton conducts research to the highest standards of research integrity. As a publicly-funded organisation, the University has to ensure that it is in the public interest when we use personally-identifiable information about people who have agreed to take part in research. This means that when you agree to take part in a research study, we will use information about you in the ways needed, and for the purposes specified, to conduct and complete the research project. Under data protection law, 'Personal data' means any information that relates to and is capable of identifying a living individual. The University's data protection policy governing the use of personal data by the University can be found on its website (https://www.southampton.ac.uk/legalservices/what-we-do/data-protection-and-foi.page).

This Participant Information Sheet tells you what data will be collected for this project and whether this includes any personal data. Please ask the research team if you have any questions or are unclear what data is being collected about you.

Our privacy notice for research participants provides more information on how the University of Southampton collects and uses your personal data when you take part in one of our research projects and can be found at http://www.southampton.ac.uk/assets/sharepoint/intranet/ls/Public/Research%20and%20Integrity%20Privacy%20Notice/Privacy%20Notice%20for%20Research%20Participants.pdf

Any personal data we collect in this study will be used only for the purposes of carrying out our research and will be handled according to the University's policies in line with data protection law. If any personal data is used from which you can be identified directly, it will not be disclosed to anyone else without your consent unless the University of Southampton is required by law to disclose it.

Data protection law requires us to have a valid legal reason ('lawful basis') to process and use your Personal data. The lawful basis for processing personal information in this research study is for the performance of a task carried out in the public interest. Personal data collected for research will not be used for any other purpose.

For the purposes of data protection law, the University of Southampton is the 'Data Controller' for this study, which means that we are responsible for looking after your information and using it properly. The University of Southampton will keep identifiable information about you for 10 years after the study has finished after which time any link between you and your information will be removed. More information can be found at the University data management policy (http://www.calendar.soton.ac.uk/sectionIV/research-data-management.html)

To safeguard your rights, we will use the minimum personal data necessary to achieve our research study objectives. Your data protection rights – such as to access, change, or transfer such information - may be limited, however, in order for the research output to be reliable and accurate. The University will not do anything with your personal data that you would not reasonably expect.

If you have any questions about how your personal data is used, or wish to exercise any of your rights, please consult the University's data protection webpage (https://www.southampton.ac.uk/legalservices/what-we-do/data-protection-and-foi.page) where you can make a request using our online form. If you need further assistance, please contact the University's Data Protection Officer (data.protection@soton.ac.uk).

All the information that we collect about you during the course of the study will be kept strictly confidential. You will not be identified in any reports or publications and your name and other personal information will be anonymised.

Thank you very much for reading the information sheet and considering taking part in this research is appreciated.

[17/02/2021] [02] [62401]

A.2 Consent Forms

UNIVERSITY OF Southampton

CONSENT FORM

Study title: Enhancing the grocery shopping experience of customers aged 65+ in the UK by using emerging technologies
Researcher name: Fahad Alhathal
ERGO number: 62401

Please initial the boxes if you agree with the statements:

I have read and understood the information sheet [17/02/2021] version [02] and have had the opportunity to ask questions about the study.	
I agree to take part in this research project and agree for my data to be used for the purpose of this study.	
I understand my participation is voluntary and I may withdraw at any time for any reason without my participation rights being affected.	
I understand that should I withdraw from the study then the information collected about me up to this point may still be used for the purposes of achieving the objectives of the study only.	
I understand that taking part in the study involves audio recording which will be transcribed and then destroyed for the purposes set out in the participation information sheet.	
I understand that I will not be directly identified in any reports of the research.	

Name of participant (print name)……

Signature of participant……

Date……

Name of researcher (print name)……

Signature of researcher ……

Date……

[18/01/2021] [01]

A.3 Asking for permission to place posters

University of Southampton

Asking for permission to place posters

Study Title: Enhancing the grocery shopping experience of customers aged 65+ in the UK by using emerging technologies
Researcher: Fahad Alhathal
University email: f.i.alhathal@soton.ac.uk
Ethics/ERGO no: 62401

What is the research about?

My name is Fahad Alhathal, and I am a PhD at the University of Southampton in the United Kingdom.
My research aims to explore the grocery shopping experience of customers aged 65+ in the UK. In order to design better solutions by using emerging technologies that supermarkets could adopt in the UK.

How you can help?

By allowing the researcher to place posters in your place in order to recruit participants for this study.

What are the benefits of helping the study?

You will not receive any direct benefits; however, your help in the study will support design better solution for society, through the knowledge that gained from this study.

Where can I get more information?

If you wish to receive further information about the study, you may contact by email f.i.alhathal@soton.ac.uk. Or any of the supervision team Dr Yuanyuan Yin email: Y.Yin@soton.ac.uk, Dr Gary Wills email: gbw@ecs.soton.ac.uk.

Your help is greatly appreciated!

☐ **Yes, I'm allowing the researcher to place the posters in our place.**

Name:

Position:

Date:

Appendix B Systematic Literature Review (Databases and NVivo 12 results)

B.1 Details of 1st systematic literature review of Scopus database

Scopus	
Date: 09/05/2020	Time: 06:33 pm
Search formula	(TITLE-ABS-KEY (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") AND TITLE-ABS-KEY (supermarket* OR grocer* OR "brick-and-mortar"))
Records	2319 titles
Filters & limitation	Only Articles = (1980) Articles written in English = (1882) Limited to UK & Undefined = (293) Have Access = (205)
Search formula with filters & limitation	(TITLE-ABS-KEY (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") AND TITLE-ABS-KEY (supermarket* OR grocer* OR "brick-and-mortar")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "bz")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (AFFILCOUNTRY , "Unite Kingdom") OR LIMIT-TO (AFFILCOUNTRY , "Undefined"))
Records after filters & limitation	205 titles

B.2 Details of 1st systematic literature review of ProQuest database

Asking for permission to place posters

ProQuest	
Date: 10/05/2020	Time: 01:20 am
Search formula	1. TI(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") OR AB(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") OR IF(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") 2. TI(supermarket* OR grocer* OR "brick-and-mortar") OR AB(supermarket* OR grocer* OR "brick-and-mortar") OR IF(supermarket* OR grocer* OR "brick-and-mortar") 3. (TI(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") OR AB(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") OR IF(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year")) AND (TI(supermarket* OR grocer* OR "brick-and-mortar") OR AB(supermarket* OR grocer* OR "brick-and-mortar") OR IF(supermarket* OR grocer* OR "brick-and-mortar"))
Records	52200 titles
Filters & limitation	Limited to Peer reviewed = (1243) Limited to Article & Undefined = (1150) Limited to Scholarly Journals = (1146) Articles written in English = (1132) Exclude by Location = (829)
Records after filters & limitation	829 titles

Included Databases

ABI/INFORM Collection	Canadian Business & Current Affairs	Education Database	Materials Science Database	Research Library: Science & Technology

	Database: Health & Medicine			
ABI/INFORM Global	Canadian Business & Current Affairs Database: History	Engineering Collection	Materials Science Index	Research Library: Social Sciences
ABI/INFORM Trade & Industry	Canadian Business & Current Affairs Database: Literature & Language	Engineering Database	MEDLINE®	Research Library: The Arts
Accounting, Tax & Banking Collection	Canadian Business & Current Affairs Database: Science & Technology	Engineering Index	Meteorological & Geoastrophysical Abstracts	Science Database
Advanced Technologies & Aerospace Collection	Canadian Business & Current Affairs Database: Social Sciences	Environmental Science Collection	Middle East & Africa Database	SciTech Premium Collection
Advanced Technologies & Aerospace Database	Canadian Business & Current Affairs Database: The Arts	Environmental Science Database	Military Database	Social Science Database
Advanced Technologies & Aerospace Index	Career & Technical Education Database	Environmental Science Index	Natural Science Collection	Social Science Premium Collection
AGRICOLA	Career & Technical Education Database: Business	ERIC	Nursing & Allied Health Database	Social Services Abstracts
Agricultural & Environmental Science Collection	Career & Technical Education Database: Health & Medicine	GeoRef	PAIS Index	Sociological Abstracts
Agricultural Science Collection	Career & Technical Education Database: History	Health & Medical Collection	Periodicals Archive Online	Sociology Collection
Agriculture Science Database	Career & Technical Education Database: Literature & Language	Healthcare Administration Database	Political Science Database	Sociology Database
Applied Social Sciences Index & Abstracts (ASSIA)	Career & Technical Education Database: Science & Technology	India Database	Politics Collection	Technology Collection

Aquatic Science & Fisheries Abstracts (ASFA) 1: Biological Sciences & Living Resources	Career & Technical Education Database: Social Sciences	India Database: Business	ProQuest Central	Telecommunications Database
Aquatic Science & Fisheries Abstracts (ASFA) 2: Ocean Technology, Policy & Non-Living Resources	Computer Science Database	India Database: Science & Technology	ProQuest One Literature	TOXLINE
Aquatic Science & Fisheries Abstracts (ASFA) 3: Aquatic Pollution & Environmental Quality	Consumer Health Database	International Bibliography of the Social Sciences (IBSS)	Psychology Database	Turkey Database
Arts & Humanities Database	Criminal Justice Database	Library & Information Science Abstracts (LISA)	Public Health Database	UK & Ireland Database
ASFA: Aquatic Sciences and Fisheries Abstracts	Criminology Collection	Library & Information Science Collection	Publicly Available Content Database	Worldwide Political Science Abstracts
Asian & European Business Collection	Design & Applied Arts Index (DAAI)	Library Science Database	Religion Database	
Biological Science Collection	Earth, Atmospheric & Aquatic Science Collection	Linguistics and Language Behavior Abstracts (LLBA)	Research Library	
Biological Science Database	Earth, Atmospheric & Aquatic Science Database	Linguistics Collection	Research Library: Business	
Biological Science Index	East & South Asia Database	Linguistics Database	Research Library: Health & Medicine	
Canadian Business & Current Affairs Database	East Europe, Central Europe Database	Materials Science & Engineering Collection	Research Library: History	
Canadian Business & Current Affairs Database: Business	Education Collection	Materials Science Collection	Research Library: Literature & Language	

B.3 Details of 1st systematic literature review of WoS database

Web of Science Core Collection (WoS)	
Date: 10/05/2020	Time: 02:08 am
Search formula	TS=((senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") AND (supermarket* OR grocer* OR "brick-and-mortar"))
Records	777 titles
Filters & limitation	Only Articles (708) Articles written in English (686) Limited to England, Scotland, North Ireland and Ireland (68) Have Access (59)
Records after filters & limitation	59 titles

B.4 Details of 1st systematic literature review of EBSCO database

EBSCO (PsycINFO)	
Date: 10/05/2020	Time: 10:41 pm
Search formula	1. S1 = TI (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") OR AB (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") OR KW (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year") 2. S2= TI (supermarket* OR grocer* OR "brick-and-mortar") OR AB (supermarket* OR grocer* OR "brick-and-mortar") OR KW (supermarket* OR grocer* OR "brick-and-mortar") 3. S1 AND S2

Records	387 titles
Filters & limitation	• Limited to Academic Journals (340) • Articles written in English (326) • Have Access (283)
Records after filters & limitation	283 titles

B.5 Details of 2nd systematic literature review of Scopus database

Scopus	
Date: 02/06/2020	Time: 11:07 am
Search formula	(TITLE-ABS-KEY (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR consumer* OR customer*) AND TITLE-ABS-KEY ("food shopping"))
Records	339 titles
Filters & limitation	Only Articles = (309) Articles written in English = (303) Limited to UK & Undefined = (66) Have Access = (53)
Search formula with filters & limitation	(TITLE-ABS-KEY (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR consumer* OR customer*) AND TITLE-ABS-KEY ("food shopping")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (AFFILCOUNTRY , "United Kingdom") OR LIMIT-TO (AFFILCOUNTRY , "Undefined"))

Records after filters & limitation	53 titles

B.6 Details of 2nd systematic literature review of ProQuest database

ProQuest	
Date: 02/06/2020	Time: 12:20 pm
Search formula	(TI(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR consumer* OR customer*) OR AB(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR consumer* OR customer*) OR IF(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR consumer* OR customer*)) AND (TI("food shopping") OR AB("food shopping") OR IF("food shopping"))
Records	526 titles
Filters & limitation	Limited to Peer reviewed = (136) Limited to Article & Undefined = (127) Limited to Scholarly Journals = (127) Articles written in English = (125) Exclude by Location = (87)

Records after filters & limitation: 87 titles

Included Databases

ABI/INFORM Collection	Canadian Business & Current Affairs Database: Health & Medicine	Education Database	Materials Science Database	Research Library: Science & Technology
ABI/INFORM Global	Canadian Business & Current Affairs Database: History	Engineering Collection	Materials Science Index	Research Library: Social Sciences
ABI/INFORM Trade & Industry	Canadian Business & Current Affairs Database: Literature & Language	Engineering Database	MEDLINE®	Research Library: The Arts
Accounting, Tax & Banking Collection	Canadian Business & Current Affairs Database: Science & Technology	Engineering Index	Meteorological & Geoastrophysical Abstracts	Science Database
Advanced Technologies & Aerospace Collection	Canadian Business & Current Affairs Database: Social Sciences	Environmental Science Collection	Middle East & Africa Database	SciTech Premium Collection
Advanced Technologies & Aerospace Database	Canadian Business & Current Affairs Database: The Arts	Environmental Science Database	Military Database	Social Science Database
Advanced Technologies & Aerospace Index	Career & Technical Education Database	Environmental Science Index	Natural Science Collection	Social Science Premium Collection
AGRICOLA	Career & Technical Education Database: Business	ERIC	Nursing & Allied Health Database	Social Services Abstracts
Agricultural & Environmental Science Collection	Career & Technical Education Database: Health & Medicine	GeoRef	PAIS Index	Sociological Abstracts
Agricultural Science Collection	Career & Technical Education Database: History	Health & Medical Collection	Periodicals Archive Online	Sociology Collection

Agriculture Science Database	Career & Technical Education Database: Literature & Language	Healthcare Administration Database	Political Science Database	Sociology Database
Applied Social Sciences Index & Abstracts (ASSIA)	Career & Technical Education Database: Science & Technology	India Database	Politics Collection	Technology Collection
Aquatic Science & Fisheries Abstracts (ASFA) 1: Biological Sciences & Living Resources	Career & Technical Education Database: Social Sciences	India Database: Business	ProQuest Central	Telecommunications Database
Aquatic Science & Fisheries Abstracts (ASFA) 2: Ocean Technology, Policy & Non-Living Resources	Computer Science Database	India Database: Science & Technology	ProQuest One Literature	TOXLINE
Aquatic Science & Fisheries Abstracts (ASFA) 3: Aquatic Pollution & Environmental Quality	Consumer Health Database	International Bibliography of the Social Sciences (IBSS)	Psychology Database	Turkey Database
Arts & Humanities Database	Criminal Justice Database	Library & Information Science Abstracts (LISA)	Public Health Database	UK & Ireland Database
ASFA: Aquatic Sciences and Fisheries Abstracts	Criminology Collection	Library & Information Science Collection	Publicly Available Content Database	Worldwide Political Science Abstracts
Asian & European Business Collection	Design & Applied Arts Index (DAAI)	Library Science Database	Religion Database	
Biological Science Collection	Earth, Atmospheric & Aquatic Science Collection	Linguistics and Language Behavior Abstracts (LLBA)	Research Library	
Biological Science Database	Earth, Atmospheric & Aquatic Science Database	Linguistics Collection	Research Library: Business	
Biological Science Index	East & South Asia Database	Linguistics Database	Research Library: Health & Medicine	
Canadian Business & Current Affairs Database	East Europe, Central Europe Database	Materials Science & Engineering Collection	Research Library: History	

Canadian Business & Current Affairs Database: Business	Education Collection	Materials Science Collection	Research Library: Literature & Language

B.7 Details of 2nd systematic literature review of WoS database

Web of Science Core Collection (WoS)	
Date: 02/06/2020	Time: 12:04 pm
Search formula	TS=((senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR consumer* OR customer*) AND ("food shopping"))
Records	216 titles
Filters & limitation	Only Articles (195) Articles written in English (192) Limited to England, Scotland, North Ireland and Ireland (36) Have Access (36)
Records after filters & limitation	36 titles

B.8 Details of 2nd systematic literature review of EBSCO database

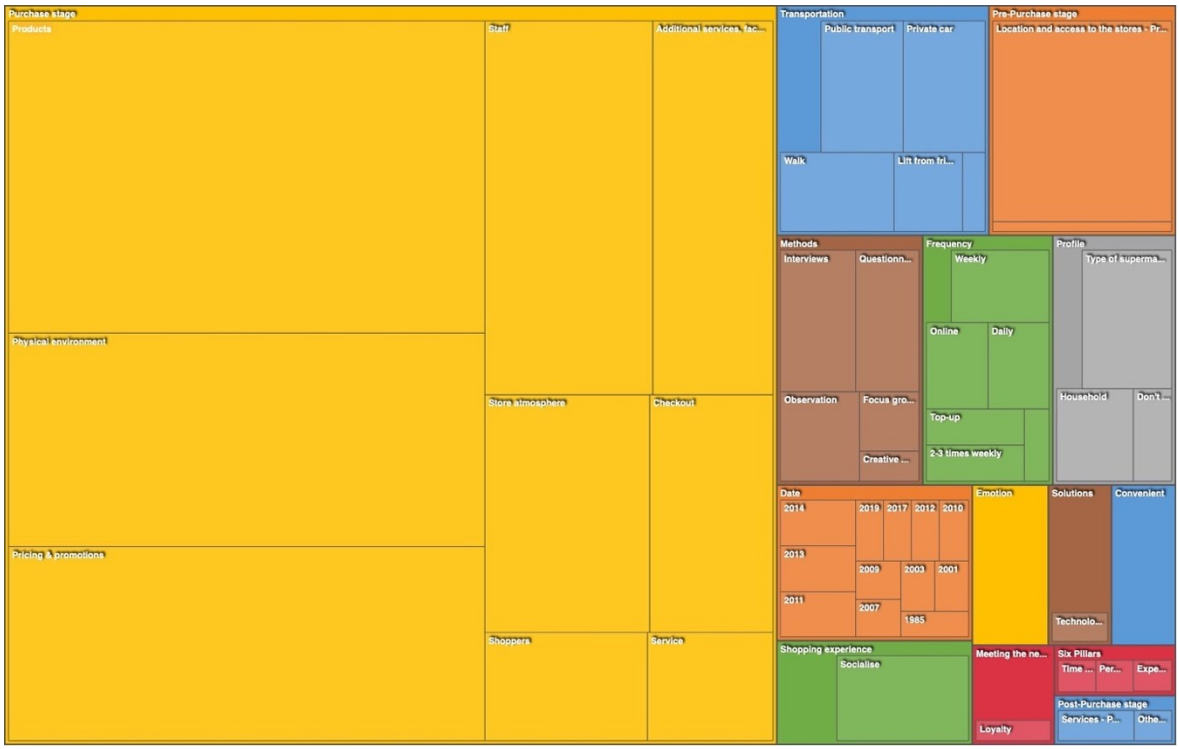
EBSCO (PsycINFO)	
Date: 02/06/2020	Time: 10:46 am
Search formula	1. TI (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR Consumer* OR customer*) OR AB (senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR Consumer* OR customer*) OR KW

(senior* OR retiree* OR elderl* OR "older" OR "old age" OR "Baby boomer" OR "aging" OR "ageing" OR "aged" OR "age-friendly" OR "65 Year Old" OR "60+ Year" OR Consumer* OR customer*)

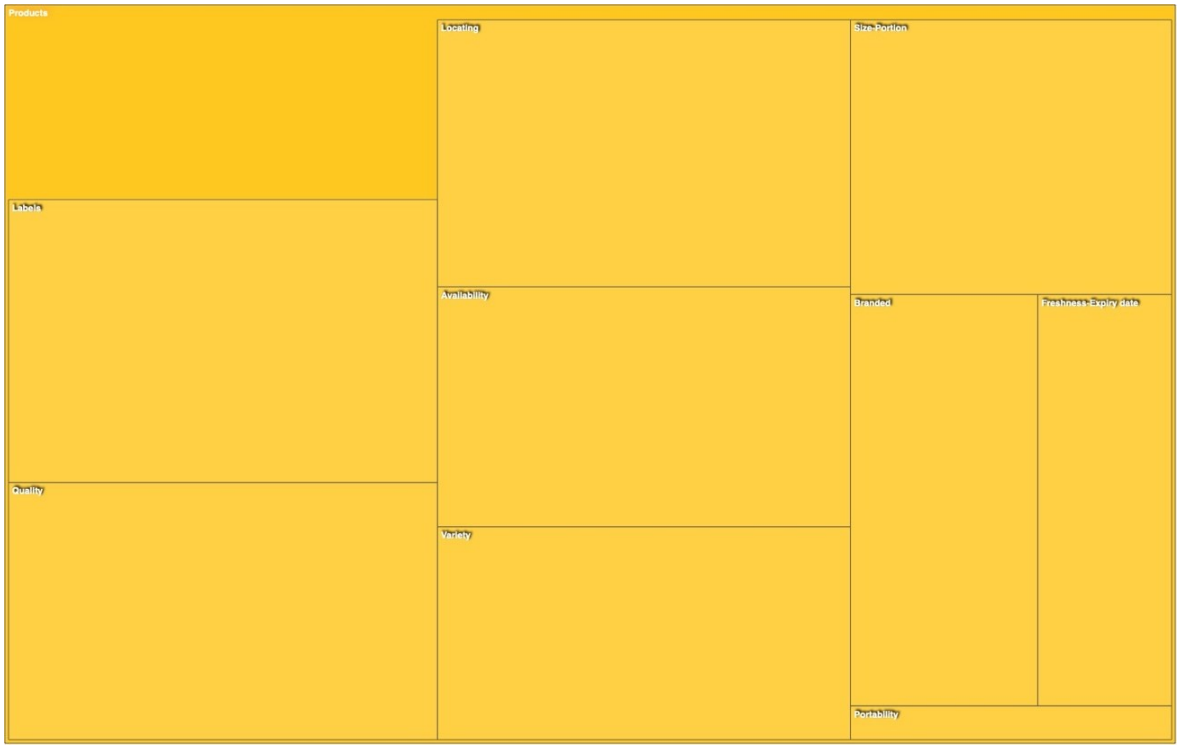
2. TI "food shopping" OR AB "food shopping" OR KW "food shopping"
3. 1 AND 2

Records	68 titles
Filters & limitation	• Limited to Academic Journals (61) • Articles written in English (61) • Have Access (61)
Records after filters & limitation	61 titles

B.9 Hierarchy chart of the coding in NVivo 12



B.10 Details of the hierarchy chart of the products



B.11 Word frequency query by using Nvivo12

Unsaved Query

Word Frequency Criteria

Search in: Files and Externals | Selected Items | Items in Selected Folders

Finding matches: Exact match only (e.g. "talk")
Include stemmed words (e.g. "talking")

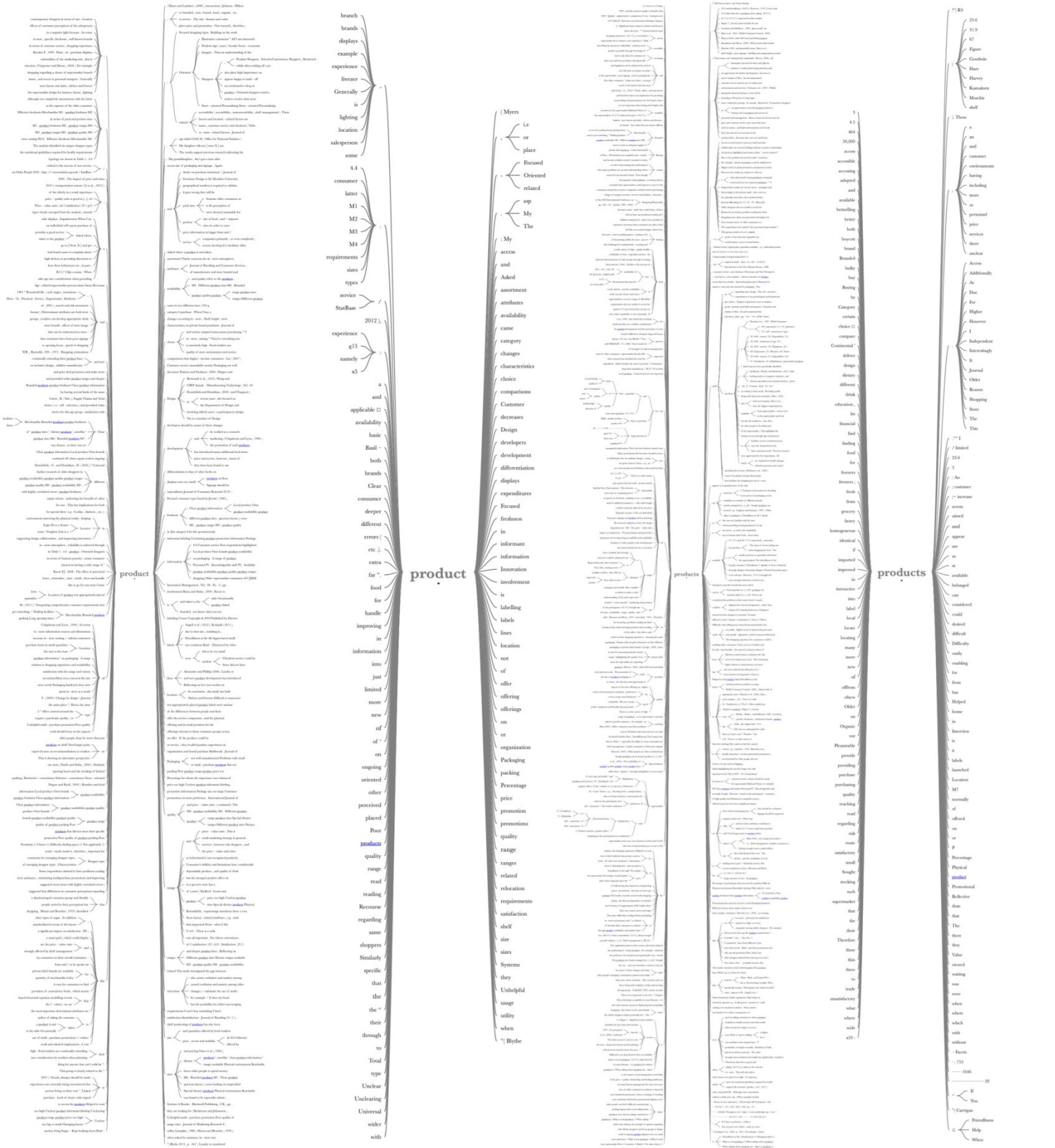
With minimum length: 3

Summary | Word Cloud

Word	Length	Count	Weighted Percentage
shop'	5	1,437	1.39%
consumers'	10	1,387	1.34%
foods	5	867	0.84%
older	5	846	0.82%
retailing	9	807	0.78%
stores	6	783	0.76%
research'	9	634	0.61%
journals	8	513	0.50%
using	5	482	0.47%
supermarket	11	474	0.46%
service	7	460	0.44%
aging	5	437	0.42%
shoppers	8	426	0.41%
products'	9	419	0.41%
marketing	9	416	0.40%
study	5	415	0.40%
highlighted	11	55	0.05%
merchandising	13	55	0.05%
reasons	7	55	0.05%

B.12 Word cloud by using Nvivo12

B.13 Word tree for products by using Nvivo12



Appendix C Study 2: Card sorting method

C.1 Card sorting activities on Miro website

References

Q: Why these are very important to be solved in your current grocery shopping experience?

Demographics information

Q1: Age?

Q2: What gender do you identify as?

Q3: Does anyone live with your household? If Yes, how many?

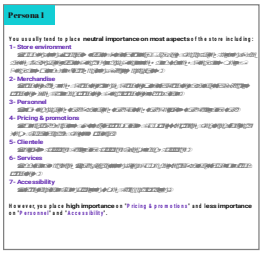
Dealing with technology

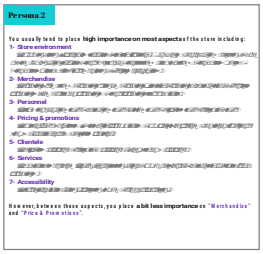
Q1: Do you have a smartphone or tablet?

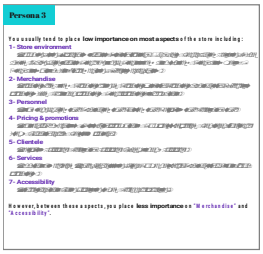
Q2: Do you currently use a smartphone or tablet?

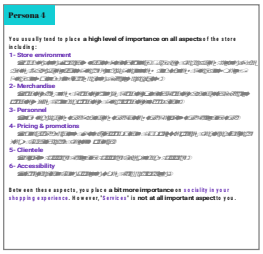
Q3: What technologies do you currently use?

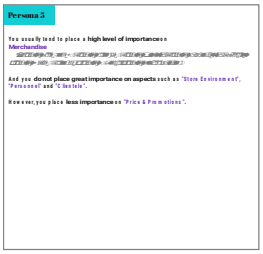
Q: Which of these personas are most likely to describe your grocery shopping behaviour?



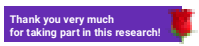








Q: Would you like to add or edit anything?



C.2 Overview of the ratings of the participants based on how important these issues are to be solved for them, where 1 is very important to be solved and 5 is not at all important to be solved

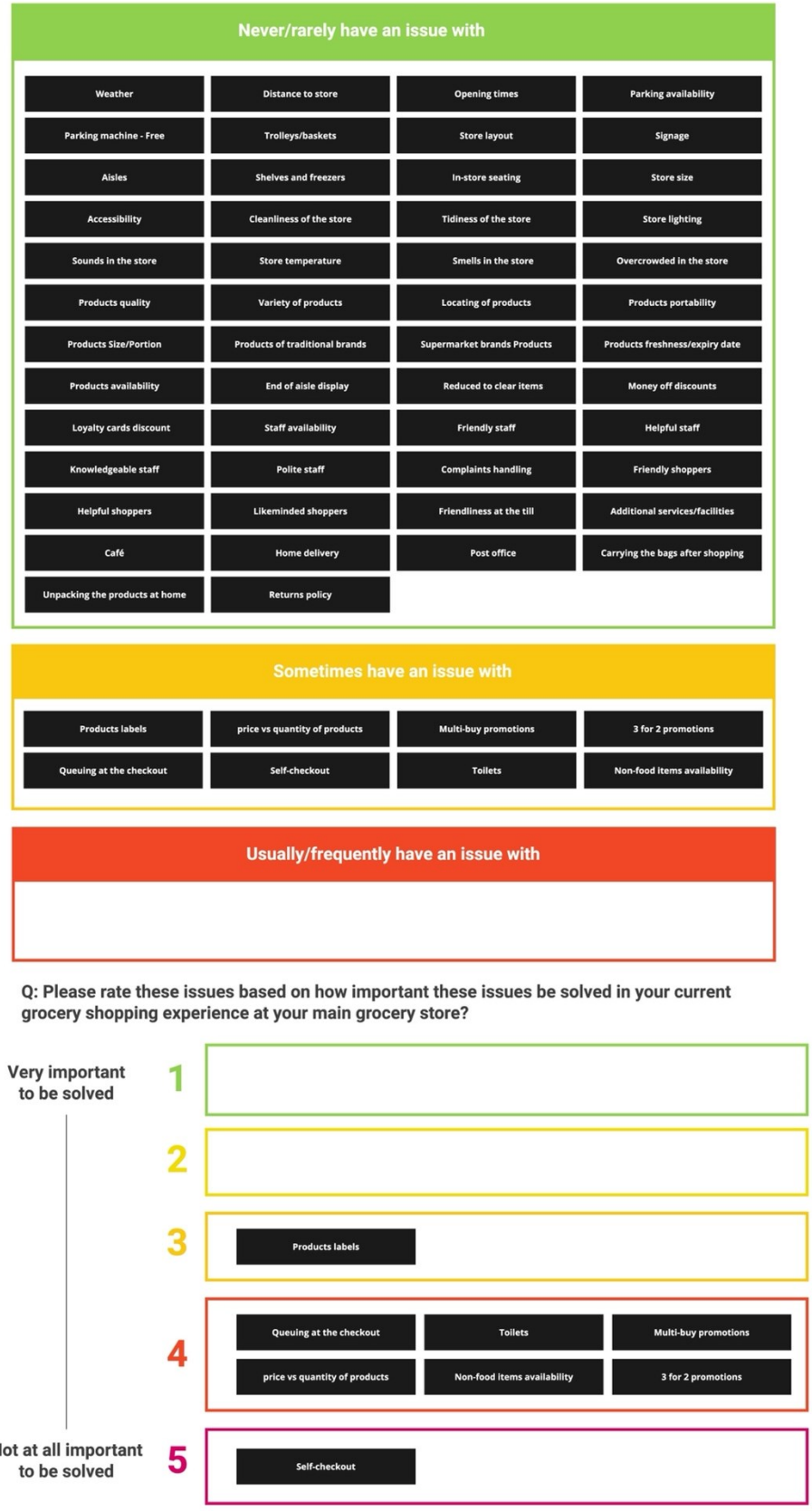
Touchpoint	P2.1	P2.2	P2.3	P2.4	P2.5	P2.6	P2.7	P2.8	P2.9	P2.10	P2.11	P2.12	P2.13
Staff availability		5	3	4	3		5	1	4	3			3
Multi-buy promotions	4		1	2	5	5	3	3					
Products labels	3		3		4	1	4			1			1
3 for 2 promotions	4		1	2	5	4	4						
Locating of products			3		3	2	3	4			3		
Products availability				2	2		3	3	3		2		
Tidiness of the store				3		2	5	2	2				2
Queuing at the checkout	4				4	1	3		2				
Friendly shoppers			4		4	3	5		5				
Signage			3		2	1	4		2				
Sounds in the store					2	2		2			1	4	
Knowledgeable staff				4		2	5				4		3
Store layout			3		1	1			2				
Home delivery		4			5					1			3
Overcrowded in the store			2		2				1			4	
Shelves and freezers					3	3				2			2
Products freshness/ expiry date				1		1			1				1

References

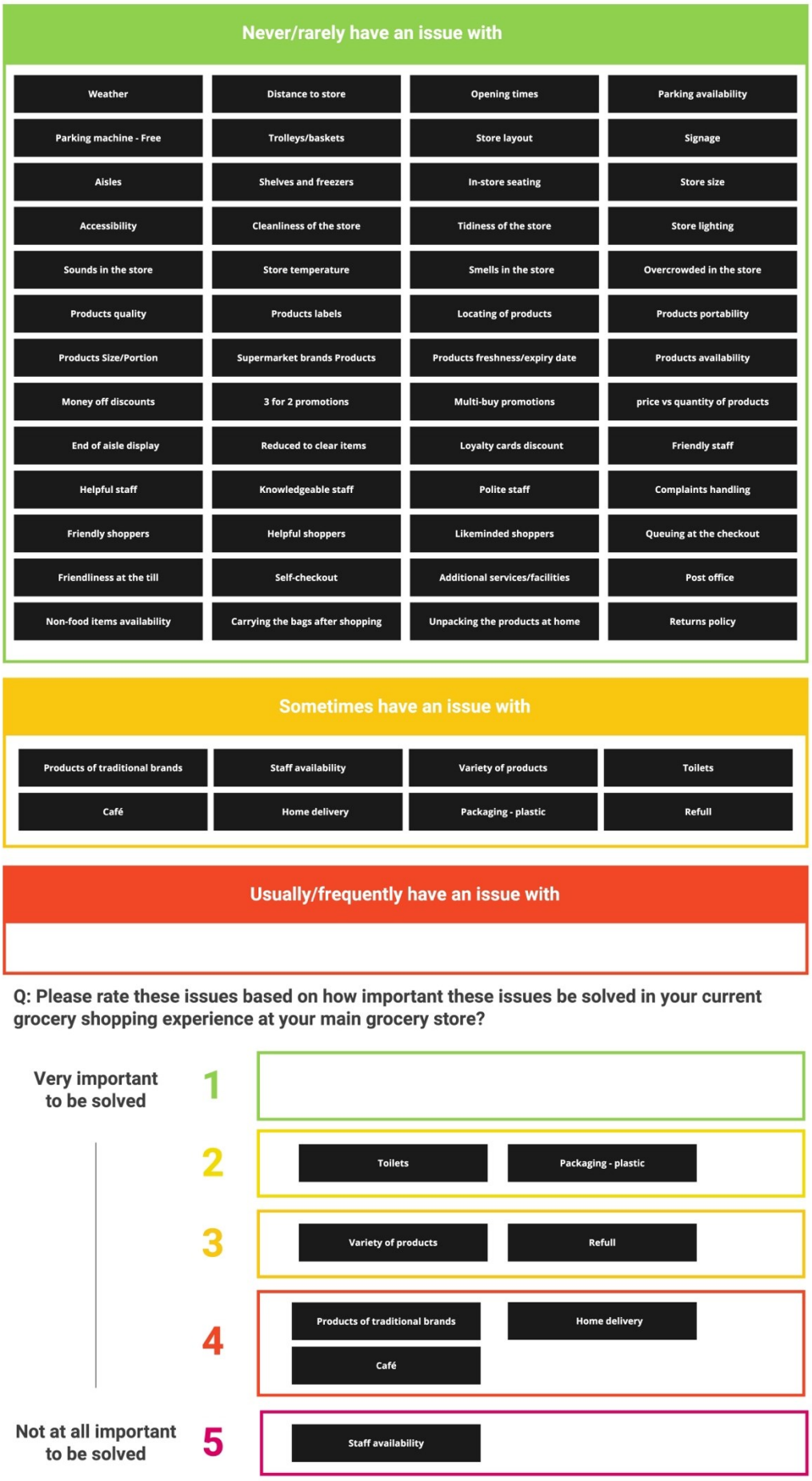
Toilets	4	2						1	1	
Products Size/Portion			4			3	1			5

C.3 The sorting and rating of the pain points based on each participant

C.3.1 Participant 1.1



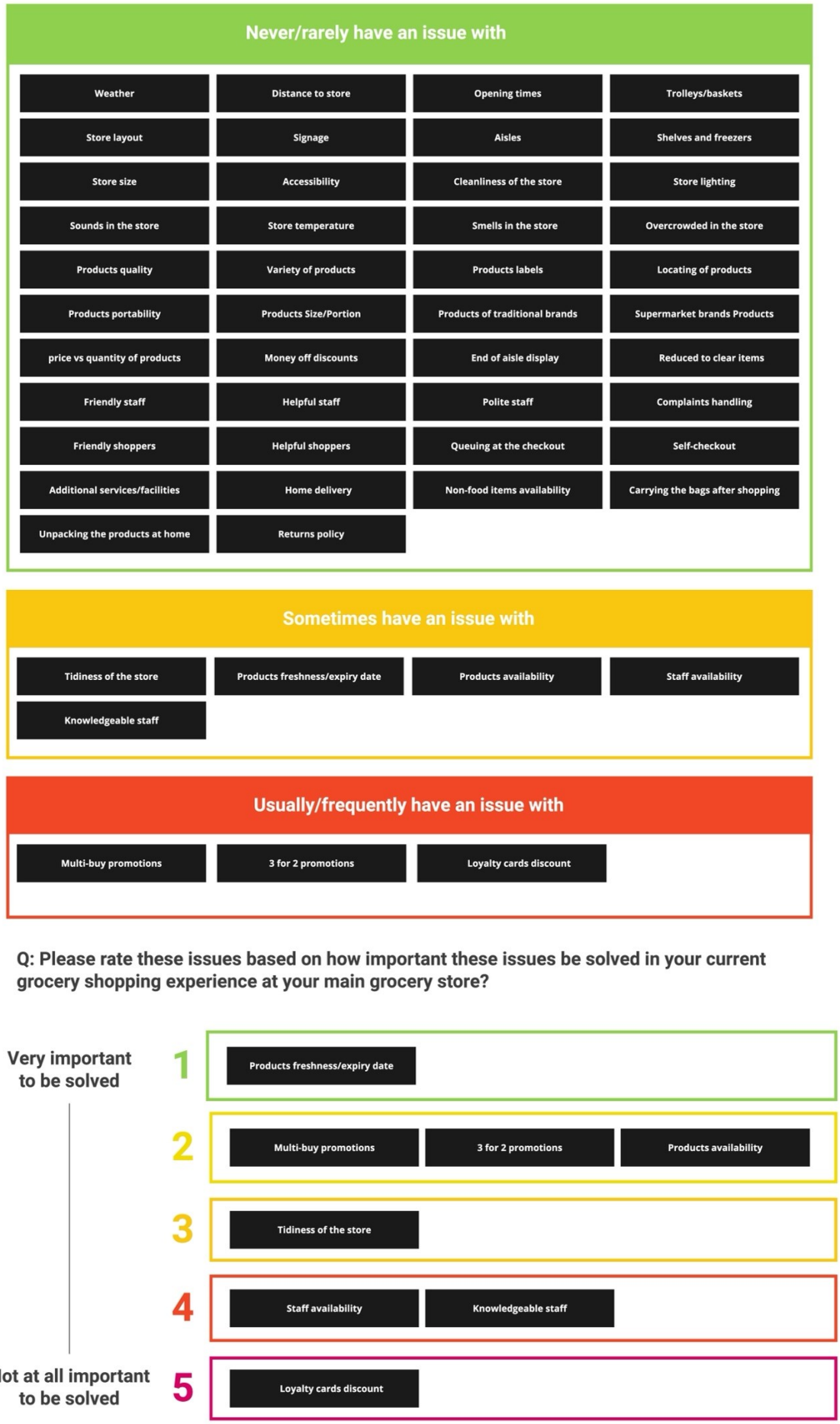
C.3.2 Participant 1.2



C.3.3 Participant 1.3

Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?

C.3.4 Participant 1.4

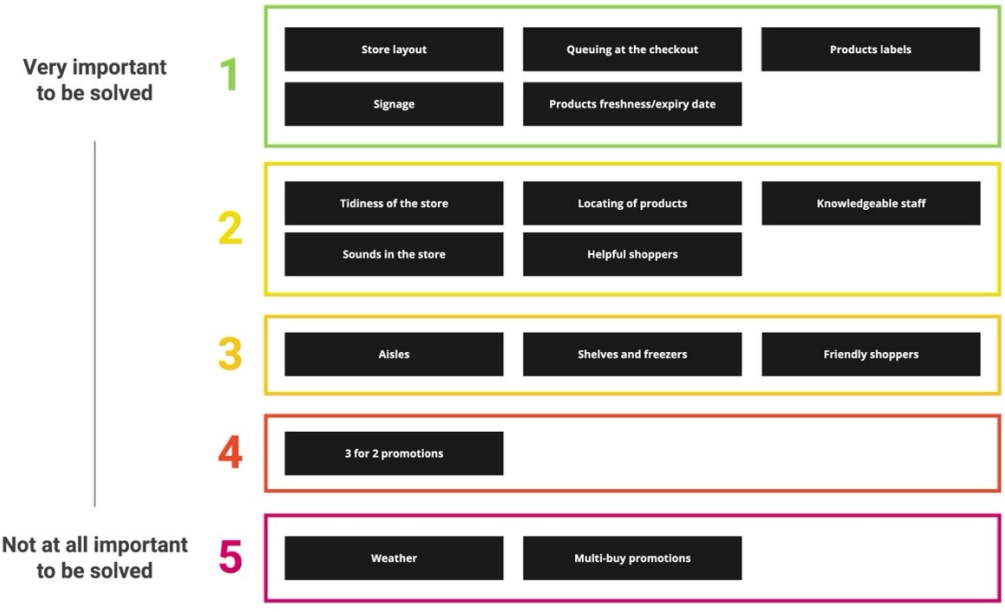


C.3.5 Participant 1.5

Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?

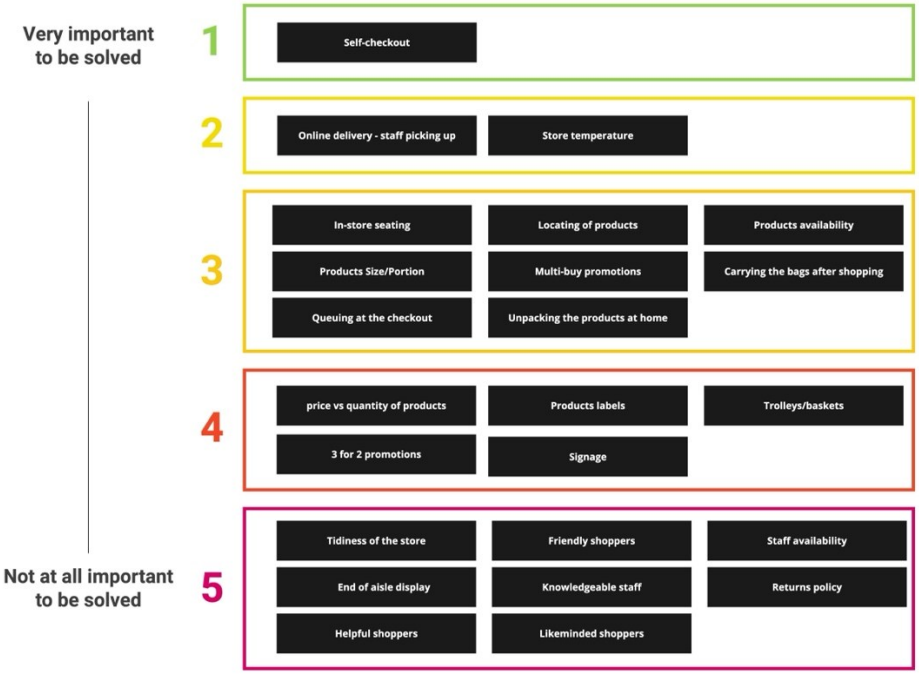
C.3.6 Participant 1.6

Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?



C.3.7 Participant 1.7

Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?



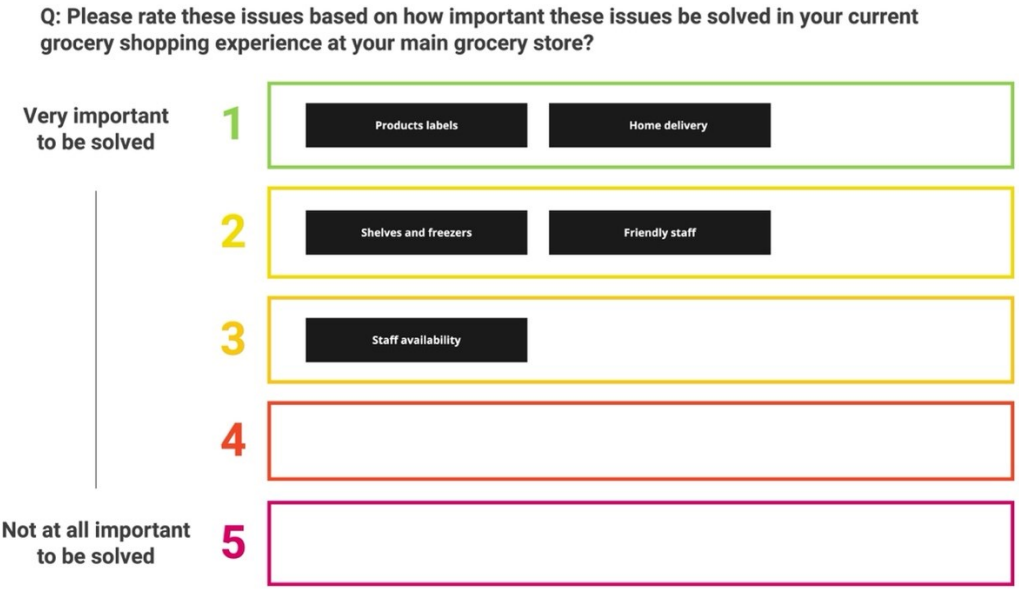
C.3.8 Participant 1.8

Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?

C.3.9 Participant 1.9

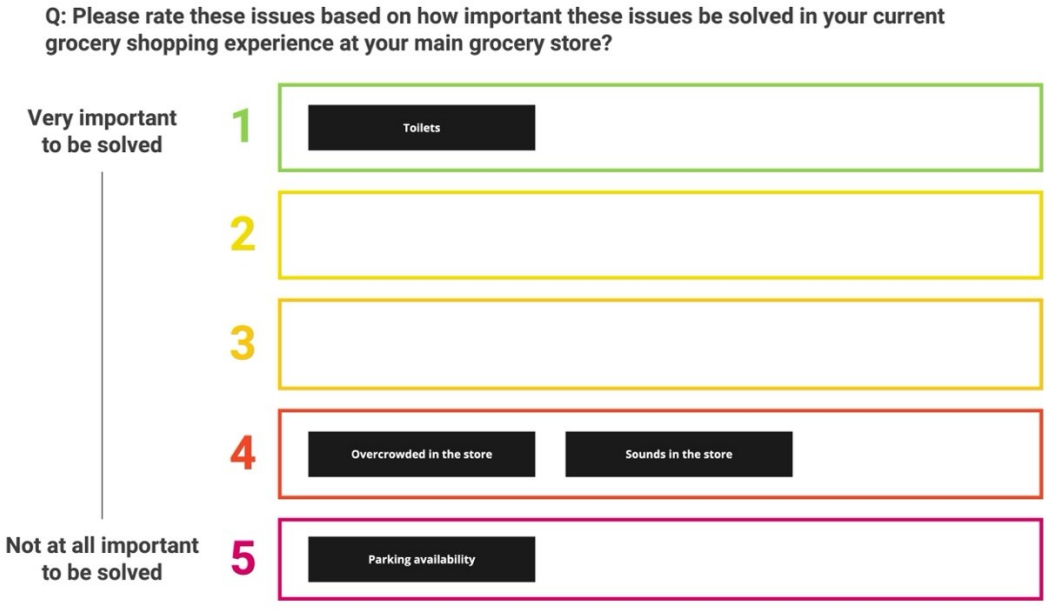
Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?

C.3.10 Participant 1.10

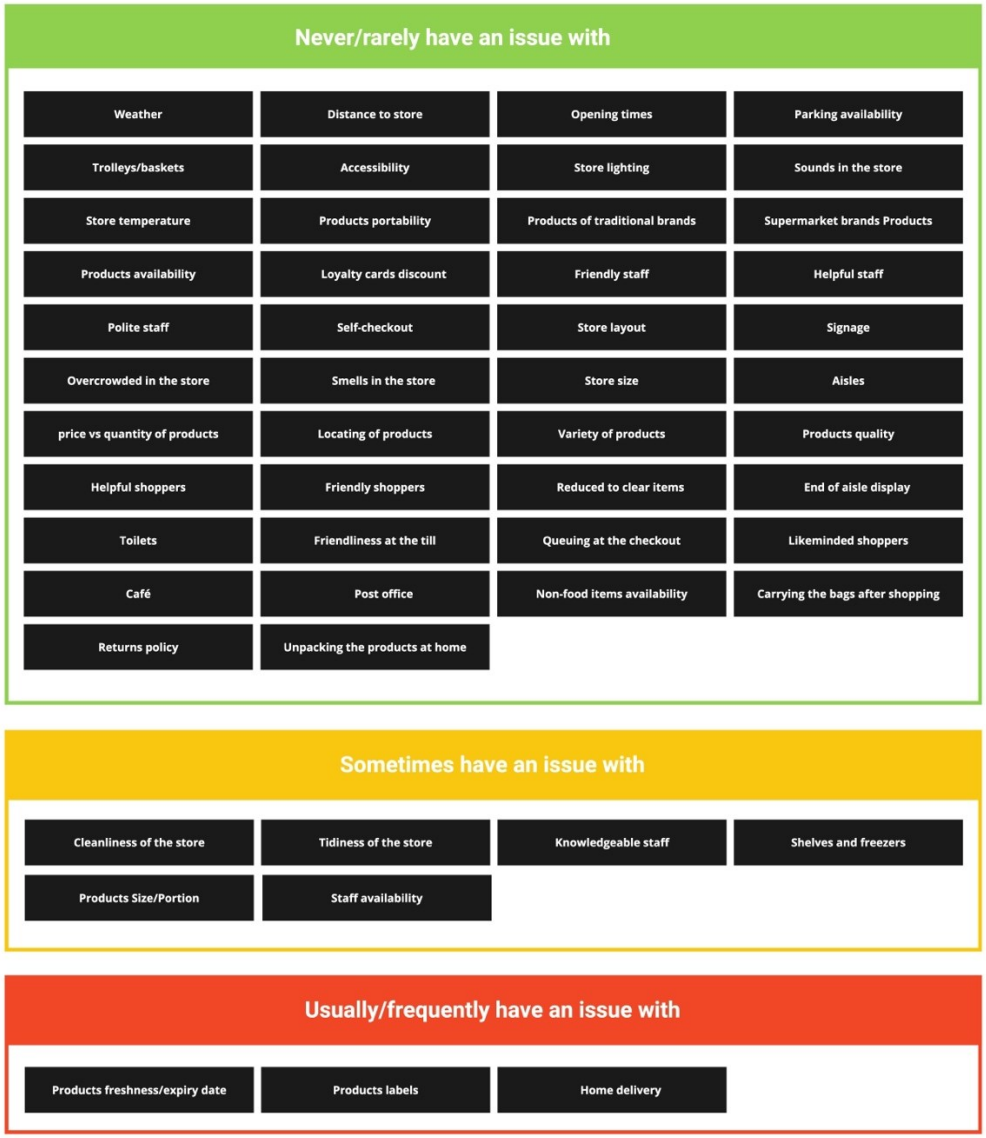


C.3.11 Participant 1.11

C.3.12 Participant 1.12



C.3.13 Participant 1.13



Q: Please rate these issues based on how important these issues be solved in your current grocery shopping experience at your main grocery store?

Appendix D Study 3: questionnaire method

D.1 The questionnaire using Microsoft Forms

Exploring the grocery shopping experience of customers aged 65+ in the UK

This questionnaire will take approximately 10 minutes to complete.

What is the research about?
This questionnaire is a part of a study focus on exploring the grocery shopping experience of customers aged 65+ in the UK. Carried out by Fahad Alhathal, a PhD student at the University of Southampton in the United Kingdom.
This study was approved by the Faculty Research Ethics Committee (FREC) at the University of Southampton (Ethics/ERGO Number: 62401).

What will happen to me if I take part?
This study involves completing an anonymous questionnaire which should take approximately 10 minutes of your time in one sitting. If you are happy to complete this questionnaire, you will need to tick (check) the box below to show your consent. As this questionnaire is anonymous, the researcher will not be able to know whether you have participated, or what answers you provided.

Why have I been asked to participate?
You have been asked to take part because you are aged 65 or over, doing your grocery shopping at a physical store in the UK before the pandemic(COVID-19) or during it.
I am aiming to recruit around 300 participants for this study.

What information will be collected?
The questions in this survey ask for information in relation to your grocery shopping behaviours. Also, your satisfaction and the importance of different aspects in your current grocery shopping journey. In addition, some demographics information (age, gender and household) and the use of technology. This information will help to analyse data and get a clear direction for the study
You do not have to answer all the questions if you do not wish to do so.

What are the possible benefits of taking part?
If you decide to take part in this study, you will not receive any direct benefits; however, your participation will contribute to knowledge in this area of research. Which will help to design a better grocery shopping experience for customer aged 65+ in the UK.

Are there any risks involved?
It is expected that taking part in this study will not cause you any psychological discomfort and/or distress, however, should you feel uncomfortable you can leave the survey at any time or contact the following resources for support: https://www.nhs.uk/conditions/stress-anxiety-depression/mental-health-helplines/ (https://www.nhs.uk/conditions/stress-anxiety-depression/mental-health-helplines/)

8/14/2021

What will happen to the information collected?
All information collected for this study will be stored securely on a password-protected computer and backed up on a secure server. In addition, all data will be pooled and only compiled into data summaries or summary reports. Only the researcher and their supervisor will have access to this information

The information collected will be analysed and written up as part of the researcher's thesis which may use to publish articles in academic journals or presented at conferences.

The University of Southampton conducts research to the highest standards of ethics and research integrity. In accordance with our Research Data Management Policy, data will be held for 10 years after the study has finished (March 2024) when it will be securely destroyed.

What happens if there is a problem?
If you are unhappy about any aspect of this study and would like to make a formal complaint, you can contact the Head of Research Integrity and Governance, University of Southampton, on the following contact details: Email: rgoinfo@soton.ac.uk (mailto:rgoinfo@soton.ac.uk), phone: + 44 2380 595058.
Please quote the Ethics/ERGO number above. Please note that by making a complaint you might be no longer anonymous.

More information on your rights as a study participant is available via this link:
https://www.southampton.ac.uk/about/governance/participant-information.page (https://www.southampton.ac.uk/about/governance/participant-information.page)

Thank you for reading this information sheet and considering taking part in this research.
University of Southampton
Researcher: Fahad Alhathal
University email: f.i.alhathal@soton.ac.uk
Ethics/ERGO no: 62401
Version and date: 02 – 10/06/2021

* Required

Agreement to take part in the study

8/14/2021

1

Please tick (check) this box to indicate that you have read and understood the information on this form and are aged 65 or over and agree to take part in this questionnaire. *

◯ Yes I agree

8/14/2021

Shopping Behaviour

2

Which of these stores do you consider as your main grocery store? (Please select one) This store will be referred to as the main grocery store in the following questions. *

- ○ Asda
- ○ Aldi
- ○ Budge
- ○ Costco
- ○ The Co-operative (Co-op)
- ○ Lidl
- ○ Marks and Spencer
- ○ Morrisons
- ○ Iceland
- ○ Tesco
- ○ Sainsbury's
- ○ Waitrose
- ○ Independent convenience store/local shop (e.g. local grocery stores)
- ○ Branded convenience store/local shop (e.g. Costcutter, SPAR, Nisa)
- ○ Supermarket-owned convenience store (e.g. Sainsbury's Local, Tesco Express)
- ○ Butcher/Greengrocer/Baker
- ○ Open markets (street market, farmer's market)
- ○ No main store, I visit different stores equally
- ○ [ ] Other

8/14/2021

3

Has the frequency of your grocery shopping in a physical store changed with the pandemic(COVID-19)? *

- ◯ Yes
- ◯ No

4

What is the frequency of your grocery shopping in a physical store? *

- ◯ Daily
- ◯ Between two to six times per week
- ◯ Once a week
- ◯ Once every two weeks
- ◯ Less often

5

Before the pandemic(COVID-19), what is the frequency of your grocery shopping in a physical store? *

- ◯ Daily
- ◯ Between two to six times per week
- ◯ Once a week
- ◯ Once every two weeks
- ◯ Less often

8/14/2021

6

During the pandemic(COVID-19), what is the frequency of your grocery shopping in a physical store? *

- ○ Daily
- ○ Between two to six times per week
- ○ Once a week
- ○ Once every two weeks
- ○ Less often

8/14/2021

Labelling

7

How often do you read the information on a packaging or product? [In the store or at home] *

- ◯ Once a week or more
- ◯ One or more times a month
- ◯ Once every few months
- ◯ Less often than once every few months
- ◯ Never

8

Do you require any special dietary requirements?

Please select all that apply

- ☐ No dietary requirements
- ☐ Alcohol content
- ☐ Gluten-free
- ☐ Low fat
- ☐ Low sodium
- ☐ Low sugar
- ☐ Nut allergy
- ☐ Vegan
- ☐ Vegetarian
- ☐ _____

Other

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9

The information on a packaging or product *

To what extent do you agree or disagree with these statements regarding the information on a packaging or product at your main grocery store?

	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
I find the information on a packaging or product is difficult to read	○	○	○	○	○
I would like to read the information on a packaging or product more often if it was clearer	○	○	○	○	○
I regularly look at the nutritional information on packaging or product (e.g. salt, sugar and fat content)	○	○	○	○	○
The font size used for the information on packaging or product is too small (e.g. for instructions or ingredients)	○	○	○	○	○
Cooking instructions on packaging/products are usually clear	○	○	○	○	○
I look for products with the longest use-by dates	○	○	○	○	○
Contrast and colours of the information on packaging or product are usually good	○	○	○	○	○

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10

Which of these elements are important to you on a packaging/product information

Please select all that apply

- [ ] Ingredients
- [ ] Dietary requirements
- [ ] Storage instructions
- [ ] Cooking instructions
- [ ] Ethical information (e.g sourcing, sustainability)
- [ ] Origin - where come from
- [ ] Other

11

How important is packaging/product information to you in-store at your main grocery store? *

	1	2	3	4	5	6	7	
Not at all important	○	○	○	○	○	○	○	Very Important

12

How satisfied or dissatisfied are you with packaging/product information in-store at your main grocery store? *

Very dissatisfied ☆ ☆ ☆ ☆ ☆ ☆ ☆ Very satisfied

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13

Shelf labelling *

To what extent do you agree or disagree with these statements regarding shelf labelling at your main grocery store?

	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
I find shelf labels hard to read	○	○	○	○	○
Font size for unit price is too small to read on shelf labelling (i.e. price you pay per item)	○	○	○	○	○
I like to compare prices by weight	○	○	○	○	○
Font size for comparative weight price is too small (e.g. price per 100g)	○	○	○	○	○
It is difficult to work out what is the best value when items are on promotion when comparing with non-promotion products	○	○	○	○	○
It can be confusing to know which items are on promotion if labels refer to a particular package size, flavour etc.	○	○	○	○	○
The shelf labels hard to read because it is positioned too high/low	○	○	○	○	○
It is hard to read the shelf labels because there is no enough lighting in the store	○	○	○	○	○

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	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
The shelf labels are hard to read because of their colours and contrast	○	○	○	○	○

14

How important are shelf labels to you at your main grocery store? *

	1	2	3	4	5	6	7	
Not at all important	○	○	○	○	○	○	○	Very Important

15

How satisfied or dissatisfied are you with shelf labels at your main grocery store? *

Very dissatisfied ☆ ☆ ☆ ☆ ☆ ☆ ☆ Very satisfied

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Store layout and products

16

How do you often find or locate a product? *

Please select all that apply

- [ ] Using overhead signage as a guide
- [ ] Asking a member of the store staff
- [ ] I know where the product is because I'm familiar with the store
- [ ] Asking a customer
- [ ] By guessing
- [ ] Other

8/14/2021

17

Store layout *

To what extent do you agree or disagree with these statements regarding store layout at your main grocery store?

	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
I think the layout/ordering of products is logical (e.g. fresh produce first, different product grouping, frozen food at end)	○	○	○	○	○
The shopping aisles are not wide enough to shop comfortably when it is busy	○	○	○	○	○
There are often staff obstructing the aisles while they replenish stock or picking up for online orders	○	○	○	○	○
There is not enough space after the checkouts to manage the thoroughfare of customers packing and leaving	○	○	○	○	○
The current overhead signage is helpful for locating items on each aisle	○	○	○	○	○
It is easy to find the exact location of a product when you know in which aisle	○	○	○	○	○

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18

How important are store layout and ease of in-store navigation to you at your main grocery store? *

	1	2	3	4	5	6	7	
Not at all important	○	○	○	○	○	○	○	Very Important

19

How satisfied or dissatisfied are you with store layout and ease of in-store navigation at your main grocery store? *

Very dissatisfied ☆ ☆ ☆ ☆ ☆ ☆ ☆ Very satisfied

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20

Products availability and location *

To what extent do you agree or disagree with these statements regarding products availability and location at your main grocery store?

	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
It is annoying when the product I want is out of stock	○	○	○	○	○
It is easy to find an alternative product when the product I want is out of stock	○	○	○	○	○
It is frustrating when the grocery store moves the products around the store.	○	○	○	○	○
It is confusing when I can not find a product in the expected location	○	○	○	○	○
I often ask staff to check for a product in their back stock because they might have it but no one has time to bring it to the shelves	○	○	○	○	○
It is a good idea when grocery store moves the products around the shop to give a chance to discover new products	○	○	○	○	○
It is easy to reach products on the top shelves or in the bottom of freezers	○	○	○	○	○

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21

How important are products availability and location to you at your main grocery store? *

	1	2	3	4	5	6	7	
Not at all important	○	○	○	○	○	○	○	Very Important

22

How satisfied or dissatisfied are you with products availability and location at your main grocery store? *

Very dissatisfied ☆ ☆ ☆ ☆ ☆ ☆ ☆ Very satisfied

8/14/2021

Checkouts

23

How often do you use a self-checkout machine for your grocery shopping at your main grocery store? *

- ◯ Always
- ◯ Once a week or more
- ◯ One or more times a month
- ◯ Once every few months
- ◯ Less often than once every few months
- ◯ Never

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24

How often do you use a shopping support device (such as a handheld scanner, scan as you shop app) for your grocery shopping at your main grocery store? *

- ○ Always
- ○ Once a week or more
- ○ One or more times a month
- ○ Once every few months
- ○ Less often than once every few months
- ○ Never

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25

Checkouts *

To what extent do you agree or disagree with these statements regarding checkouts at your main grocery store?

	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
I don't use self-checkouts because I find the technology too challenging	○	○	○	○	○
I don't use self-checkouts because I find their unreliability irritating	○	○	○	○	○
I don't use self-checkouts because I prefer the human interaction at the staffed checkout	○	○	○	○	○
I don't use self-checkouts because I feel embarrassed to ask employees for help when I need it	○	○	○	○	○
I find it tiring to stand in a checkout queue for too long, such as for 10 minutes	○	○	○	○	○
Checkout staff often scan shopping too fast	○	○	○	○	○
It is easy to unload my shopping from the trolley onto the checkout belt	○	○	○	○	○
I often feel rushed at the checkout by staff	○	○	○	○	○
It can be difficult to lift my shopping off the checkout and back into the trolley once bagged	○	○	○	○	○

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	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly
I am happy for staff to engage in a long conversation with me at the checkout	○	○	○	○	○
I like to have help with my packing	○	○	○	○	○
I would like to be able to shop in-store then deliver my groceries"stuff" to the home on the same day	○	○	○	○	○

26

How important is checkouts to you at your main grocery store? *

	1	2	3	4	5	6	7	
Not at all important	○	○	○	○	○	○	○	Very Important

27

How satisfied or dissatisfied are you with checkouts at your main grocery store? *

Very dissatisfied ☆ ☆ ☆ ☆ ☆ ☆ ☆ Very satisfied

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Dealing with technology

28

Do you have a smartphone or tablet? *

(e.g. iPhone, Android phone, iPad, Samsung Galaxy Tab)

- ◯ Yes
- ◯ No

29

Do you currently use a smartphone or tablet? *

(e.g. iPhone, Android phone, iPad, Samsung Galaxy Tab)

- ◯ Yes
- ◯ No

30

On average, how often do you use a smartphone or tablet?

- ◯ Every day, or almost every day
- ◯ At least once a week (but not every day)
- ◯ At least once a month (but not every week)
- ◯ At least once every 3 months
- ◯ Less than every 3 months
- ◯ Never

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Overall Shopping Satisfaction

31

How well do your main grocery store meets your needs? *

	1	2	3	4	5	6	7	8	9	10	
Not at all well	○	○	○	○	○	○	○	○	○	○	Extremely well

32

Overall, how satisfied or dissatisfied are you with your main grocery store? *

Very dissatisfied ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ Very satisfied

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Demographics information

33

Please rank each of the following aspects in order of importance to you at your main grocery store (with the top being the most important aspect to the bottom being the least important aspect)

Store environment (e.g. Good lighting, Spacious layout, Quality trolleys & baskets, Reachable shelving, Wide aisles, Navigable layout, Clear signage, Cleanliness and tidiness, Pleasant smells, Pleasant sounds, In-store seating, Efficient checkouts)

Merchandise (e.g. Product freshness, Product ranges, Product quality, Product availability, Different product sizes, Branded products, Clear product information)

Personnel (e.g. Knowledgeable staff, Available staff, Polite staff, Helpful staff, Friendly staff)

Pricing & promotions (e.g. Money-off discounts, Multi-buy promotions, Competitive prices, Reduced-to-clear items, Loyalty cards, Returns policy)

Clientele (e.g. Helpful shoppers, Friendly shoppers, Likeminded shoppers)

Services (e.g. Additional services (cafe, key cutting, etc), Home delivery, Availability of non-food products)

Accessibility (e.g. Store location, Long opening times, Free car parking, Underground parking)

All these aspects not important at all

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34

Which of these descriptions are most likely to describe your grocery shopping behaviour?

1- Store environment (e.g. Good lighting, Spacious layout, Quality trolleys & baskets, Reachable shelving, Wide aisles, Navigable layout, Clear signage, Cleanliness and tidiness, Pleasant smells, Pleasant sounds, In-store seating, Efficient checkouts)
2- Merchandise (e.g. Product freshness, Product ranges, Product quality, Product availability, Different product sizes, Branded products, Clear product information)
3- Personnel (e.g. Knowledgeable staff, Available staff, Polite staff, Helpful staff, Friendly staff)
4- Pricing & promotions (e.g. Money-off discounts, Multi-buy promotions, Competitive prices, Reduced-to-clear items, Loyalty cards, Returns policy)
5- Clientele (e.g. Helpful shoppers, Friendly shoppers, Likeminded shoppers)
6- Services (e.g. Additional services (cafe, key cutting, etc), Home delivery, Availability of non-food products)
7- Accessibility (e.g. Store location, Long opening times, Free car parking, Underground parking)

- ◯ I usually tend to place neutral importance on most aspects of the store including Store environment, Merchandise , Personnel, Pricing & promotions, Clientele, Services and Accessibility. However, I place high importance on "Pricing & promotions" and less on "Personnel" and "Accessibility".
- ◯ I usually tend to place high importance on most aspects of the store including Store environment, Merchandise, Personnel, Pricing & promotions, Clientele, Services and Accessibility. However, between these aspects, I place a bit less importance on "Merchandise" and "Price & Promotions".
- ◯ I usually tend to place low importance on most aspects of the store including Store environment, Merchandise, Personnel, Pricing & promotions, Clientele, Services and Accessibility. However, between these aspects, I place less importance on "Merchandise" and "Accessibility".
- ◯ I usually tend to place a high level of importance on all aspects of the store including Store environment, Merchandise, Personnel, Pricing & promotions, Clientele and Accessibility. Between these aspects, I place a bit more importance on sociality in my shopping experience. However, "Services" is not at all important aspect to me.
- ◯ I usually tend to place a high level of importance on "Merchandise" and I do not place great importance on aspects such as "Store Environment", "Personnel" and "Clientele". However, I place less importance on "Price & Promotions".
- ◯ None of the above describes my grocery shopping behaviour.

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35

What is your age *

- ◯ Under 65
- ◯ 65-69
- ◯ 70-74
- ◯ 75-79
- ◯ 80-84
- ◯ 85 and over

36

What gender do you identify as? *

- ◯ Female
- ◯ Male
- ◯ Non-binary
- ◯ Prefer not to say

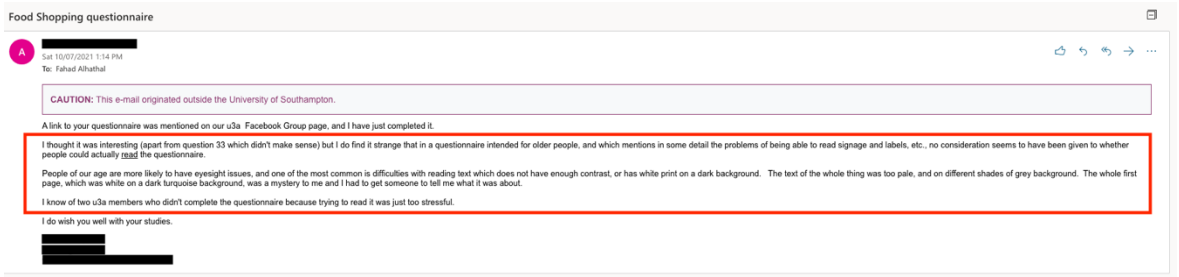
37

How many people are in your household?

- ◯ 1 (Only you)
- ◯ 2 (including you)
- ◯ 3 (including you)
- ◯ 4 and more (including you)
- ◯ Prefer not to say

8/14/2021

D.2 Emails from some participants regarding problems using Microsoft Forms



Food Shopping questionnaire

A [redacted]
Sat 10/07/2021 1:14 PM
To: Fahad Alhathal

CAUTION: This e-mail originated outside the University of Southampton.

A link to your questionnaire was mentioned on our u3a Facebook Group page, and I have just completed it.

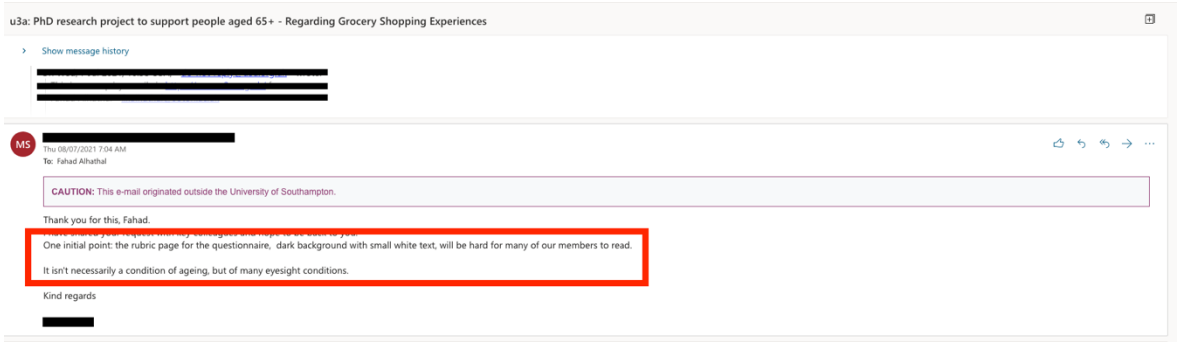
I thought it was interesting (apart from question 33 which didn't make sense) but I do find it strange that in a questionnaire intended for older people, and which mentions in some detail the problems of being able to read signage and labels, etc., no consideration seems to have been given to whether people could actually read the questionnaire.

People of our age are more likely to have eyesight issues, and one of the most common is difficulties with reading text which does not have enough contrast, or has white print on a dark background. The text of the whole thing was too pale, and on different shades of grey background. The whole first page, which was white on a dark turquoise background, was a mystery to me and I had to get someone to tell me what it was about.

I know of two u3a members who didn't complete the questionnaire because trying to read it was just too stressful.

I do wish you well with your studies.

[redacted]



u3a: PhD research project to support people aged 65+ - Regarding Grocery Shopping Experiences

Show message history

[redacted]

MS [redacted]
Thu 08/07/2021 7:04 AM
To: Fahad Alhathal

CAUTION: This e-mail originated outside the University of Southampton.

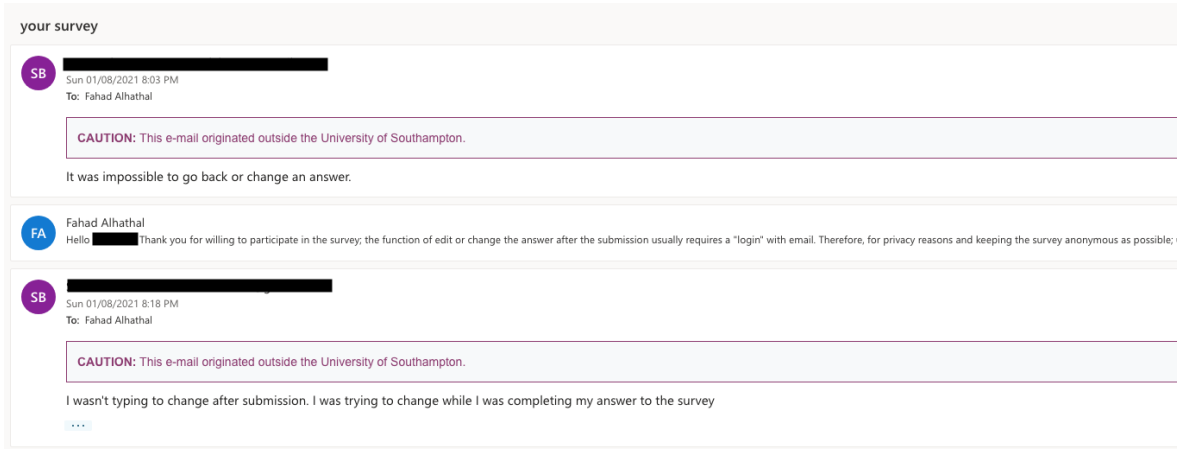
Thank you for this, Fahad.

One initial point: the rubric page for the questionnaire, dark background with small white text, will be hard for many of our members to read.

It isn't necessarily a condition of ageing, but of many eyesight conditions.

Kind regards

[redacted]



your survey

SB [redacted]
Sun 01/08/2021 8:03 PM
To: Fahad Alhathal

CAUTION: This e-mail originated outside the University of Southampton.

It was impossible to go back or change an answer.

FA Fahad Alhathal
Hello [redacted] Thank you for willing to participate in the survey; the function of edit or change the answer after the submission usually requires a "login" with email. Therefore, for privacy reasons and keeping the survey anonymous as possible;

SB [redacted]
Sun 01/08/2021 8:18 PM
To: Fahad Alhathal

CAUTION: This e-mail originated outside the University of Southampton.

I wasn't typing to change after submission. I was trying to change while I was completing my answer to the survey

...

Appendix E Study 4: card sorting materials

E.1 Pre-session questionnaire

BACKGROUND SURVEY
Please finish this survey and return it back with the Consent Form to f.i.alhathal@soton.ac.uk

---

HOW TO FILL THIS SURVEY
Please answer the single choice and multiple-choice questions by:

- Underline the answer

OR

- Make the answer **bold**

OR

- Change the colour of the answer

Shopping Habits

Q1: What stores do you use to do your grocery shopping? *Please select all that apply*

- Asda
- Aldi
- Budgens
- Costco
- The Co-operative (Co-op)
- Lidl
- Marks and Spencer
- Morrison's
- Iceland
- Tesco
- Sainsbury's
- Waitrose
- Independent convenience store/local shop (e.g. local grocery stores)
- Branded convenience store/local shop (e.g. Costcutter, SPAR, Nisa)
- Supermarket-owned convenience store (e.g. Sainsbury's Local, Tesco Express)
- Butcher/Greengrocer/Baker
- Open markets (street market, farmer's market)
- Other (please specify): ……..

Q2: Which store do you mainly use for grocery shopping? *For example: Waitrose, Sainsbury's, Lidl, etc.*

Q3: Where is your main grocery store? *For example: Sainsbury's Portswood, Winchester Iceland etc. "This store will be referred to as your main grocery store in the following questions"*

Q4: What is the frequency of your grocery shopping in general?

- Daily
- Between two to six times per week
- Once a week
- Once every two weeks
- Less often

Q5: How often do you visit your main grocery store?

- Daily
- Between two to six times per week
- Once a week
- Once every two weeks
- Less often

Q6: How do you travel to your main grocery store? *Please select all that apply*

- Foot
- By car
- By public bus
- By private bus service (e.g. dial-a-ride)
- By taxi
- By train
- By bicycle
- By mobility scooter
- Other (please specify): .....

Q7: How do you normally shop at your main grocery store?

- Alone
- With someone
- Other (please specify): .....

Dealing with technology

Q1: Do you have a smartphone or tablet? *For example: iPhone, Galaxy Samsung, iPad, etc*

- Yes
- No

Q2: Do you currently use a smartphone or tablet?

- Yes
- No

Q3: Do you use any navigation apps? *For example: Google Maps, Waze, etc*

- Yes
- No

Q4: If you use any a navigation apps, please specify the names? *For example: Google Maps, Waze, etc*

Demographics information

Q1: What is your age? *For example: 68 years*

Q2: What gender do you identify as?

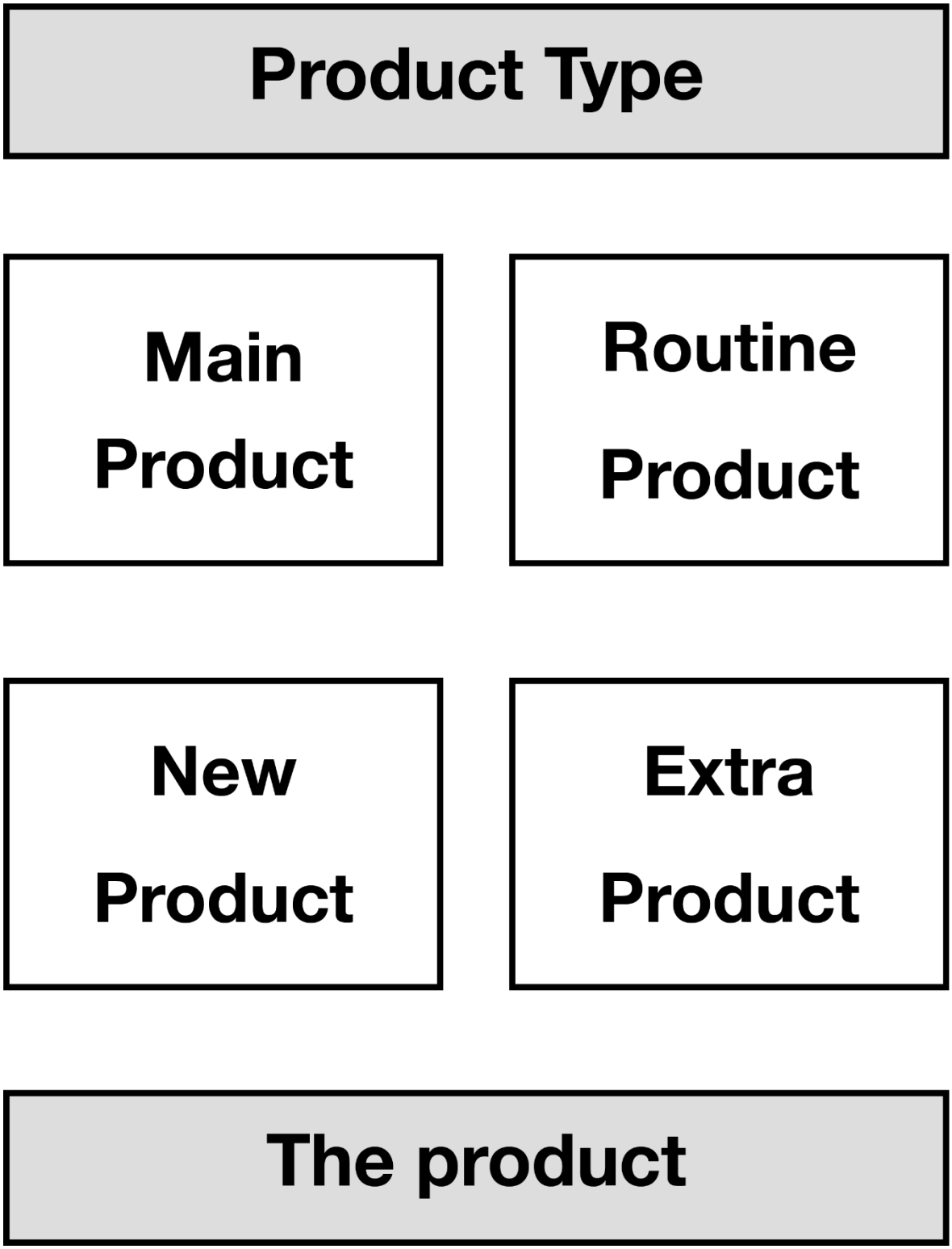
- Female
- Male
- Non-binary
- Prefer not to say

Q3: How many people are in your household?

Thank you for your time!

Study title: Enhancing the grocery shopping experience of customers aged 65+ in the UK by using emerging technologies
Researcher name: Fahad Alhathal
ERGO number: 62401

E.2 Stage one: materials related to recall previous experiences from the participants



What happen?

Ask staff

How often do you use this way?
Never ○○○○○○○ Always

How useful using this way?
Not at all useful ○○○○○○○ Exteremly useful

How confident are you with this option?
Not at all confident ○○○○○○○ Exteremly confident

Look around

How often do you use this way?
Never ○○○○○○○ Always

How useful using this way?
Not at all useful ○○○○○○○ Exteremly useful

How confident are you with this option?
Not at all confident ○○○○○○○ Exteremly confident

Search online before going to the store

How often do you use this way?
Never ○○○○○○○ Always

How useful using this way?
Not at all useful ○○○○○○○ Exteremly useful

How confident are you with this option?
Not at all confident ○○○○○○○ Exteremly confident

Ask a customer

How often do you use this way?
Never ○○○○○○○ Always

How useful using this way?
Not at all useful ○○○○○○○ Exteremly useful

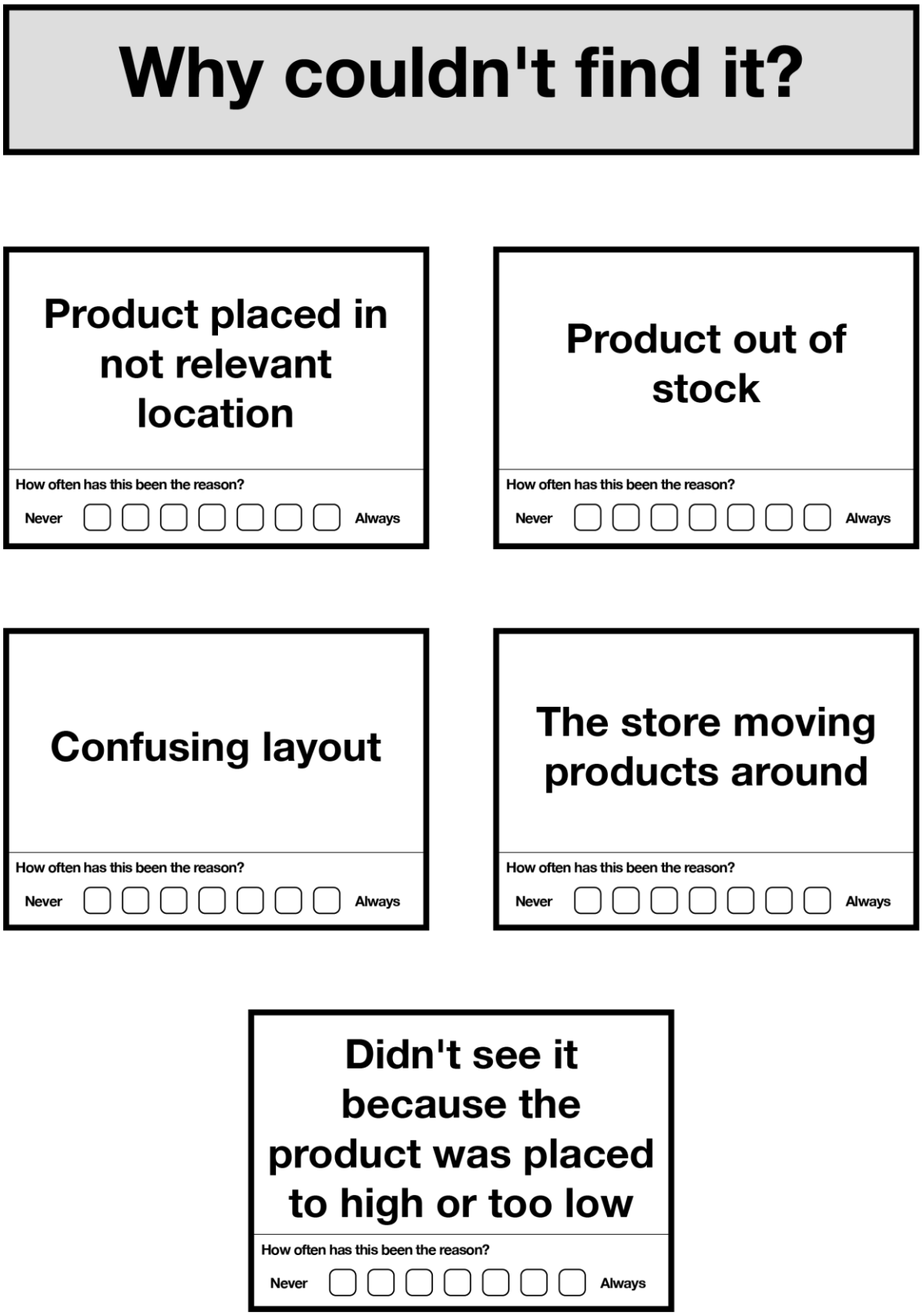
How confident are you with this option?
Not at all confident ○○○○○○○ Exteremly confident

Use signage as a guide

How often do you use this way?
Never ○○○○○○○ Always

How useful using this way?
Not at all useful ○○○○○○○ Exteremly useful

How confident are you with this option?
Not at all confident ○○○○○○○ Exteremly confident


Why couldn't find it?
Product placed in not relevant location
How often has this been the reason?
Never
Always
Product out of stock
How often has this been the reason?
Never
Always
Confusing layout
How often has this been the reason?
Never
Always
The store moving products around
How often has this been the reason?
Never
Always
Didn't see it because the product was placed to high or too low
How often has this been the reason?
Never
Always

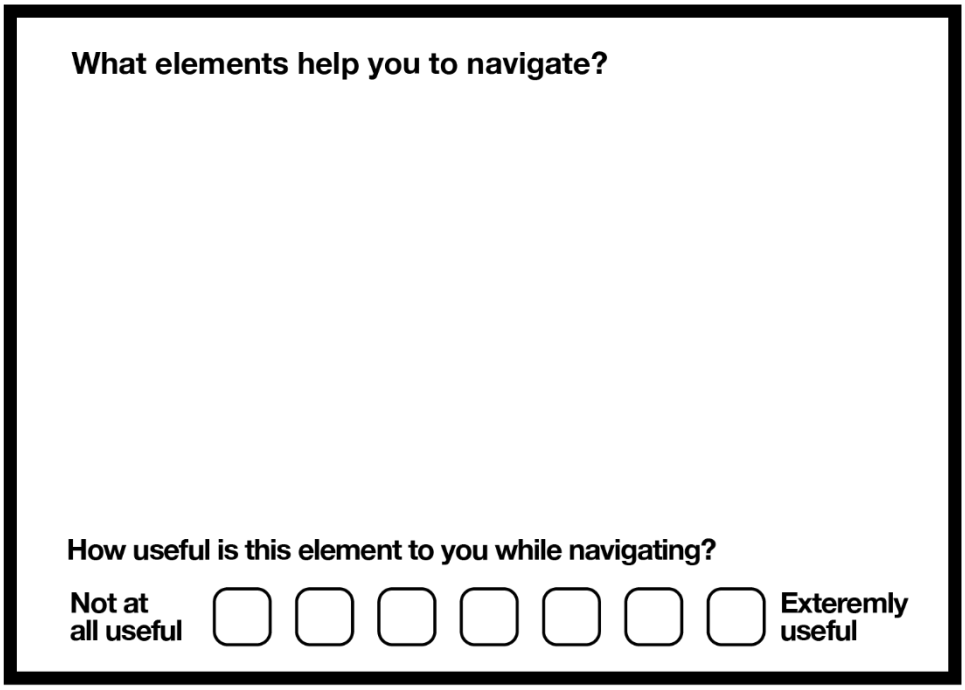
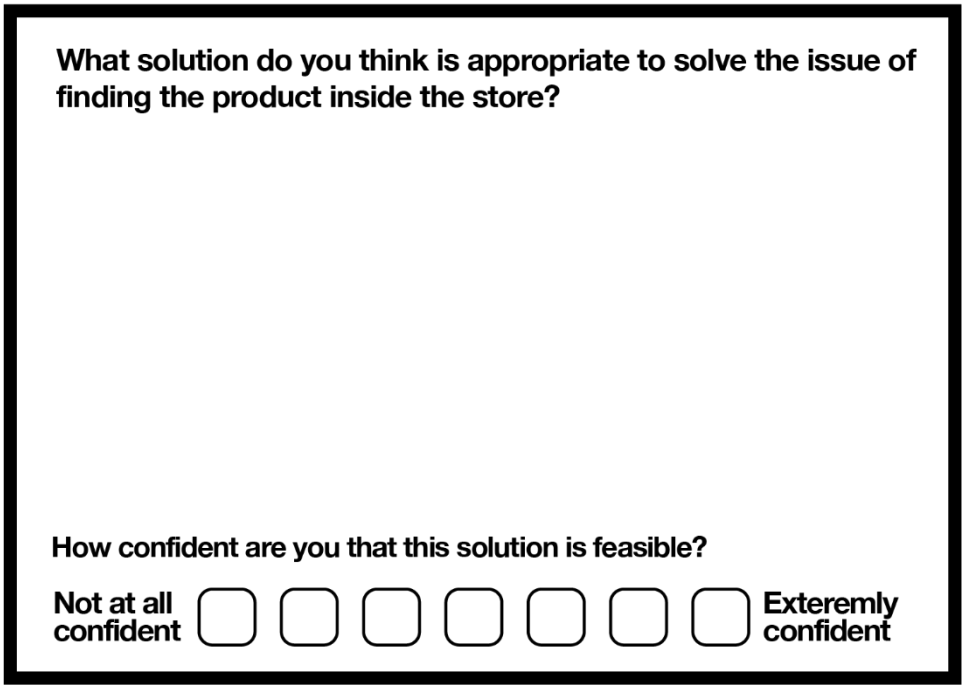
Next step?

Leave the store

Go to another

Look for an alternative

Leave the product for

E.3 Stage two: materials related to recall participants' experience if someone has asked them about a product location.

E.4 Stage three: materials related to understanding how participants navigate and finding possible solutions