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Title	Disrupting routines, facilitating control: exploring a change towards healthier food purchasing behaviour using a health app
Authors	Flaherty, Sarah Jane
Publication date	2019
Original Citation	Flaherty, S. J. 2019. Disrupting routines, facilitating control: exploring a change towards healthier food purchasing behaviour using a health app. PhD Thesis, University College Cork.
Type of publication	Doctoral thesis
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Disrupting Routines, Facilitating Control: Exploring a Change Towards Healthier Food Purchasing Behaviour Using a Health App

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A thesis submitted to the National University of Ireland, Cork for the degree of Doctor of Philosophy in the School of Public Health

May 2019

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Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. The chapters that have been published are acknowledged and references are provided of the relevant publication. The work, upon which this thesis is based, was carried out in collaboration with a team of researchers and supervisors who are duly acknowledged in the text of the thesis. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.

Signature: _____

Date: _____

Research Dissemination

Peer-Reviewed Publications

Flaherty, S-J., McCarthy, M., Collins, A., & McAuliffe, F. (2019). A Different Perspective on Consumer Engagement: Exploring the Experience of Using Health Apps to Support Healthier Food Purchasing. *Journal of Marketing Management,* 35(3-4), 310-337. doi: 10.1080/0267257X.2019.1576756

Flaherty, S-J., McCarthy, M., Collins, A., & McAuliffe, F. (2018). Can existing mobile apps support healthier food purchasing behaviour? Content analysis of nutrition content, behaviour change theory and user quality integration. *Public Health Nutrition*, 21(2), 288-298. doi:10.1017/S1368980017002889

McCarthy, M., Collins, A., **Flaherty, S-J.,** McCarthy, S. (2017). Healthy eating habit: A role for goals, identity and self-control? *Psychology & Marketing*, 34 (8), 772–785. doi:10.1002/mar.21021

Conference Presentations (Oral and Poster)

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2018). Engaging Healthy Eating App Consumers: Importance of Context and Congruence. Oral presentation at the Colloquium on European Research in Retailing 2018, Surrey, 11th – 13th July 2018.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2018). Moving Beyond the Generic: The Importance of Capturing the Nuance in Consumer Engagement. Oral presentation at the Cork University Business School 2018 Postgraduate Research Symposium, Cork, 29th May 2018.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2018). Autonomy, Privacy, and Connection: qualitative exploration of factors influencing acceptance of healthy eating apps in a lower socioeconomic cohort. Oral presentation at 4th Annual UCL Centre for Behaviour Change Conference, London, 21st – 22nd February 2018.

Flaherty, S-J. (2018). Healthy Eating Apps – a Helping Hand? Invited Speaker at UCD Healthy Eating Week 2018, Dublin, 19th February 2018.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2018). Individual Autonomy and Localised Privacy: Exploring the factors influencing acceptability of healthy eating apps in a lower socioeconomic cohort. Oral presentation at the 4th Annual SPHeRE Conference, Dublin, 11th January 2018.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2017). Experiences of women from a lower socioeconomic background when using healthy eating mobile apps: a qualitative interview study. Poster presented at Society of Social Medicine 61st Annual Scientific Meeting, Manchester, 6-8th September 2017.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2017). Can existing mobile apps support healthier food purchasing behaviour? Assessing the integration of behaviour change theory and user quality components in mobile apps. Poster presented at 14th Annual Psychology Health and Medicine Conference, Dublin, 3rd March 2017.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2017). Can existing mobile apps support healthier food purchasing behaviour? Assessing the integration of behaviour change theory and user quality components in mobile apps. Poster presented at the 3rd Centre for Behaviour Change Digital Health Conference, London, 22nd - 23rd February 2017.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2017). Can existing mobile apps support healthier food purchasing habits? Poster presented at SPHeRE Network Annual Conference, Dublin, 12th January 2017.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2016). Assessment of mobile apps on their integration of user quality and behaviour change theory relevant to healthier food purchasing behaviour. Oral presentation at HRB CHDR Winter Workshop, Dublin, 1st December 2016.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2016). Can existing apps support healthier food purchasing behaviour? Assessing the integration of behaviour change theory and user quality components in mobile apps. Poster presented at National Health Services Research Institute (NHSRI) Research Day, Cork, 10th November 2016.

Flaherty, S-J., McCarthy, M., Collins, A., and McAuliffe, F. (2016). Can existing apps support healthier food purchasing behaviour? Assessing the integration of behaviour change theory and user quality components in mobile apps. Poster presented at Irish Human-Computer Interaction Conference, Cork, 14th October 2016.

Flaherty, S-J. (2016). Changing Habits: Exploring the potential role of mobile apps to support healthier food purchasing habits. Oral presentation at Nutrition Society Postgraduate Conference, Cork, 11-12th February 2016.

Awards

I was awarded the Shani Rushin Award for Academic Excellence for the SPHeRE PhD Scholars 2014 Cohort. This award is presented to the PhD Scholar that achieves the highest overall results for completed modules.

In 2015, I completed a placement with Dr. Sinéad McCarthy, Research Officer at the Teagasc Research Centre in Ashtown, Co. Dublin, to contribute to the examination of individual-level determinants of a healthy eating habit. In 2016, I completed a placement with Dr. Anna-Maria Saarela, Senior Lecturer, in the Faculty of Business, Tourism and Culture at Savonia University, Finland. The purpose of this placement was to build personal knowledge and skills in relation to the use of think-aloud and additional audio-visual methods to capture food purchasing behaviour.

I was awarded an early career researcher travel bursary by the Society of Social Medicine to attend their 2017 Annual Scientific Meeting in Manchester, England.

I was a recipient of the Cork University Business School Research Development Fund to support the presentation of my research at the 4th Annual UCL Centre for Behaviour Change Conference in London in February 2018.

Acknowledgements

I would like to extend my gratitude to everyone who has contributed to my PhD journey and made the completion of this thesis possible.

I would like to sincerely thank my supervisors Mary McCarthy, Alan Collins, and Fionnuala McAuliffe. Alan and Mary, I am truly grateful for your support and mentoring over the past four years. Thank you for continuing to challenge me throughout the PhD and trusting in my ability. While the research process was not always easy, I have learned so much from working with you both and your guidance has helped me to become a better researcher with a more critical and theoretical eye! Fionnuala, thank you for your expertise and practical advice throughout the research.

This research was funded by the HRB Centre for Health and Diet Research and conducted as part of the HRB SPHeRE PhD Programme. I would like to thank the members of both groups for their support in developing and shaping this research, and providing advice and expert guidance throughout the process.

I wish to sincerely thank all of the staff in the Department of Food Business and Development and in the School of Public Health. No question or favour was too large or small, so thank you all sincerely. A special thanks to Aoife, Ber, Breda, Bríd, Claire, Declan, Dervla, Eimear, Fiona, Mark, Marie, Niamh, Nora, and Vicky. A big thank you also to past colleagues, including Edel, Alan, and Grainne, who passed on their research expertise and, most importantly, methods for PhD survival.

A special mention has to go to my fellow PhD students. A massive thanks to the 2014 SPHeRE cohort: Alan, Amelia, Dani, Paula, and Pauline, and especially the Cork contingent Ailbhe, Brenda, Caragh, Kieran, and Rebecca. You were always there to listen or lend advice about the various challenges of PhD life, and crucially to have a laugh when it all got a bit too much. Who knows, who cares! I want to specifically mention our wonderful friend Siobháin O'Doherty. Your warmth, humility, and wicked sense of humour will never be forgotten. You are a constant inspiration and I will try to carry your enthusiasm and sense of fairness with me throughout my career.

I am also very grateful to the PhD students in the Departments of Food Business and Development, and Management and Marketing. A special mention to Seán, my research partner in crime, for sharing this PhD journey – the good and the bad! It was great to have someone there that understood and to vent to from time to time, although

can I admit now that I won't miss the 'jokes'! Thank you to Dave and Grace – it feels like we started yesterday so I can't believe that we've all finally made it. Thank you also to those that I met along the way and made the PhD a fun and enjoyable experience: Conor, Emmanuel, James, Lucas, Mara, Maxwell, Sami, and Sarah.

I want to acknowledge the on-going support from my family and friends. I want to thank my parents, Betty and Mick, for everything that they have done for us over the past four years, from feeding me when I first moved to Cork (and still keeping us in a constant supply of apple tarts) to sourcing gates and sheds. It has made a big difference to our lives and we are forever grateful. I want to thank my siblings for all their help over the past four years and asking just enough about the PhD to show they care but never too much to stress me out completely. I also want to thank all of the people close to me whose continual words of encouragement have been greatly appreciated. A special mention has to go to Aoife, Elaine, Kath, and Lisa who acted as expert reviewers and proof-readers at various stages. Most importantly, you were amazing friends and there for me during some difficult times; I can never thank you enough.

Finally, the biggest thanks needs to go to my partner James. Thank you for your constant belief in me, even when I didn't think that I could finish it! Thank you for all the sacrifices that you have made over the past four years and the ready supply of tea when I was writing up. I really appreciate everything that you have done to support me through this process. I'm truly grateful that you were beside me for this journey and I look forward to sharing post-PhD life together.

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List of Abbreviations

AVE	Average Variances Extracted
BCT	Behaviour Change Technique
BE	Behavioural Engagement
BMI	Body Mass Index
CE	Cognitive Engagement
CESCA	Cork Equal and Sustainable Communities Alliance
CFI	Comparative Fit Index
DALYs	Disability-Adjusted Life Years
EE	Emotional Engagement
GBD	Global Burden of Disease
GDPR	General Data Protection Regulations
MARS	Mobile App Rating Scale
NANS	National Adult Nutrition Survey
NS	Non Significant
RMSEA	Root Mean Square Error of Approximation
SRHI	Self-Reported Habit Index
SRMR	Standardised Root Mean Square Residual
SE	Socioeconomic
SEM	Structural Equation Modelling
TLI	Tucker Lewis index

Abstract

Background

Unhealthier food consumption patterns constitute a leading risk factor for ill health. As an important step in the food consumption process, changing food purchasing may improve the healthfulness of dietary patterns. Changing behaviour towards healthier food purchasing may be viewed as effortful by consumers due to inadequate nutrition knowledge and skills which may inhibit their ability to make healthy choices within the supermarket. A dominance of routines and habits further impedes the use of deliberative decision-making, which makes information provision and goal-setting less effective. Behaviour change may be supported by disrupting undesirable behavioural patterns, building of personal resources, and reframing behavioural outcomes. This should prompt a greater use of reflective cognitive processes during food purchasing and aid healthier behaviour. However, there is limited evidence in relation to food purchasing. Given recent technological advances, apps offer a potential tool to facilitate such change. The high use of apps across social groups suggests that they may be appropriate for supporting behaviour change in lower socioeconomic groups. It is unclear if existing apps are appropriately designed or acceptable for use for the necessary time period, particularly for individuals from a lower socioeconomic background. Such knowledge gaps must be addressed to inform intervention design. This thesis aims to contribute to the theoretical understanding of the interplay between mobile app technology and behaviour change with food purchasing as the behaviour of interest, and a particular focus on women from a lower socioeconomic background.

Methods

This thesis was grounded in a pragmatic philosophical perspective and consisted of four phases. In phase one, structural equation modelling was undertaken to examine the individual-level determinants of a healthy eating habit and the extent to which personal goals and self-control are linked to a healthy eating habit. A content analysis of existing apps was undertaken in phase two to examine their capacity to support healthier food purchasing behaviour. A structured analytical matrix was employed where relevant literature and theory was drawn upon. A phenomological methodology was used for the remaining two research phases. In phase three, the researcher explored the experience of using a health app to support healthier food purchasing behaviour. Women from a lower socioeconomic background were recruited and asked to use two, of three possible, apps over a two-week period. Subsequent semi-structured interviews explored the experience of using an app including those personal and app-related factors of importance. Inductive thematic analysis was conducted to explore common patterns across participants' experiences.

In the fourth research phase, the lived experience of changing purchasing behaviour was explored in women from a lower socioeconomic background using a health app over an 8-11 week period. Participants were asked to use one, of two possible, apps. Multiple data collection methods were employed to capture the lived experience of behaviour change and app use. At baseline, an accompanied shop, incorporating the use of think-aloud protocol and researcher observations, was conducted, followed by an in-depth interview and questionnaire completion. At the midway point, participants were asked to complete a reflective account of their experience thus far. They were also asked to share their till receipts for the study duration. At follow-up, an

accompanied shop, in-depth interview, and questionnaire completion was again employed. Interpretative phenomenological analysis was conducted to gain insight into the behaviour change experience. Theoretical thematic analysis was employed to examine app use through the lens of engagement theory.

Findings

Self-control and deliberative cognitive processes were central to maintaining a healthy eating habit. This challenges the current conceptualisation and suggests the need to view complex food behaviours as highly routinised; this is an important consideration for behaviour change. Food purchasing behaviour was not a primary focus of existing apps with behavioural outcomes, such as weight-loss, as their main goal. While existing apps have the potential to support healthier purchasing behaviour, there is an opportunity to broaden their capacity. Health apps, through the process of self-monitoring, problem solving, and behavioural prompts, disrupted existing purchasing patterns. This prompted the use of reflective cognitive processes such that purchasing behaviour was directed by personal resources and healthy food goals. However, the extent to which reflective cognition continued to be employed during behaviour change was influenced by the broader goal system in which healthy food goals resided.

The importance of user engagement was highlighted through this exploratory research. Engagement was expressed at an intrinsic level as a sense of personal autonomy, an increased perceived capacity to change, and viewing the app as a confidential and empathetic ally. App features that facilitated their expression were considered to result in optimal engagement. Findings suggest that an individual's involvement, in relation to healthy food, may act as a trigger for different phases of engagement as variations in goal saliency lead to flux in involvement levels. The importance of individual characteristics on app engagement was evident which emphasises the need to integrate tailored features into health apps to ensure that it is congruent with personal goals.

Conclusions

The present findings add to the existing understanding of the interplay between app technology and behaviour change. If appropriately designed health apps may facilitate a more conscious approach to food purchasing and support healthier purchasing behaviour. An individual's goal system architecture may influence the extent to which the reflective cognitive system is employed during behaviour change, which progresses existing knowledge of the influence of goal systems on behaviour change. The present research contributes to the extant literature in relation to user engagement. The intrinsic expressions of engagement are proposed to result from different configurations of engagement dimensions which suggests an interaction between these dimensions rather than an isolated existence. The potential role of involvement as a trigger of engagement phases further challenges the current conceptualisation of engagement. Such findings add to the call for the use of alternative non-quantitative, context-specific means of measurement to adequately capture the engagement process. In conclusion, findings suggest the potential to expand existing behaviour change theory, to integrate components of engagement, for improved relevance in the app technology space. Future health app design must consider the individual user and incorporate tailored features to ensure user self-congruence and support continued engagement to facilitate change. Health apps may be an effective tool to support healthier food behaviours in women from a lower socioeconomic background but they may be most effective when implemented as part of a range of individual, community, and broader structural measures.

Chapter 1

Introduction

1.1 Providing the Context: Dietary Patterns and Disease

The relationship between dietary intake and chronic disease development is well established. Unhealthy food consumption patterns constitute a leading risk factor for premature death and disability globally with over-nutrition recently surpassing under-nutrition as a leading risk factor for illness (Institute for Health Metrics and Evaluation, 2013; Stanaway et al., 2018). The most recent Global Burden of Disease study estimated that inadequate dietary patterns, such as those low in fruit and vegetables, contributed to approximately 32% of global deaths and 21% of disability-adjusted life years (DALYs) in 2017 (Stanaway *et al.*, 2018). Overweight and obesity are also important risk factors for chronic disease development with dietary intake imbalance a key contributor (Visscher & Seidell, 2001; Williams *et al.*, 2015). However, the above Global Burden of Disease measure does not include the indirect influence of diet on chronic disease through overweight and obesity. Thus, unhealthy dietary patterns are likely to confer a greater contribution to chronic disease and disability if this indirect influence is also considered.

In line with international patterns, cardiovascular disease and cancer constitute the two main causes of death in the Republic of Ireland (Central Statistics Office, 2018) with unhealthier dietary patterns a significant risk factor for both. Indeed, facilitating healthier dietary patterns offers one of the most effective means of reducing coronary heart mortality (O'Flaherty *et al.*, 2016) with a potential 26% reduction possible by attaining substantial changes to the Irish diet (O'Keeffe *et al.*, 2013). However, even modest improvements to Irish dietary patterns would have a significant positive impact on population risk. O'Keeffe *et al.* (2013) estimated that reducing salt intake by one gram per day, increasing fruit and vegetable intake by one portion per day, and reducing saturated and trans fat intake by 3% and 1% respectively, could result in an annual 10% reduction in cardiovascular disease mortality in Ireland. It was estimated that the economic costs of overweight and obesity in 2009 amounted to €1.13 billion in the Republic of Ireland (safefood, 2012a). The percentage of individuals who are classified as overweight or obese has slightly increased since this report, and current economic costs are likely to be greater which illustrates some of the economic impact of unhealthier dietary patterns in Ireland. Such evidence illustrates the clear link between diet and risk of chronic disease, and the potential role that healthier

consumption patterns may play in supporting improved health outcomes in the Republic of Ireland.

Recent evidence from the Healthy Ireland survey series provides a useful insight into the current health and dietary patterns in the Republic of Ireland. It is estimated that 62% of Irish adults are considered overweight or obese (Department of Health & Ipsos MRBI, 2017) illustrating a doubling of levels since the late 1990's (Morgan *et al.*, 2008). There is also much evidence illustrating that many Irish consumers do not meet recommended dietary guidelines. Only 37% reported that they consumed the recommended five portions of fruit and vegetables each day, which is often a key indicator of a healthy diet. Furthermore, 34% of respondents reported daily consumption of foods high in fat, salt, and sugar compared to only 9% reporting that they never consume such items, or less than once a week. Such patterns were more pronounced in more disadvantaged communities where 36% of respondents from these communities reported unhealthier food consumption patterns compared to 32% in more affluent areas (Department of Health & Ipsos MRBI, 2018). Such dietary patterns may have a negative impact on population health with significant economic and societal implications, both directly through healthcare costs and indirectly through absenteeism and reduced productivity (Candari, Cylus & Nolte, 2017). Thus, dietary-related diseases constitute a significant problem for Irish society leading to negative consequences both economically and for population health. Furthermore, clear disparities across socioeconomic groups are evident highlighting the need for targeting of interventions for lower socioeconomic groups to address such inequality.

Dietary interventions are needed that support healthier food consumption patterns across all communities to achieve the desired improvements in population health which evidence suggests are possible. In response to the above evidence, *A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016-2025* was introduced, which incorporates a number of action points relating to dietary improvement and addressing dietary and health inequalities, including the development of strategies that facilitate behaviour change (Department of Health, 2016a). A framework of change has been proposed by Hawkes *et al.* (2015) illustrating a number of mechanisms that may facilitate such dietary behaviour change, including the creation of food environments that enable healthier food preference learning, and encouraging the re-assessment of existing unhealthier food behaviours. Consequently, this framework prompts a focus

on the interaction between the consumer and particular food environments to understand how healthier food behaviours may be facilitated and maintained. One such focus may be the retail environment and supporting healthier food purchasing.

1.2 Healthy Food Purchasing Behaviour as a Means of Diet Improvement

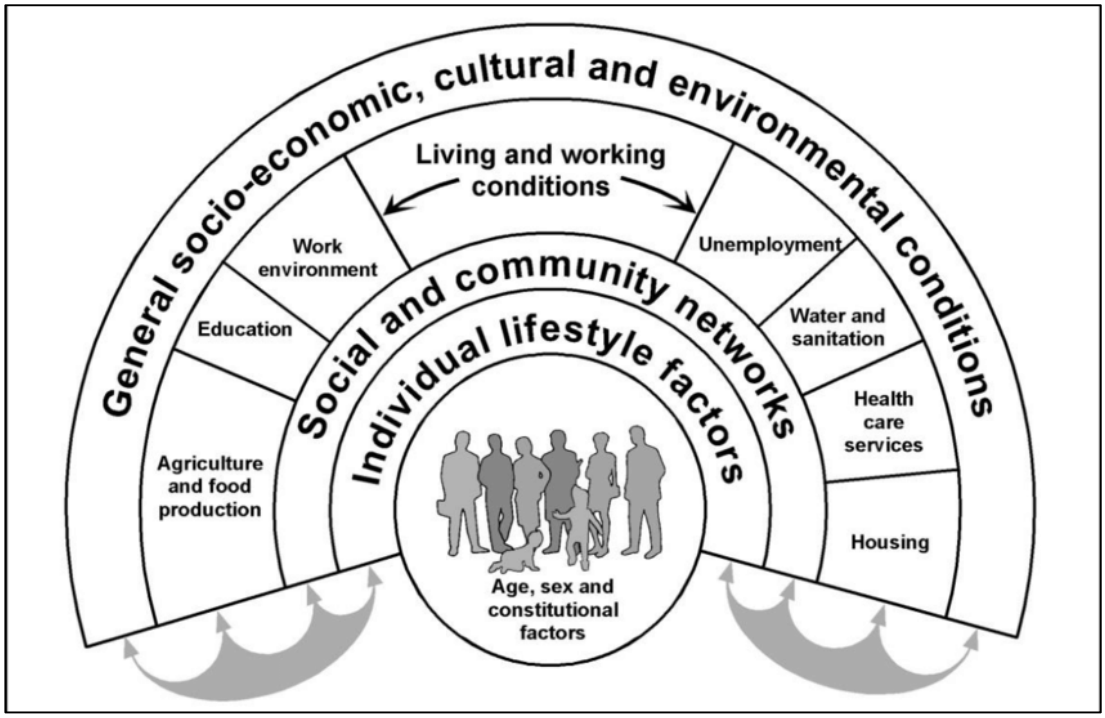
The acquisition of food is an important step in the food choice decision-making process. The majority of food consumed is purchased in the supermarket (Department for Environment, Food & Rural Affairs, 2015; safefood, 2013), and consequently is the primary focus of this thesis with a particular emphasis on the main, weekly or regular, food shop undertaken by consumers. Changing food purchasing behaviour towards healthier options offers an important means of improving dietary patterns. It may support healthier dietary intake by limiting the availability or quantity of unhealthier foods in the home environment, thus reducing the likelihood of their consumption at home should competing goals arise. Glanz, Bader, and Iyer (2012) refer to supermarkets as critical allies that are pivotally positioned to support healthier purchasing behaviour and related health outcomes. Owing to the wide range of food products available in supermarkets, and the quantity of purchasing conducted in this space, changing supermarket purchasing behaviour is viewed as the most appropriate option to aid consumers in attaining a balanced and affordable diet (Story *et al.*, 2008).

Despite such potential opportunities, limited evidence is available on the most effective means of supporting healthier food purchasing behaviour that are acceptable to both consumers and retailers (Adam & Jensen, 2016; Escaron *et al.*, 2013; Sparks & Burt, 2017). Recent evidence from Bord Bia (2017) suggests that healthy eating is viewed as important by consumers during their food choice but many express confusion in relation to nutrition labelling and being able to choose healthier foods during food shopping. Thus, there also appears to be consumer interest in healthier purchasing behaviour. It is evident that supermarket food purchasing is a central element of the food choice process and warrants further consideration to determine appropriate and effective means of supporting healthier dietary patterns.

This thesis will explore potential opportunities to support healthier food purchasing behaviour at an individual level and the role that health apps may play in facilitating this change. It is acknowledged, however, that individual behaviour occurs within the context of wider social determinants of health, and that food behaviours are influenced

by social and ecological factors present in an individual's environment. Dahlgren & Whitehead (2007) conceptualised these broader determinants as "rainbow-like layers of influence", as presented in figure 1.1. This model illustrates that individual lifestyle factors, such as individual food behaviours, constitute just one layer of influence, and that broader determinants also have a significant impact on health outcomes. Wilkinson & Marmot (2003) comment that many of the common causes of ill health are environmental further illustrating the importance of recognising these wider influences. A holistic perspective to health, one that acknowledges multiple layers of influence, is recommended to better support population health and address existing health inequalities (Dahlgren & Whitehead, 2007). In the context of food purchasing, individual behaviour may be influenced by the socio-cultural norms of an indivdual's community (Rozin, 2006; Sobal & Bisogni, 2009). Employment opportunities may indirectly influence an individual's financial income and subsequently the budget available for food purchasing and consumption of healthier foods (Daniel, 2016; MacMahon & Weld, 2015). Further discussion of the socioecological factors that influence individual food purchasing behaviour is presented in chapter two.

Figure 1.1 Determinants of Health (Dahlgren & Whitehead, 2007).



The researcher is conscious of these wider influences and the potential limitation of focusing solely on lifestyle behaviours as a means of changing health outcomes. This thesis research is not an attempt to address these multiple layers of influence, but aims to obtain a deeper understanding of facilitating change at an individual level and supporting healthier lifestyle behaviours. In doing so, it is anticipated that this research will contribute to the existing knowledge base in relation to supporting population health, and subsequently inform the development of interventions that encompass different components to address multiple determinants of health.

1.3 Thesis Aim

The overarching aim of this thesis is to contribute to the theoretical understanding of the interplay between mobile app technology and behaviour change in the context of highly routinised and habitual behaviour, with food purchasing as the behaviour of interest and women from a lower socioeconomic background as the population of interest. There are four research objectives connected to this overarching aim:

1: Examine the individual-level determinants of a healthy eating habit and the extent to which personal goals and self-control are linked to a healthy eating habit.

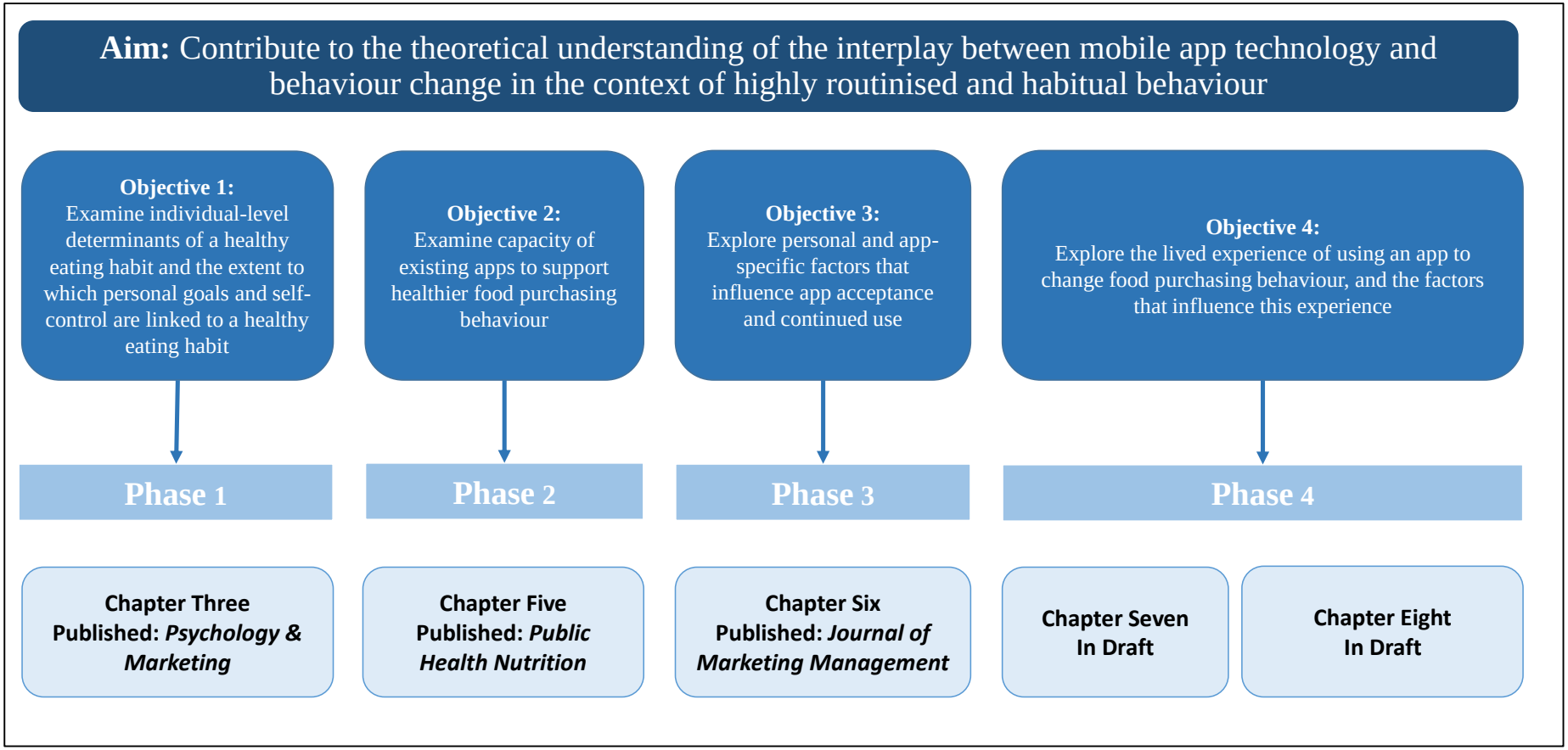
2: Examine the capacity of existing apps to support healthier food purchasing behaviour through the integration of features that disrupt undesirable purchasing patterns, build personal resources, and reframe behavioural outcomes.

3: Explore the personal and app-specific factors that influence the acceptance and continued use of health apps in those individuals attempting to change their food purchasing behaviour.

4: Explore the lived experience of using an app, and the recommended behaviour change techniques, to change food purchasing behaviour and the personal, social, and environmental factors that influence this experience.

Building on the literature and primary findings presented in chapters two and three, more specific details on the development of these research objectives is presented in chapter four. Figure 1.2 provides an overview of the thesis research design.

Figure 1.2 Research Design Overview



1.4 Thesis Overview

This thesis comprises of a further eight chapters, including five chapters that are presented in an extended publication format (chapter three, and chapters five to eight). Each of these chapters are in the format of a journal article and incorporate a review of relevant literature, an outline of the associated methods and findings, and a subsequent discussion of findings. The final discussion chapter, chapter nine, draws together these findings to analyse their implication at a broader level. The following section will provide a brief account of each chapter.

Chapter two provides an in-depth examination of the extant literature in relation to food purchasing behaviour. Drawing on a socioecological perspective, it will outline the different individual, social, environmental, and cultural factors that may influence purchasing behaviour. Owing to the complexity of food purchasing, consumers often employ simplification strategies, such as heuristics and routines; such strategies will also be discussed and their role in directing purchasing behaviour. Drawing on relevant literature, potential strategies for behaviour change will be discussed alongside possible challenges to their implementation. Finally, the researcher will outline the existing evidence that positions health apps as a potential tool with which to facilitate a change towards healthier purchasing behaviour.

Chapter three relates to primary research that was undertaken as part of a placement that was undertaken at Teagasc during the first research phase. This research explored the role of individual-level determinants of a healthy eating habit, the relevance of personal goals, and the role of self-control as a mediator of personal goals. This research was an integral part of the thesis as it helped to shape the researchers understanding of healthy eating habits and routines and illustrated the important role of self-control as a mediator of personal goals to support a healthy eating habit. Alongside the literature review, as presented in chapter two, it informed the methods employed to explore food purchasing behaviour as it emphasised the relevance of both automatic and deliberative cognitive processes to healthy food behaviours. This is discussed further in both chapter three and four. The researcher was a co-author on the associated paper that was published in *Psychology & Marketing*; reference details are provided in the previous research dissemination section.

Chapter four presents the aim and objectives of this thesis and the research design considered most appropriate to address these objectives. An overview of the philosophical perspective that was adopted is provided alongside a discussion of its role in shaping the methods employed. Women from a lower socioeconomic background were chosen as the population of interest for this thesis, and a rationale for focusing on this group is provided alongside associated challenges. The researcher's statement of reflexivity is outlined in this chapter and how her background and position may have shaped the research process. The specific data collection and analysis methods that were employed at each phase are not included in chapter four but are integrated into the relevant findings chapters, where they are presented alongside the associated findings and discussion.

Chapter five relates to the second phase of the research where primary research was undertaken to examine the potential capacity of existing mobile apps to support healthier food purchasing behaviour. An assessment of a sample of existing health apps was undertaken to examine the quality of nutrition content and the integration of user quality components and behaviour change theory relevant to food purchasing behaviour. As outlined earlier, a review of the relevant literature is provided alongside the methods employed. Results are presented and subsequently discussed in line with the existing knowledge base. This chapter has been published in *Public Health Nutrition*, and reference details are provided in the research dissemination section.

Chapter six relates to the third phase of research and examines the experience of using a health app to support a change towards healthier food purchasing behaviour and those personal and app-specific factors that influence this experience. A qualitative, phenomenological exploration of the lived user experience was employed. A review of the relevant literature and theoretical framework is provided. Findings are presented, including the conceptual model of engagement that was developed by drawing on these findings, and discussed in relation to the extant literature. This chapter is published in the *Journal of Marketing Management*, and further details are provided in the research dissemination section.

Chapters seven and eight relate to the fourth, and final, phase of the research. Chapter seven builds on the findings of chapter six and employs a user engagement theoretical lens to examine those factors that influence user engagement over an extended period of time. Chapter eight explores the lived experience of changing food purchasing

behaviour using a health app, including those personal, social, and environmental factors that influence behaviour change. A qualitative, phenomenological exploration of the lived user experience was again employed to examine behaviour change and user engagement over an eight to eleven week period. Both chapters are currently being prepared for submission to relevant journals.

Chapter nine provides a summary of research alongside an overarching discussion of the findings. Final conclusions are presented alongside the implications of the findings for theory, policy, and practice. The strengths and limitations of the research are acknowledged and suggestions for future research are proposed.

1.5 Summary

This chapter has introduced the rationale for focusing on changing food purchasing behaviour as a means of supporting improved patterns of food consumption and subsequent health outcomes; thus, providing the context for this thesis research. It further outlined the aim and objectives of this thesis and a diagrammatical overview of the research design. Further specific details will be provided in following chapters, prior to presentation of findings and related discussion. A short outline of each chapter was also presented which was intended to provide a brief overview of the thesis and aid the understanding of the reader.

Chapter 2

Literature Review

2.1 Introduction

Unhealthy eating patterns are a leading risk factor in the development of chronic disease, as outlined in chapter one (Institute for Health Metrics and Evaluation, 2013; Gakidou et al., 2017). Consequently, it is necessary to explore how healthier eating patterns can be supported to improve related health outcomes. Following on from chapter one, this current chapter will discuss the relationship between food purchasing behaviour and eating patterns, and how a change in such behaviour may provide an opportunity to support healthier eating patterns. In order to best illustrate this, it is necessary to provide an overview of the food purchasing process and outline the primary determinants of food purchasing behaviour. Drawing on a socioecological perspective, which recognises the role of individual, social, and environmental influences on individual behaviour, this chapter will outline those factors that have an impact on food purchasing in these different spheres of influence and the interconnection that exists.

This chapter will further discuss the food purchasing process in detail and the various strategies that individuals employ as a means of simplifying this process, while highlighting the potential influence that these strategies may have on purchasing behaviour, including healthier behaviour. An overview of the opportunities for behaviour change will then be provided, alongside a discussion of the potential challenges faced in achieving behaviour change. Overall, this chapter will illustrate the complexity of food purchasing behaviour and the need to consider, and address, such complexity if behaviour change is to be successful. It will then discuss the existing knowledge on the potential role of mobile apps as a facilitator of behaviour change. An outline will be provided of the prevalent gaps in existing knowledge, both theoretical and practical, in relation to the interplay between app technology and behaviour change in the current context of food purchasing behaviour. It is important that such gaps are addressed before a more conclusive answer can be provided in relation to the role of health apps as a facilitator of food purchasing behaviour change.

2.2 Food purchasing behaviour and dietary intake

As outlined in chapter one, food purchasing is an important step in the food choice process that influences subsequent food consumption patterns. It forms part of the consumer subsystem of the overall food and nutrition system that guides food

behaviour (Sobal, Kettel Khan & Bisogni, 1998). It influences the foods available for preparation and consumption at the household level, and thus can have an impact on the health outcomes of household members (Sobal *et al.*, 1998). The majority of food consumed is purchased in the supermarket (Department for Environment, Food and Rural Affairs, 2015; safefood, 2013) and consequently retail food purchasing behaviour is the chosen interest of this thesis, with a specific focus on the weekly, or regular, shopping trip. Furthermore, a focus on changing retail food purchasing behaviour is viewed as most appropriate as supermarkets constitute a primary food source for many consumers and the wide range of food products available in supermarkets offers the capacity to attain a balanced and affordable diet (Story *et al.*, 2008). Indeed, Glanz *et al.* (2012) refer to supermarkets as critical allies in supporting healthier food purchasing behaviour and related health outcomes. Despite such potential opportunities, limited evidence is available on the most effective means of supporting healthier purchasing behaviour that are acceptable to both consumers and retailers (Adam & Jensen, 2016; Escaron *et al.*, 2013; Sparks & Burt, 2017). Consequently, it is important to review food purchasing behaviour in further detail to gain a clearer understanding of its determinants and examine means of facilitating change to aid adoption of healthier food purchasing behaviour. These will be examined further in the following sections.

2.3 Determinants of Food Purchasing Behaviour

Behaviour refers to the physical actions, both overt and covert actions, which a person performs in response to internal or external events and are controlled by the brain (Davis *et al.*, 2015). Behaviour can be viewed as goal-directed in the sense that individuals perform such actions to attain goals, which are defined as "*cognitive representations of a desired end-point*" (Fishbach & Ferguson, 2007). Goals are derived from the desire to satisfy individual needs and wants. Individual needs are comprised of biogenic and psychogenic needs. Biogenic needs are basic needs necessary to maintain life such as hunger, while psychogenic needs are those needs acquired through individual experience and typically reflect the needs of the society in which one lives (Solomon *et al.*, 2013). Individual needs can generally be met in different ways and the particular form of consumption used to satisfy specific needs represents an individual's wants, and are also typically influenced by personal and cultural factors (Solomon *et al.*, 2013). Goals may be clearly defined as concrete

concepts or they may be more abstract in nature and represent an end-point that may never be achieved. They are proposed to exist in a hierarchy where higher-order abstract goals shape the setting of lower-order concrete goals (Bagozzi & Edwards, 1998). Thus, goals are often viewed as the "*focal points for human behaviour*" (Fishbach & Ferguson, 2007). Consequently, understanding the formation of personal goals is an important starting point for understanding purchasing behaviour.

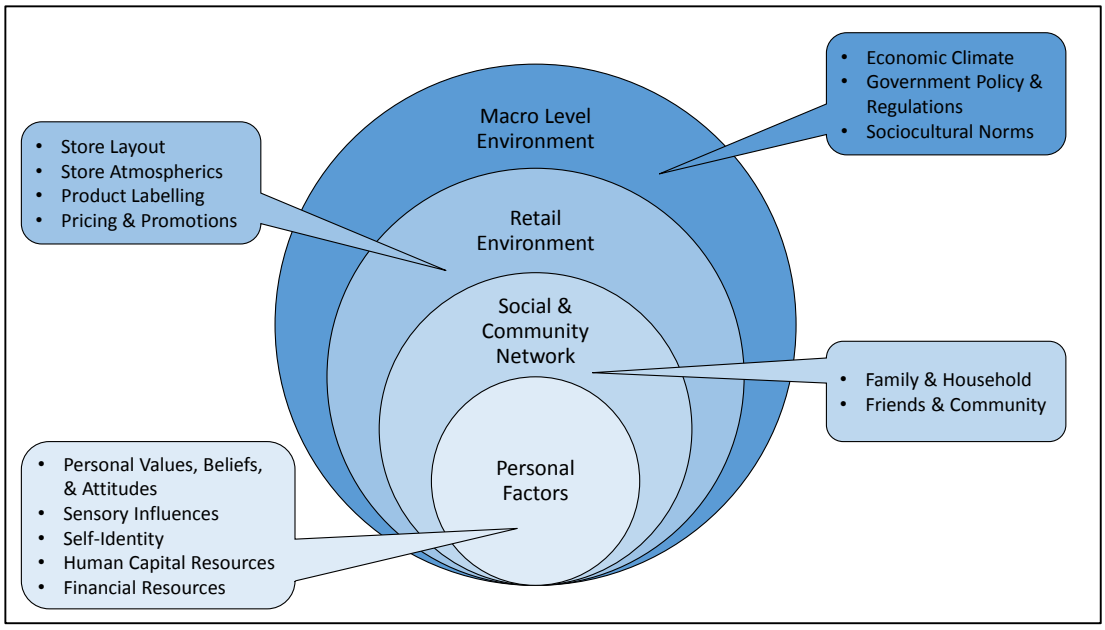
The presence of goals alone will not drive behaviour but adequate motivation is required to enable action. The activation of a need or want occurs when a discrepancy is identified between present and desired states, which prompts an individual to act towards satisfying this need (Solomon *et al.*, 2013). The psychological state associated with this process is referred to as motivation and incorporates the "*internal processes that activate, guide, and maintain behaviour, especially goal-directed behaviour"* (Baron, 1991) as an individual strives to satisfy unmet needs of sufficient pressing (Kotler & Armstrong, 2004; Maslow, 1943). The magnitude of the discrepancy, as perceived by the individual, influences an individual's level of motivation and the energy that they are willing to expend on achieving this goal (Solomon *et al.*, 2013). Therefore, different goals may be associated with different levels of motivation as the perceived discrepancy varies and different personal and contextual factors influence goal setting and attainment (Solomon *et al.*, 2013).

It is evident that personal goals, driven by individual needs and wants, shape food purchasing behaviour and it is important to understand the factors that influence their formation. This thesis draws on a socioecological perspective that recognises the role of individual, social, and environmental influences in shaping goal formation and related behaviour (Stokols, 1996; Story *et al.*, 2008). This perspective acknowledges that particular contexts may shape individual goals and views behaviour as influenced by contextual conditions rather than occurring in isolation. Figure 2.1 outlines the socioecological model of food purchasing behaviour that is employed throughout this thesis. This model draws upon relevant frameworks (safefood, 2012b; Story *et al.*, 2008) to demonstrate the multiple factors that influence food purchasing behaviour and the interconnection that exists. While the model separates factors into categories, in reality they are not isolated but rather interconnect within and across categories to shape behaviour (Story *et al.*, 2008). This model emphasises that food purchasing behaviour should not be viewed within a single level but consideration must be

afforded to the additional levels of influence (Townsend & Foster, 2013). Stokols (1996) stresses that similar environmental conditions may influence behaviour differently depending on the combination of personal and environmental factors of relevance in a specific context. As food purchasing is considered a "*contextualised act*" (Buttle, 1992), each factor may play a different role depending on the specific consumer context and the importance afforded to various factors by the individual.

The following sub-sections will discuss these factors in further detail including their relevance to food purchasing behaviour. This section is organised according to the categories outlined in the socioecological model (Figure 2.1), and each sub-section will address a particular model category. Owing to the multiple and varied factors that influence individual food behaviour, it is beyond the scope of the present research to consider all such potential influences. This section will focus on those influences of most salience to healthy food purchasing behaviour.

Figure 2.1 Socioecological Model of Food Purchasing Behaviour[1]



[1] This model was adapted from safefood (2012b) and Story *et al.* (2008).

2.3.1 Personal Factors

The biopsychosocial perspective of food choice recognises the role of biological, cognitive, and sociocultural influences and processes in food choice as individuals actively negotiate and manage their food choice goals (Engel, 1980). These include personal values, beliefs, and attitudes, sensory influences, self-identity, nutrition-related human capital resources, and financial resources; each of which will be discussed in turn.

2.3.1.1 Personal Values, Beliefs, and Attitudes

Values, beliefs, and attitudes lie at the core of personal goals and the behaviours chosen to attain those goals. Values are "*concepts…about desirable end states or behaviours that transcend specific situations (and) guide the selection of behaviour*" (Schwartz & Bilsky, 1987). Values are typically more abstract in nature and provide a guiding principle for individuals such that goals and behaviours are selected according to their alignment with existing values (Grunert & Juhl, 1995). While many values are viewed as universal, an individual's culture has a substantial influence on those values viewed as important and the potential variations that may exist within a society (Solomon *et al.*, 2013). Values may guide behaviour through their influence on belief and attitude formation and are viewed as the moral compasses underpinning everyday actions. Drawing on a personal value system, individual beliefs are formed through the subjective judgement of an object and informed by direct experience, inferred through earlier experiences, or through knowledge or experience received from significant others or trusted organisations (Fishbein & Ajzen, 1975). Thus, individuals may have similar values but their translation into behavioural beliefs may depend on personal and contextual factors and result in different belief formation.

Attitudes in relation to specific objects are subsequently formed drawing on the beliefs of the individual and their evaluation on whether a particular behaviour will achieve a desired goal (Conner & Sparks, 1996). Consequently, a favourable or unfavourable attitude will be formed influencing subsequent goal formation and behavioural performance. Attitudes are comprised of affective and cognitive dimensions which, respectively, represent the emotional and intellectual response to a particular behaviour (Wood, 2000). They may have different influences on behaviour with much evidence suggesting that affective components have a stronger impact on behaviour, although this may depend on personal characteristics and the behaviour in question

(Conner *et al.*, 2011; Walsh & Kiviniemi, 2014). The context in which the attitude is formed is also important as this may determine the salience of the beliefs cognitively accessible and subsequently drawn upon during attitude formation (Conner & Armitage, 2006). While particular attitudes may be stable and endure over time and in differing contexts, conflicting or ambivalent attitudes may be present as contextual changes arise (Bohner & Dickel, 2011). Personal values, beliefs, and attitudes influence the formation of personal goals and the behaviour chosen to achieve such goals; thus, they constitute significant determinants of food purchasing behaviour.

2.3.1.2 Sensory Influences

At the simplest level, food choice goals are driven by basic biological needs related to the sensory appeal of food, encompassing the taste, smell, and appearance of food, and individual taste preferences. Indeed, this is often cited as the most important driver of food choice (Block *et al.*, 2013; Bord Bia, 2017; Furst *et al*., 1996; Hawkes *et al.*, 2015; Steptoe, Pollard & Wardle, 1995). Innate biological influences drive us to choose specific foods that were historically important for survival, such as those foods higher in fat and sugar (Wardle & Cooke, 2008). It is often proposed that food choice goals are innately driven to ensure consumption of such foods that are typically unhealthier options. Indeed, individuals typically have more favourable attitudes towards such foods as they are viewed as more palatable and tastier options that offer immediate rewards of pleasure and enjoyment (Luomala, Laaksonen & Leipämaa, 2004; Raghunathan, Naylor & Hoyer, 2006). However, the consumption of alternative and healthier foods is also prevalent illustrating wider cognitive and sociocultural influences in the setting of food choice goals (Falk, 1994; Mennell, 1996; Roininen *et al.*, 2001). For example, the foods to which one is exposed in early life may shape sensory preferences and later consumption of healthier foods (Wardle & Cooke, 2008).

Rozin (2006) argues that an individual's culture dictates the foods and eating practices to which an individual will be exposed throughout their life. This may influence individual development of food choice values, shape individual preferences and goals. Nestle *et al.* (1998) note that preferences and dislikes do not always directly equate with food consumption patterns and that individuals may adapt consumption patterns due to goals related to health, body weight, or appearance. In fact, some argue that taste preferences have a relatively weak influence on daily food behaviours with

choice driven by the context in which it takes place (Cohen & Babey, 2012; Lawless, 1991; Meiselman, 1994). Thus, innate biological processes shape food purchasing goals and related behaviour throughout life, in conjunction with learned sociocultural influences.

2.3.1.3 Self-Identity

Self-identity relates to "*the relatively enduring characteristics that people ascribe to themselves, which take the form of (or incorporate) socially given linguistic categorizations*" (Sparks & Guthrie, 1998) and has been referred to as behaviour's "*generative force*" (Biddle, Bank & Slavings, 1987). Self-identity is viewed as closely related to personal values and subsequently to individual beliefs and attitudes. Values may inform an individual's self-concept, the "*cognitive and affective understanding of who and what we are*" (Malär et al., 2011), which subsequently contributes to self-identity (Verplanken & Holland, 2002). As values are viewed as the "*fundamental components of a group's culture*" (Smolicz, 1981), shared values are incorporated into the cultural identity of this group and subsequently influence self-identity (Smolicz, 1981). Furthermore, values have been shown to predict self-identity expression and the strength of individual identity roles (Hitlin, 2003; van der Werff, Steg & Keizer, 2013), illustrating the clear association between these two constructs.

Self-identity is of importance as it offers a direction by which individuals can regulate behaviour (Ryan & Deci, 2003; Stryker & Burke, 2000). It is often viewed as a key influence on food behaviour because of the importance of food in our everyday lives (Senauer, 2001). Self-identity is built upon the social and personal roles that an individual occupies and the particular groups to which one connects as shaped by societal influences and individual perceptions of those roles (Hogg & Abrams, 1988; Stets & Burke, 2000). Individual identity is built upon the combination of identities that we occupy (Hogg & Abrams, 1988) with individual goals and related behaviour influenced by all identity roles. Competing identities may be activated in particular contexts as individuals assume their various roles (Gibbons *et al.*, 2006; Strachan & Brawley, 2009) which may result in the elicitation of conflicting goals. In such instances, role salience often dictates the primary identity expressed (Stryker, 1968) and is dependent upon the individuals connected with that identity and the strength or depth of those connections (Stets & Burke, 2000). Consequently, the goals related to this salient identity will be prioritised and direct subsequent behaviour.

The retail environment is a significant context as it acts as a forum in which identities can be expressed and created as consumers attempt to connect with others through common purchases and consumption (Arnould & Thompson, 2005). Consequently, certain products are consumed while others are actively avoided in an attempt to demonstrate self-identity (Lindeman & Stark, 2000; Shavitt, 1990). While many different food-related identities may exists, the healthy-eater identity is possibly of most relevance to this work. Possession of a healthy-eater identity is associated with healthier food behaviours (Dennison & Shepherd, 1995; Sparks & Guthrie, 1998), higher levels of nutrition knowledge and diet-related self-efficacy (Strachan & Brawley, 2009), and greater responsiveness to nutrition interventions (Kendzierski, 2007; Kendzierski & Costello, 2004; Strachan & Brawley, 2008; Strachan & Brawley, 2009). Drawing on such evidence, it is clear that self-identity is an important influence on food purchasing behaviour as consumers aim to enact particular personal and sociocultural identities through their food purchasing choices.

2.3.1.4 Nutrition-Related Human Capital Resources

Human capital resources relate to the "*knowledge, skill or expertise in people acquired through investments in formal or informal education, training or learning by doing*" (Ratchford, 2001) or "*the stock of information and knowledge obtained in the past that makes the consumer more productive in the current period*" (Putrevu & Ratchford, 1997). Nutrition-related human capital resources relate to the knowledge and skills gained in relation to nutrition, cooking, and the task of food purchasing. Human capital resources can shape belief and attitude formation which will influence the food purchasing goals set by the individual and the behaviour chosen to achieve such goals. Individual knowledge and skills are built throughout life in response to family and social networks (Caraher et al., 1999; Withall, Jago & Cross, 2009) and are also influenced by media channels and health professionals (Holgado et al., 2000; Medeiros, Russell & Shipp, 1991).

Consumers store knowledge in two forms. Objective knowledge which relates to accurate information about a product, and subjective knowledge which relates to the individual's perception of a product (Pieniak, Verbeke & Scholderer, 2010b). While objective knowledge can inform a consumer's subjective knowledge, other factors, such as self-confidence, are also important in its formation (Aertsens *et al.*, 2011; Carlson *et al.*, 2009). Importantly, subjective knowledge is shown to have a greater

influence on attitude formation and subsequent behaviour than objective knowledge (Ellen, 1994; Pieniak, Aertsens & Verbeke, 2010a; Pieniak *et al.*, 2010b). Thus, an individual's objective nutrition-related knowledge is only one consideration and their subjective perceptions of food and nutrition also constitute important determinants of purchasing behaviour.

Public understanding of nutrition does not always match the standards proposed by health professionals (Blake *et al.*, 2007; Povey *et al.*, 1998) illustrating a clear discrepancy between objective and subjective nutrition knowledge for many consumers. This discrepancy between objective and subjective nutrition knowledge may have an important impact on food purchasing behaviour as it may influence the ability of the consumer to form, and attain, healthy purchasing goals. If an individual's subjective categorisation of foods as healthy or unhealthy is not based on accurate nutrition knowledge, any purchasing goals formed may not achieve the desired impact on diet and health. Indeed, many consumers report confusion when attempting to make healthier food choices. A lack of competence in nutrition knowledge due to constant changes in nutrition messages is cited as one cause of confusion (Anderson, Milburn & Lean, 1995). An inability to appropriately interpret nutrition labels and health claims is also illustrated as a barrier for choosing healthy foods during food shopping (Grunert, Wills & Fernández-Celemín, 2010; Hollywood *et al.*, 2013). This illustrates the range and complexity of the nutrition knowledge required to set appropriate healthy food goals and regulate behaviour accordingly.

Nutrition knowledge alone, however, is not always sufficient. Relevant food skills, such as cooking skills, budgeting, and time management, are required to translate nutrition knowledge into practice (Frobisher, Jepson & Maxwell, 2005). Possession of such food skills supports healthier food purchasing behaviour as it allows for the preparation of a broader variety of foods and less reliance on convenience and pre-packed foods (Hollywood *et al.*, 2013; Larson *et al.*, 2006). In contrast, healthy eating is viewed as monotonous and repetitive in those with limited cooking skills (Hollywood *et al.*, 2013). The ability to manage time and money effectively, in respect to food purchasing, is also important. The time available for food acquisition, preparation, and consumption all influence our food behaviour as individuals are more likely to choose convenience and pre-packed foods when under perceived time pressure (Bava, Jaeger & Park, 2008; Jabs & Devine, 2006; Murcott & Anderson,

1998; O'Brien *et al.*, 2015). Thus, the food skills available to the individual may influence personal goals and subsequent behaviour as it shapes the options perceived as accessible and relevant to individual needs. Consumers from a lower socioeconomic background may be less likely to possess sufficient nutrition-related human capital resources (Adams *et al*., 2015; Turrell & Kavanagh, 2006). This is not only related to nutrition knowledge and cooking skills, but a lack of available time is also of concern (Méjean *et al*., 2017; Miller & Branscum, 2012; Zachary *et al*., 2013). Indeed, socioeconomic differences in nutrition knowledge are shown to contribute to differences in the purchasing of healthier foods (Turrell & Kavanagh, 2006).

In the absence of sufficient nutrition-related human capital resources, some consumers may view the act of purchasing healthy food as challenging. Additional effort may be required by these consumers to adequately plan and compile a healthy shopping list and to interpret nutrition labels during shopping to aid healthier food choice (Hollywood *et al.*, 2013). The cognitive space necessary for undertaking a healthy shop, as perceived by such consumers, may not always be available in times of reduced cognitive capacity which may add a further challenge to attaining healthy food purchasing goals (Hollywood *et al.*, 2013). Consequently, the nutrition-related human capital resources, and other related resources, held by the individual are important personal factors. They may influence the goals set by the individual and direct subsequent purchasing behaviour.

2.3.1.5 Financial Resources

The financial resources available to a consumer warrant special attention as these may shape goal formation and subsequent behaviour as the need to manage household finances is balanced against alternative personal considerations. Consequently, perceived cost is often cited as a key determinant of food choice (Furst *et al.*, 1996; Glanz *et al.*, 1998; Ni Mhurchu *et al.*, 2011), especially for those on lower incomes who are typically more conscious of cost due to greater financial burden (Steenhuis, Waterlander & de Mul, 2011). While many household bills are fixed the food budget is viewed as more flexible and consequently drawn upon if savings are to be made (Coakley, 2001; Graham, 1992; MacMahon & Weld, 2015). Healthier food options are typically more expensive (Drewnowski, 2004; Waterlander *et al.*, 2010) with recent evidence from the UK illustrating that it may be up to 29% more expensive to consume a diet that meets recommended nutritional guidelines than one that meets no

such guideline (Jones, Tong & Monsivais, 2018). Individuals on lower incomes are typically required to spend a higher proportion of their household income to purchase a healthy basket (MacMahon & Weld, 2015). Thus, they may be more motivated by economic goals leading to the purchase of unhealthier foods in an attempt to attain value for money and maintain budget restraints (Coakley, 2001; Dobson *et al.*, 1994; Dowler, 1997; Steenhuis *et al.*, 2011). The purchase of new healthier foods may be viewed as risky behaviour by those from lower socioeconomic households as children often refuse new foods. This may increase household food expenditure which may not be feasible for those on lower incomes (Daniel, 2016).

While cost is cited as a significant factor by many (Furst *et al.*, 1996), this does not always translate into a negative impact on the healthfulness of food behaviour. The possession of sufficient nutrition-related human capital resources can counteract some of the cited negative influences and support healthier food behaviour (Miller & Branscum, 2012). Indeed, Wiig Dammann and Smith (2009) illustrate that individuals from lower socioeconomic backgrounds may be able to mitigate some of the negative influence of financial constraints if they posess sufficient knowledge and skills. Personal goals may influence the perceived cost of healthy foods which may be viewed as more affordable by those motivated to consume a healthier diet (Hill *et al.*, 2016). Thus, financial resources may influence personal goals as they shape the options perceived as accessible and capable of meeting individual needs. Personal resources, such as nutrition-related human capital resources, may also be significant and influence the perceived importance of cost and the individual's ability to attain healthy food purchasing goals. Further attention will be afforded to the importance of personal factors later in this chapter when discussing the food purchasing process in detail.

2.3.2 Social and Community Network

While personal factors, as discussed earlier, are central to food purchasing behaviour, the social environment which the consumer inhabits is also a key influence. Consequently, it is important to consider the social norms and relationships present in this network and their potential influence in shaping food purchasing behaviour. As outlined earlier, the society in which one lives and the individuals perceived as important have a significant influence on the values held at an individual level (Solomon *et al.*, 2013). Furthermore, socially-constructed ideals of particular roles, including those which one represents in their social network, may shape an

individual's self-identity (Stets & Burke, 2000). Thus, an individual's social and community network may shape food purchasing goals and related behaviour through their influence on such personal factors.

The influence of family relationships is present from early life as family choices dictate exposure to foods, and shape the food behaviours viewed as acceptable in a given sociocultural context (Rozin, 2006; Sobal & Bisogni, 2009). Growing up in a low-income household may limit the range of foods to which one has access which may dictate those foods viewed as normal to consume (Sobal & Bisogni, 2009). While particular behavioural patterns may remain stable and continue to be guided by early life, transitional periods which change family and household makeup may disrupt such patterns leading to new food behaviours. Women may be more affected by such transitions as they report a tendency to change food behaviours to align with male partners in an attempt to express the perceived identity role of the female in long-term relationships (Beagan & Chapman, 2004; Brown & Miller, 2002; Szabo, 2012). Male partners are viewed as having a limited interest in healthy food behaviours (Cronin *et al.*, 2014; Inglis, Ball & Crawford, 2005) with responsibility falling upon female partners for ensuring healthy food choices are made (Beagan & Chapman, 2004; Newcombe *et al.*, 2012).

Despite changes in household composition in recent decades, women appear to remain as those primarily responsible for food acquisition and preparation in many households, although male partners and children continue to be the primary influencers of the food choices made (Ball *et al.*, 2011; Checkout, 2017; Lake *et al.*, 2006; Vaughan *et al.*, 2017). Women prioritise the preferences and needs of other household members before their own (Hollywood *et al.*, 2013; Inglis *et al.*, 2005) as a means of maintaining household harmony and avoiding potential conflict (Barker *et al.*, 2008; Furst *et al.*, 1996; Zachary *et al.*, 2013). However, this management of relationships leads to the deprioritisation of health in the purchasing process as it is viewed as too difficult to attain a healthy basket that is acceptable to all household members (Hollywood *et al.*, 2013). The necessity for managing relationships appears to be of greater importance for females (Lennernäs *et al.*, 1997), especially those of lower educational attainment as partners are less likely to share responsibility leading to greater conflict in decision-making (Barker *et al.*, 2008). Thus, the influence of perceived social roles and the need to negotiate the requirements of significant family

members may influence food purchasing goals and subsequent behaviour, and may differ across socioeconomic groups.

Wider than the family network are the social and community networks to which people belong which may set social norms and subsequently shape purchasing goals and behaviour. As discussed previously, personal beliefs and attitudes underpin individual goals and behaviours but they lie alongside the perceived behavioural norms of one's social group, which individuals may use as a standard with which to align behaviour (Ajzen, 1991; Montaño & Kasprzyk, 2008). Food choices are not isolated but "*form in relation to other people, alongside everyday activities"* as individuals aim to communicate and share understanding with their peers (Delormier, Frohlich & Potvin, 2009). It is established that food behaviours of socially connected individuals are correlated as individuals attempt to conform to social norms in terms of quantity and taste preferences (Higgs & Thomas, 2016). Such conformity may have differing effects on purchasing behaviour. The presence of unhealthier social norms may reduce motivation to change behaviour towards healthier purchasing patterns (Schultz *et al.*, 2007), while healthier norms may provide positive social support and set a standard for aspiration which may prompt healthier behaviour (Rivis & Sheeran, 2003; Uchino, Cacioppo & Kiecolt-Glaser, 1996). Thus, perceived behavioural norms of one's social network may shape purchasing behaviour as the individual attempts to conform to social standards and connect with peers.

2.3.3 Retail Environment

While personal factors and social networks are evidently significant, purchasing behaviour is enacted in a physical environment and consequently is influenced by the cues present in this environment. While it is acknowledged that food is purchased in a variety of food environments, ranging from a work canteen to a fast-food outlet, food purchased in the supermarket continues to represent the majority of food consumed in many households (safefood, 2013). Thus, the supermarket retail environment is the purchasing context of interest for this thesis, with a particular focus on the main, or 'weekly', household shop. This section will discuss those factors of relevance to this environment and their influence on food purchasing behaviour.

The cues used by consumers during food purchasing are typically categorised as intrinsic or extrinsic to the product. Intrinsic cues are those characteristics inherent to the product and which cannot be changed without physically altering the product itself,

and include the colour, shape, and size of the product (Oude Ophuis & Van Trijp, 1995). Extrinsic cues, in contrast, are external to the product and their manipulation does not alter the physical product, and include price, brand, store features, and product information (Oude Ophuis & Van Trijp, 1995). Such cues are evaluated by the individual to form a subjective evaluation of perceived quality, which is a significant driver of purchasing behaviour (Bredahl, 2004). Perceived quality relates to the individuals' perception of product quality in relation to salient goals and values (Brunsø *et al.*, 2005; Oude Ophuis & Van Trijp, 1995). It is built upon a subjective evaluation of objective and subjective attributes that draws on previous experience and cognitive competencies (Bredahl, 2004; Brunsø *et al.*, 2005).

While consumers are exposed to a variety of cues in the retail environment, not all cues are used. Rather the cues sought and evaluated are influenced by contextual factors, including the decision context, and personal characteristics, such as personal values, goals, possession of relevant knowledge, and cognitive load (Bredahl, 2004; Grunert, Bredahl & Brunsø, 2004). Thus, the cues used may differ between products and across different shopping trips as the individual aims to satisfy various purchasing goals. While intrinsic cues are often viewed as the primary influence on perceived quality (Szybillo & Jacoby, 1974), extrinsic cues also play a significant role (Bredahl, 2004). Furthermore, they may be of more relevance in particular contexts, such as when product quality is difficult to evaluate (Zeithaml, 1988), there is minimal difference between intrinsic cues (Brunsø *et al.*, 2005), and little previous experience with or relevant knowledge about the food product (Bredahl, 2004; Lawley, Birch & Hamblin, 2012). Thus, intrinsic and extrinsic cues are important in-store influences on food purchasing behaviour. However, the significance of each cue will depend on the extent to which they align with personal values and goals and how best they can be interpreted by the individual. This section will discuss those cues of most relevance to healthy food purchasing behaviour at both product and store levels.

2.3.3.1 Store Layout

Store layout influences the cues to which a consumer is exposed as it determines how the store is navigated and viewed by the consumer and influences the probability of a given product being seen. A classic example is the positioning of popular food items, such as milk or bread, in locations where consumers have to travel through the store increasing their contact with a wider range of products with the aim of eliciting

additional purchasing goals (Larson, 2006). A newer development is the use of large power displays near store entrances to focus attention on particular promotions (Sparks & Burt, 2017). The checkout area is typically a significant section of the retail store as all consumers must visit this space. Products placed at checkouts typically fall into the unhealthy category (Haigh & Durham, 2012; Horsley *et al.*, 2014) and account for almost half (46%) of the unhealthier purchases made (Cohen & Babey, 2012). Calls have been made to implement checkout policies that remove confectionary and sugar-sweetened beverages from the checkout area to support healthier purchasing behaviour (safefood, 2014).

The impact of such policies on behaviour is unknown. Recent evidence suggests that clear and consistent checkout policies may support a reduction in unhealthier food purchasing (Ejlerskov *et al.*, 2018). However, the replacement of products with those of negligible nutritional difference, such as replacing chocolate bars with energy bars of similar nutritional value, may confound any potential benefits (Sparks & Burt, 2017). Furthermore, it may be a misconception that such purchases are impulsive and that their removal will eliminate such behaviour. Some consumers consciously choose to purchase products in the checkout area and their removal may simply result in these consumers purchasing such products in the main product aisles rather than a change in overall food purchasing behaviour (Miranda, 2008). They may also contribute to greater dietary inequity as they appear to be more effective for those population groups that already demonstrate healthier purchasing behaviour (Ejlerskov *et al.*, 2018).

The placement of products is also important as it is estimated that the majority of attention paid to specific products is due to display cues rather than consumer preferences and search goals (van der Lans, Pieters & Wedel, 2008). A consumers' attention is typically drawn to those products centrally positioned on the shelf leading to increased sales (Chandon *et al.*, 2009; Christenfeld, 1995). Furthermore, a higher shelf position may direct behaviour in those consumers motivated by quality-related goals as consumers infer a correlation between vertical shelf position and quality (Drèze, Hoch & Purk, 1994; Meier, Warde & Holmes, 2018; Piller *et al.*, 2005). Consumers do not evaluate foods on their own but rather foods are evaluated as part of whole product categories. The category into which a food is placed and the products positioned nearby elicit particular beliefs which influence quality evaluation and subsequent purchasing behaviour (Larson, 2006). Thus, the store layout and the

position of products within the store are likely to result in the expression and prioritisation of specific cues that may direct purchasing behaviour through elicitation of particular purchasing goals. Such cues may direct the heuristics, routines, and habits expressed during food purchasing; these will be discussed in greater detail in a later section on the food purchasing process.

2.3.3.2 Store Atmospherics

As consumers respond to their environment holistically, retailers have focused on creating a pleasant retail environment that will evoke a positive affective response. As discussed previously, affective attitudes may have a significant impact on behaviour (Conner *et al.*, 2011; Walsh & Kiviniemi, 2014). The objective of this approach is to encourage consumers to spend longer in the supermarket as this typically results in increased sales (Brand, 1963; Donovan *et al.*, 1994). The use of store atmospherics, where the sensory appeal of the retail environment is manipulated to elicit this positive affective response, is being drawn upon to a greater extent as grocery shopping moves from being viewed solely as a utilitarian behaviour to one that may incorporate hedonic elements (Puccinelli *et al.*, 2009; Spence *et al.*, 2014). Altering the lighting and colour in the supermarket can be used to create a particular mood, convey a certain identity, or highlight specific products (Bellizzi & Hite, 1992; Jacobs *et al.*, 1991; Larson, 2006; Summers & Hebert, 2001). Olfactory atmospherics are used to evoke positive memories of food consumption and increase the appeal of the shopping experience (Goldman & Seamon, 1992; Gulas & Bloch, 1995; Spangenberg *et al.*, 2006). Thus, sensory cues within the retail environment may infer particular product quality and direct purchasing behaviour through priming of certain purchasing goals. However, the extent of their influence will depend on their congruency with consumer preferences for such sensory cues, and the role that the emotional state plays in directing purchasing behaviour (Babin & Darden, 1995; Morrin & Chebat, 2005; Spence *et al.*, 2014).

2.3.3.3 Product Labelling

The product label is an important consideration and provides a number of extrinsic cues to the consumer, including brand, product and nutritional information. Brand is often viewed as a crucial cue for consumers as it allows distinction between products where evaluation of intrinsic cues is unfeasible or indistinguishable (Brunsø *et al.*, 2005; Oude Ophuis & Van Trijp, 1995). Information on production and processing of

the food product are other objective measures of importance on the label. Branding, used alongside production and processing information, may provide an objective and reliable measure of product quality, as perceived by consumers, as they draw on previous experience or inferred beliefs to inform perceived quality evaluation (Bredahl, 2004; Brunsø *et al.*, 2005; Grunert *et al.*, 2004). However, the importance of branding and product information depends on the consumer as differences in involvement and relevant knowledge will influence its use during product evaluation (Brunsø *et al.*, 2005). Furthermore, the personal goals of the consumer may influence the impact of branding on purchasing behaviour (Richardson, Dick & Jain, 1994). Thus, its significance as a purchasing cue may vary depending on contextual and consumer characteristics.

Another important aspect of product labelling, in the context of healthier food purchasing behaviour, is the provision of nutritional information. Nutritional information may inform food choice and ensure its alignment with health-related purchasing goals (Cecchini & Warin, 2016; Kerr, McCann & Livingstone, 2015; van Kleef *et al.*, 2008; Watson *et al.*, 2014). In particular, traffic-light labelling schemes are shown to be most effective at supporting healthier food choice (Cecchini & Warin, 2016). The depth at which information is used during food purchasing varies across consumers. Consumers from a lower socioeconomic background typically use less nutrition information during product evaluation (Campos, Doxey & Hammond, 2011; Persoskie, Hennessy & Nelson, 2017), which is mainly due to lower nutrition knowledge and limited nutrition-related self-efficacy. The format in which nutrition information is presented also influences the extent to which it is used. The inclusion of excessive information and design features on the label may reduce attention to nutrition information (Bialkova, Grunert & van Trijp, 2013). Consumers appear to prefer a simple graphic design, such as traffic lights, rather than a quantitative format (Campos *et al.*, 2011; Sparks & Burt, 2017), and this is particularly true for those from a lower socioeconomic background where lower education and literacy may be a barrier (Campos *et al.*, 2011). However, this is again influenced by consumer knowledge levels and their ability to interpret the provided information (Campos *et al.*, 2011) illustrating the importance of consumer's personal resources.

The use of nutrition claims on food products are welcomed by some consumers as they provide a cue which may allow for simplification of the purchasing process. They

remove the need to accurately interpret nutrition information and reduce the time and cognitive effort required (Campos *et al.*, 2011). However, some consumers may associate healthier foods with undesirable sensory attributes (Luomala *et al.*, 2004; Raghunathan *et al.*, 2006; Wilcox, Roggeveen & Grewal, 2011). Consequently, the presence of nutrition claims may result in perceived negative product quality and direct behaviour away from healthier food purchasing. Furthermore, the use of a single cue to evaluate nutritional quality may lead to less healthier foods being categorised inappropriately as healthy, a phenomenon known as 'health halos' (Talati *et al.*, 2016). Thus, the provision of nutrition information on product labels can be an important cue used for certain consumers during purchasing, with potentially positive or negative effects from a healthy food purchasing perspective. Furthermore, its influence on healthier purchasing behaviour may be influenced by personal beliefs, goals, and relevant consumer knowledge.

2.3.3.4 Pricing and Promotions

The price of food is often viewed as a significant extrinsic cue as purchasing goals are made within the confines of available financial resources as consumers aim to attain value for money (Glanz *et al.*, 2012; Zachary *et al.*, 2013). The price of food influences both store choice and subsequent product choice during the food purchasing process (Sparks & Burt, 2017). Building on this desire to attain value for money, in-store price-related promotions are an important approach employed by retailers and include price discounts and extra-product promotions. Such promotional activities are shown to increase sales with higher discounts associated with a comparable increase in sales (Hawkes, 2009; Walters & Jamil, 2002). Price promotions may appeal to utilitarian-focused consumers who strive to maximise purchases for the available household budget, especially at critical times when funds are low (Hollywood *et al.*, 2013; Zachary *et al.*, 2013). Additionally, price promotions may elicit a sense of accomplishment and increased consumer satisfaction in hedonically-motivated consumers (Collins *et al.*, 2014). Purchasing products on price promotion is often a strategy used by those shopping with a restricted budget as they aim to save money where possible (Miller & Branscum, 2012).

Recent evidence highlights that the majority of in-store promotions in the Republic of Ireland concentrate on less healthy products with 37% of promotions related to foods high in fat, salt, and sugar compared to 14% related to fruit and vegetables (Furey *et*

al., 2017). Consequently, price-conscious consumers, such as those from a lower socioeconomic background, may be directed towards unhealthier food products as they strive to maximise perceived product quality which they equate with value for money. While it is evident that such promotions lead to higher sales they may not necessarily translate into increased consumption as stockpiling or brand switching may occur depending on the foods being promoted (Hawkes, 2009). Consequently, pricing and related promotions may be an important influence on purchasing behaviour. As existing in-store promotions appear to focus on unhealthier products, it may be that behaviour is directed towards unhealthier options. However, the actual impact on eating patterns is unclear and may depend on personal characteristics and purchasing goals.

2.3.4 Macro-Level Environment

The wider sociocultural and political environment in which one resides is an important influence on purchasing behaviour. It may dictate the cultural norms of food choice and direct behaviour according to particular economic, food, or health-related policies. Cultural norms dictate the foods to which one is exposed to throughout life which subsequently influences individual taste preferences and food choice (Rozin, 2006; Wardle & Cooke, 2008). Social and religious traditions shape cultural norms in relation to food through the restriction or consumption of particular foods either wholly or at particular times of the year creating food customs to which individuals adhere (HLPE, 2017). Government policy and regulations, in relation to agriculture, health, retailing, and economy, all play a significant role in shaping food purchasing behaviour. The nutrition policies and national dietary guidelines in place illustrate the dietary goals that individuals should aspire to achieve. Consequently, individual healthy eating goals and related behaviour may draw on such guidelines as consumers aspire to meet recommended dietary patterns.

Retail planning regulations may influence consumer accessibility to the retail store, in relation to both physical accessibility and transport links, which may shape food purchasing patterns. Agricultural policies can influence food pricing and food supply which can have both positive and negative effects on food purchasing behaviour. Trade policies can diversify the food supply through the importation of food stuffs not typically available in a country, which allows the consumption of a wider range of foods which may improve the ability to attain a balanced diet (HLPE, 2017). This

increased availability of foods typically leads to a price reduction which may be beneficial in that it potentially makes healthier foods more accessible to those with restricted financial resources. Conversely, it may negatively impact healthy behaviour if it relates to unhealthier food options (Hawkes, Jewell & Allen, 2013; Stuckler & Nestle, 2012).

The economic climate may influence the financial resources available to the individual which, as discussed previously, are an important consideration for consumers in the setting of their purchasing goals (Furst *et al.*, 1996; Glanz *et al.*, 1998; Ni Mhurchu *et al.*, 2011). A recessionary climate, as was experienced in the Republic of Ireland in the last decade, may lead to higher levels of unemployment and the implementation of austerity policies that may reduce the discretionary financial resources available (Whelan, Nolan & Maitre, 2016). As previously discussed, limited financial resources may direct food behaviour towards unhealthier patterns. Consequently, an austere economic and political climate may result in unhealthier food purchasing behaviour, especially among consumers from a lower socioeconomic background. Indeed, such patterns were seen in many countries after the 2008 recession, including the Republic of Ireland (Asgeirsdottir *et al.*, 2016; Bonaccio *et al.*, 2017; Jabakhanji *et al.*, 2017; Rajmil *et al.*, 2014). Furthermore, a return to 'normal' dietary patterns, both in terms of healthier and unhealthier behaviours, was shown in Iceland during the economic recovery period illustrating the impact of the wider economic environment on behaviour (Asgeirsdottir *et al.*, 2016). Thus, the wider sociocultural, political, and economic environment may impact behaviour by influencing purchasing goals and the resources available to attain such goals.

2.3.5 Determinants of Food Purchasing Behaviour Summary

This section outlined the range of factors that influence healthier food purchasing behaviour at the individual, social, and wider environmental levels. It is evident that different factors influence behaviour depending on the particular context in which the choice is made resulting in complexity. While conscious negotiation of different factors may be employed in certain instances, in an attempt to accommodate salient values in decision-making, this approach is not applicable to all food choice decisions (Furst *et al.*, 1996). Given the multiple food choice decisions that are made on a daily basis, it is clearly unfeasible to consciously consider all relevant factors during each food choice. Thus, consumers employ particular strategies during recurring food

choice decisions as a means of simplification and addressing the complexity faced. Such strategies are of importance as they may also influence purchasing behaviour. The next section discusses these strategies in further detail to understand the role they play and gain a fuller understanding of purchasing behaviour.

2.4 Food Purchasing Process

Food purchasing behaviour is complex. The traditional model of consumer decision-making (Figure 2.2) proposes five different stages (Blackwell, Miniar & Engel, 2005) which can form the basis for understanding the food purchasing process. Drawing on this model, food purchasing behaviour is not just concerned with what occurs in the retail store, but it is activated in advance and continues even when the consumer has left the store. This section will provide an overview of the different stages of the food purchasing process and the particular strategies employed by consumers to simplify this process to address the complexity experienced.

Figure 2.2 Consumer Decision-Making Process (Blackwell *et al.*, 2005)



According to Blackwell *et al.* (2005), need recognition arises because of a perceived discrepancy between the consumer's present and desired states. Needs may be activated by internal stimuli, such as thirst or hunger, or external cues, such as an advertisement or a product. In the context of food purchasing behaviour, routine depletion of food stock in the home or elicitation of emotional, or other, goals may trigger need recognition. Consumers possessing a healthy eating goal may perceive a discrepancy between existing purchasing behaviour and their desired behaviour. This may activate a need to change their behaviour to align with their desired state. In response to need recognition, consumers typically undertake an information search to create a set of alternative options that may address the recognised need. This information search initially draws upon internal memory but, if necessary, will draw upon personal and commercial information sources and personal experiences. The

depth of search undertaken depends on existing consumer knowledge and the value placed on obtaining additional information, plus the perceived importance attached to the purchasing decision.

Alternative options are subsequently evaluated based upon specific attributes, as deemed salient by the consumer, to determine those most likely to meet recognised needs. The final purchase typically focuses on that product which best meets individual needs, although particular contextual factors may still influence the final purchase decision. The post-purchase evaluation of the product is also viewed as important as it may influence consumer satisfaction and continued purchasing behaviour. A purchase decision may be associated with some level of cognitive dissonance as a particular product may not adequately satisfy all elements of a particular consumer need. Thus, minimal discrepancy must be achieved between consumer expectations and perceived product performance to positively reinforce the purchase decision and support its continued purchase.

This model of consumer decision-making provides a good basis for understanding the different stages through which a consumer passes. However, it is typically viewed as more relevant to higher involvement products where greater time and effort is allocated to decision-making (Jobber, 2010). Food purchasing is generally viewed as lower involvement where there is a desire to minimise time and effort and maximise consequences (Elliott & Hamilton, 1991). Furthermore, the modern food environment is one of hyper-choice and information overload which provides a challenge to in-depth decision-making in the retail store and may lead to cognitive dissonance in the post-purchase phase (Iyengar & Lepper, 2000; Mick, Broniarczyk & Haidt, 2004; Schwartz *et al.*, 2002). The provision of information sequentially rather than simultaneously, as is the case for grocery shopping, adds further difficulty to decision-making in the retail store (Bettman, Johnson & Payne, 1991). Shopping on a restricted budget is associated with increased time and cognitive effort which further limits capacity for complex decision-making (Edin *et al.*, 2013). Thus, Blackwell *et al.'s* (2005) model provides a good starting point for understanding the food purchasing process, but it is evident that alternative processes must also be considered.

Simon (1955) introduced the concept of "*bounded rationality*" where consumers have limited capacity for information processing necessitating the use of simplification strategies in complex environments to conserve cognitive resources (Bettman *et al.*,

1991; Garbarino & Edell, 1997). Consumers employ specific strategies to inform decision-making in moments of complexity and conflict drawing on their available knowledge and previous experience (Bettman *et al.*, 1991; Payne, Bettman & Johnson, 1992). The strategy employed in each decision is context-dependent and may be adapted and changed depending upon the demands of the specific decision (Bettman *et al.*, 1991). They are acquired throughout life and may change in response to life transitions and particular life events (Sobal *et al.*, 2006). Such strategies of importance in food purchasing include heuristics, routines, and habits. Each will be discussed separately alongside their potential influence on food purchasing behaviour.

2.4.1 Heuristics

Heuristics are "*procedures for systematically simplifying the available information about a problem"* which aid decision-making through the discounting of certain information in favour of a concentration on specific salient attributes (Bettman *et al.*, 1991; Scheibehenne, Miesler & Todd, 2007). According to Kahneman (2011), one of the key experts in the area of heuristics, they "*provide an off-the-shelf answer to each of the difficult questions*" that we face in everyday life. They form part of the automatic cognitive network as they provide a behavioural response with minimal effort (Kahneman, 2011) in times of insufficient information (Gomez, 2013). Their use in food choice is evident in the work of Connors *et al.* (2001), Sobal and Bisogni (2009), and Scheibehenne *et al.* (2007) where consumers use heuristics to negotiate and balance competing food choice values and provide guidelines for decision-making. Various categories of heuristics exist. The most common types employed by consumers include affect, anchoring, availability, and representativeness (Kahneman, 2011; Tversky & Kahneman, 1974).

The affect heuristic leads to an over reliance on personal emotions which direct decision-making, such as the purchasing of particular food categories when in a positive mood (Connors *et al.*, 2001). The provision of an initial value or reference point, such as the previous price or nutrient content of the product, may prompt the use of the anchoring heuristic. In this strategy, consumers consider this initial value in their final decision-making regardless of its relevance or logical sense. The representativeness heuristic relates to the use of perceived similar experiences or circumstances to inform behaviour. The availability heuristic prompts consumers to use easily processed or retrievable information to inform behaviour even if such

information is incomplete. For example, consumers may focus on specific nutrients, such as fibre, or nutrition claims, such as 'low-fat', to decide between different food products during shopping (Gomez, 2013). Indeed, Gomez (2013) reported that the availability heuristic was that most commonly used by food consumers when making healthier food choices. He also reported the regular use of negativity bias where consumers attributed a greater weight to negative nutritional attributes and food choice was directed by the perceived existence of these negative attributes. Sobal *et al.* (2006) have also listed a number of heuristics directly relevant to food behaviour, such as the employment of heuristics focused on the exclusion, restriction, and addition of particular foods or product categories. Examples of these heuristics include never eating chocolate, restricting intake of coffee to two cups per day, and adding vegetables to every meal, respectively. Consumers may also choose to replace or modify particular foods or product categories to accommodate conflicting needs.

Consumers do not just rely on one heuristic type but often possess a repertoire of heuristics that are shaped by personal and social identities and develop over time (Bisogni *et al.*, 2002; Sobal *et al.*, 2006). The heuristic category employed is dependent on the degree of conflict and complexity present, personal knowledge and ability, time availability, and additional information available in the environment (Bettman *et al.*, 1991; Payne *et al.*, 1992; Tversky & Kahneman, 1974). Consumers may apply a single category during decision-making or a number of heuristics may be combined (Bettman *et al.*, 1991). Some consumers choose to focus on a specific salient personal value which is primarily used to inform decision-making and direct food purchasing behaviour (Sobal *et al.*, 2006). The heuristic used may differ between decisions depending on the context as particular attributes or personal values become more salient and as consumers endeavour to achieve balance in decision-making (Connors *et al.*, 2001; Scheibehenne *et al.*, 2007; Sobal & Bisogni, 2009). The heuristic category employed by a consumer may be pre-meditated or spontaneously constructed depending on the context, although the use of pre-meditation is often associated with lower involvement behaviour, such as grocery shopping (Hoyer, 1984; Maubach, Hoek & McCreanor, 2009).

While the use of heuristics may simplify the purchasing process, they typically lead to less accurate decisions being made (Johnson, Payne & Bettman, 1988; Mick *et al.*, 2004) as consumers fail to consciously reflect upon relevant information (Kahneman,

2011). An evaluation of alternatives is considered a key step in Blackwell *et al's* model (Figure 2.2) but the use of heuristics limits this stage of the purchasing process and may result in a potential dismissal of products that may meet desired goals (Maubach *et al.*, 2009). The objective in repeated purchasing is often optimisation of time and cognitive effort and thus consumers are directed to make satisfactory decisions rather than optimal decisions (Hoyer, 1984). However, Scheibehenne *et al.* (2007) reported that consumers made similar food choice decisions regardless of whether heuristics or a more reflective approach was used. The authors argue that the use of heuristics may result in similar choice outcomes as they focus on the most salient attributes for a given context. Thus, food behaviour informed by heuristics may not be objectively optimal but it may meet consumer needs in a particular context.

2.4.2 Routines

A common strategy employed by consumers during purchasing is the use of knowledge scripts with grocery shopping typically viewed as routinised scripted behaviour (Erasmus, Bishoff & Rousseau, 2002; Iyer & Ahlawat, 1987). Scripts are cognitive knowledge structures that outline the appropriate behaviour that needs to be enacted in a familiar context to affect a desired goal and form the basis of routines (Abelson, 1981; Bargh & Barndollar, 1996). Scripts draw on existing knowledge, both declarative and procedural sources, to identify the appropriate behaviour response in the given context which reduces the need for in-depth information processing (Blake *et al.*, 2008). Scripted behaviour that continues to meet individual needs becomes integrated as an individual routine over time (Jastran *et al.*, 2009). Heuristics may constitute one part of a knowledge script and become integrated into a routine as a recurring, effective action is integrated into regular behavioural patterns (Sobal *et al.*, 2006). The familiarity of the environment is vital with routines embedded within specific contexts and knowledge scripts triggered upon encountering particular contextual elements (Nelson & Winter, 1982). However, as knowledge scripts draw on previous experience and various knowledge sources, they are adaptable and can be translated from one context to another (Abelson, 1981; Blake *et al.*, 2008), thus offering behaviour efficiency in similar contexts.

Such knowledge scripts are often retrieved for repeated behaviours, especially those influenced by time pressure and low involvement (Iyer & Ahlawat, 1987). Both time pressure and low involvement reduce the information sought during food choice

prompting a reliance on knowledge scripts to determine the appropriate behaviour response (Beach & Mitchell, 1978). As grocery shopping is often considered a low involvement behaviour and typically undertaken under time pressure (Hoyer, 1984; Maubach *et al.*, 2009), the use of scripted routines is essential to reduce complexity and attain acceptable, if not optimal, food choices (Hoyer, 1984; Simon, 1955). However, a reliance on scripted routines may come at a cost. While their use may result in greater behaviour efficiency, there is likely to be a negative impact on accuracy and a dismissal of ambiguous goals (Iyer & Ahlawat, 1987). Thus, new or ambiguous goals in relation to healthy food purchasing may be dismissed, especially when under time pressure, as a reliance on scripted routines prevails.

2.4.3 Habits

As discussed previously, food purchasing is often considered a routinised behaviour but elements of purchasing behaviour may also be considered habitual, such as the habitual purchase of particular brands (Bettman *et al.*, 1991; Ji & Wood, 2007; Wood & Neal, 2009). Consequently, habit is an important consideration in the discussion of food purchasing behaviour. Based on primary work that forms part of this thesis, chapter three will discuss healthy eating habit in greater detail and examine the role of specific individual-level determinants on healthy eating habit, specifically self-control and personal goals. The aim of this current section is to provide an overview of the habit construct and its relevance to food purchasing behaviour, with greater detail on healthy eating habit provided in chapter three.

William James described habit as "*the enormous flywheel of society….what keeps us all within the bound of ordinance*" (James, 1890) that provides continuity to experience and behaviour and helps to maintain social structure (Ouellette & Wood, 1998). Habits are defined as "*learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end states*" (Verplanken & Aarts, 1999) and are "*acquired gradually as people repeatedly respond in a recurring context*" (Neal *et al.*, 2012). When behaviours are repeated in a stable context, direct associations form in memory between the behavioural context and the particular behaviour being performed (Wood & Neal, 2009). As behaviour is consistently repeated in a stable context the control of the behaviour shifts from the associative network, an action-outcome and goal-directed network, to the sensorimotor network which is responsive to stimuli or contextual cues. Subsequent

performance of the task relies on contextual cues through the sensorimotor network and becomes less controlled by personal goals (Yin & Knowlton, 2006).

While routines, as outlined earlier, are also triggered by contextual cues, habits and routines differ in the degree to which they are considered an automatic response. As Abelson (1981) states, the "*difference between a script and a habit is that a script is a knowledge structure, not just a response program*", thereby illustrating the different extent to which conscious cognitive processes are employed. Habits are typically viewed as unconscious automatic behavioural responses that require minimal thought and effort and are directed by contextual cues with little influence from personal goals (Ouellette & Wood, 1998; Triandis, 1977; Wood & Neal, 2009). While goals may be of relevance to novel behaviours or weaker habits, their influence becomes inconsequential as habits grow in strength (Aldrich, Montgomery & Wood, 2011; Danner, Aarts & Vries, 2008; Triandis, 1977).

Similar to routines, habits, by definition, reduce conscious cognitive employment ensuring that behaviour can be performed without too much personal effort (Wood & Neal, 2009). The complexity of food purchasing necessitates the employment of automatic cognitive processes to build on knowledge attained over time which aids efficient decision-making. Habits are slowly built up over repeated behavioural performances and consequently are slow to change to new experiences and information sources to protect against the loss of personally valuable knowledge (Cunha, Janiszewski & Laran, 2008; Wood & Neal, 2007; Wood & Neal, 2009). However, as seen for routines, the presence of habits diminishes the search for information during decision-making as behaviour is driven by contextual cues which may result in less optimal decision-making. Thus, habits are an important element of food purchasing as cues, rather than personal goals, drive purchasing behaviour.

It is estimated that approximately 45% of our behaviours are habitual, in that they are repeated on a daily basis and usually in the same context (Neal, Wood & Quinn, 2006; Wood, Quinn & Kashy, 2002). However, it is unclear the exact extent to which food purchasing behaviour is routinised or habitual. If we look more closely at food-related behaviours within the available studies, eating behaviours and practices of food preparation and cooking are those typically mentioned (Khare & Inman, 2006; Wood *et al.*, 2002). Wood and Neal (2009) discuss habitual purchasing behaviours, such as purchasing the same brands across different shopping trips, and purchasing the same

amount in the same retail store during repeat visits. However, such behaviours may also be considered highly routinised behaviours rather than habitual. Furthermore, Pashler (1994) suggests that habits are simply well-practiced behaviours which may relate to highly routinised behaviours. This suggests that there is some lack of clarity in the existing understanding of habits and routines with a potential overlap present. While it is likely that habits are a component of purchasing behaviour, it may be that routines are of greater prevalence, although the exact contribution of each is unclear.

2.4.4 Reflective and Automatic Cognitive Systems

As discussed in the initial part of this section, food purchasing behaviour is not necessarily a conscious, reflective process due to potential constraints present in relation to time pressures and cognitive load. Instead, consumers may draw upon less deliberative processes, including heuristics, routines, and habits, as they attempt to simplify food purchasing. These different approaches illustrate the two cognitive systems that guide behaviour (Kahneman, 2011; Strack, Werth & Deutsch, 2006). The first, also known as system one, is an automatic, involuntary system that encompasses innate skills plus practices and associations that are learned over time, stored in memory, and accessed when required without effort (Kahneman, 2011). The second, also known as system two, is a more conscious and reflective system that is associated with a more effortful and slower cognitive response (Kahneman, 2011). The automatic system is permanently active and is used initially in decision-making until it is considered that additional conscious reflection is required (Kahneman, 2011; Rothman, Sheeran & Wood, 2009). As the automatic system requires minimal effort and can respond without individual awareness, it allows quick and easy performance of regular behaviours (Kahneman, 2011), although they may not always be logically accurate (Johnson *et al.*, 1988; Mick *et al.*, 2004). While the use of the reflective system is often more accurate, this conscious decision-making results in a slower response that may be easily disrupted (Rothman *et al.*, 2009; Yang *et al.*, 2012). Table 2.1 outlines the defining characteristics of each cognitive system. All of these separate terms are used throughout this thesis when referring to these different cognitive systems. Table 2.1 aims to provide clarity to the reader on system differences and related terms and to aid subsequent reading.

Table 2.1 Defining Characteristics of Cognitive Systems

System One	**System Two**
Automatic	Deliberative
Unconscious	Conscious
Involuntary	Reflective
Fast	Slow
Effortless	Effortful

Traditional theoretical models of cognition focus on the use of either reflective or automatic systems but it is now accepted that much behaviour is directed by a combination of both (Rothman *et al.*, 2009). The automatic system is associated with emotions and feelings which shape the beliefs and attitudes formed and subsequently guide conscious, reflective behaviour demonstrating an inherent link (Kahneman, 2011). The extent to which each system is engaged during behaviour differs. The perceived complexity of a task is important and there may be a greater use of the automatic system if a behaviour is viewed as simple (Kahneman, 2011). The depth of relevant individual knowledge and previous experience may guide reliance on one system over another (Yin & Knowlton, 2006). Furthermore, system utilisation is viewed as being dynamic in nature with consumer and contextual characteristics influencing the degree to which each system is used (Strack *et al.*, 2006). The emotional state of the individual may direct system use as a positive mood may result in a task being viewed as simple and requiring less reflection (Kahneman, 2011). A high motivation to process information may lead to behaviour being directed by the reflective system if sufficient time and information is available (Yang *et al.*, 2012). However, the absence of time and information may result in behaviour being directed by the automatic system as cognitive capacity limits in-depth reflective processing (Strack *et al.*, 2006). Thus, it appears that consumers rely on both automatic and reflective cognitive systems to direct behaviour, and purchasing behaviour is likely to draw on a combination of conscious, deliberative decision-making and more automatic cognitive processes.

2.4.5 Food Purchasing Process Summary

In summary, it is evident that food purchasing behaviour is directed by both automatic and reflective cognitive systems. The extent to which the food purchasing process reflects Blackwell *et al.'s* (2005) model (Figure 2.2) or the consumer draws upon heuristics, routines, and habits during food purchasing is likely to be guided by contextual and personal characteristics. Thus, the food purchasing process may differ both between and within individuals as such contextual and personal characteristics prompt the varying use of each cognitive system to guide behaviour. It is likely that each purchasing trip draws on a combination of deliberative and automatic decision-making strategies with the precise combination employed dependent on the specific context in which purchasing takes place.

2.5 Behaviour Change

The underpinning framework of health promotion, the Ottawa Charter for Health Promotion (World Health Organization, 1986), states that "*to reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment*". This Charter prompted a move towards a socioecological conceptualisation of health that empowers individuals to take control of those factors that direct health behaviour and strives to achieve equity and sustainability. As outlined in section 2.3, this thesis employs such an socioecological perspective of food purchasing behaviour and acknowledges the broader determinants that influence individual health behaviour and outcomes (Dahlgren & Whitehead, 2007). Alternative models for health promotion exist that focus on medical, behavioural, educational, empowerment, or social change approaches of achieving change (Scriven, 2010). This thesis draws on concepts from behavioural, educational, and empowerment models of health promotion to support a change towards healthier food purchasing behaviour. Specific details on the opportunities for behaviour change are outlined in the following sub-sections. Briefly, this thesis proposes an approach that educates and informs individuals on opportunities for behaviour change, while empowering individuals to take advantage of such opportunities by enhancing their ability and capacity for change, in the context of food purchasing behaviour. In line with the Ottawa Charter, such an approach may develop personal skills and contribute to the future strengthening of community action and healthy public policy, although it is

acknowledged that this approach does not directly address the broader socioecological determinants of behaviour.

The salient determinants of food purchasing behaviour at personal, social, and environmental levels have been discussed in detail in previous sections. An in-depth overview of the food purchasing process was also outlined, including the strategies implemented by consumers during food purchasing and their potential impact on behaviour. A clear understanding of food purchasing behaviour, therefore, has been outlined which is an important initial step in understanding behaviour change (Glanz & Bishop, 2010). However, it is important to acknowledge that behaviour change is conceptually different. Behaviour refers to those overt and covert actions that an individual performs in response to internal or external events (Davis *et al.*, 2015). Behaviour change refers to a change in those actions, either consciously and unconsciously, and may include the adoption of a new behaviour, the cessation of an existing behaviour, or a combination of both. Consequently, it is necessary to examine behaviour change theory to best understand how behaviour can be changed.

As outlined in section 2.4.4, two distinct cognitive systems exist that guide behaviour. The first is the automatic cognitive system, system one, and the second is conscious, reflective system, system two (Kahneman, 2011). Accordingly, behaviour change models are aligned to these two cognitive systems depending on the underlying processes of change which they propose to address. Models focused on supporting a conscious behaviour change process have been referred to as 'rational' models, while those addressing more automatic behaviours are referred to as 'context' models (Dolan *et al.*, 2010). As discussed earlier, much behaviour is directed by a combination of both cognitive systems but the degree to which each system is engaged during behavioural performance will differ depending on personal and contextual factors (Kahneman, 2011; Strack *et al.*, 2006; Yin & Knowlton, 2006). This emphasises the need to understand the behaviour of interest and the extent to which each cognitive system is likely to be engaged. This will allow for a clearer understanding of those approaches of most relevance to change behaviour (Dolan *et al.*, 2010). As food purchasing is directed by a combination of both systems, a combination of approaches is likely to be required to facilitate change.

While traditionally behaviour change was viewed as a distinct event, it is now accepted that "*change unfolds through a series of stages*" (Prochaska, Redding & Evers, 2008),

although typically not in a linear manner as individuals may relapse and return to earlier stages of change (Glanz & Bishop, 2010). The existence of different stages is an important feature of behaviour change as it illustrates the dynamic nature of the behaviour change process. The most commonly used stage model of behaviour change is the transthoeretical model, which is also known as the stages of change model (Davis *et al.*, 2015; Prochaska *et al.*, 2008). Table 2.2 outlines the different stages of change and their defining features. This model posits that individuals pass through five different stages during behaviour change and transition between stages is facilitated by different processes of change. Drawing on this model, it is possible to categorise individuals into different stages according to their readiness to change behaviour (Prochaska *et al.*, 2008). However, some have questioned the model's ability to examine behaviour change over time (Logie-MacIver, Piacentini & Eadie, 2012), and thereby its overall value in assessing behaviour change. Furthermore, it is likely that individual and contextual differences have an impact on the specific behaviour change process as these may influence transition between stages and the precise processes used to achieve change (Logie-MacIver *et al.*, 2012; Prochaska *et al.*, 2008). Nevertheless, conceptualising behaviour change as a staged process, rather than an instant occurrence, is important as it recognises the need to understand the initial individual context and the potential requirement of multiple actions and adaptations as behaviour change continues (Glanz & Bishop, 2010).

Table 2.2 Core Constructs of the Transtheoretical Model (Adapted from Prochaska *et al.*, 2008, p 98)

Stage of Change	**Description**
Precontemplation	No intention to take action within the next 6 months
Contemplation	Intends to take action within the next 6 months
Preparation	Intends to take action. Has taken steps in this direction
Action	Changed behaviour for less than 6 months
Maintenance	Changed behaviour for more than 6 months

It is evident that the behaviour change process, and the factors that facilitate behaviour change, may differ depending on the specific behaviour and by personal and

contextual characteristics. Thus, there is a need to specifically examine change in relation to food purchasing behaviour and the factors that may be of relevance in this context. Drawing on our understanding of food purchasing behaviour, as outlined in earlier sections, this section will discuss those behaviour change approaches of particular relevance to food purchasing. It will discuss how they may address the reflective and automatic cognitive systems that direct food purchasing behaviour and the challenges that may hinder the potential effectiveness of such approaches.

2.5.1 Nutrition Education

Traditional means of supporting healthier behaviours have focused on nutrition educational measures and information provision in food environments. Such measures draw on traditional economic theory which views consumers as rational and reflective beings. It posits that through provision of sufficient and relevant information the consumer will be able to make the optimal decision in relation to health and wellbeing (Guthrie, 2017). Proponents of nutrition education argue that it confers respect to the consumer offering them personal autonomy and control over their decision-making ensuring they feel empowered in their food choices (Kent, 1988). However, as previously discussed, consumers are likely to opt for satisfactory decision-making in complex and conflicting contexts (Bettman *et al.*, 1991; Hoyer, 1984). In such contexts, information provision may simply add further to the complexity hampering optimal decision-making (Iyengar & Lepper, 2000; Scammon, 1977). Educational measures may be effective for infrequent health behaviours, such as vaccination uptake, but they appear to be less successful for routinised or habitual behaviours, such as food purchasing (Rothman *et al.*, 2009; Webb & Sheeran, 2006). It has been suggested that while they may lead to the creation of more informed consumers, their sustained impact on behaviour change is likely to be limited (Webb & Sheeran, 2006).

Furthermore, the degree to which information is used in decision-making depends on the ease with which it can be processed by the consumer; thus information availability alone is insufficient (Bettman *et al.*, 1991). As consumers utilise routines or habits as a means of achieving efficiency and maintaining cognitive capacity, they are less likely to search for or use additional information during decision-making when they direct behaviour (Verplanken, Aarts & Van Knippenberg, 1997). If additional information is sought by consumers, they are more likely to search for and accept information that supports their existing behaviour rather than alternative options in an

attempt to achieve efficiency and consistency (Betsch *et al.*, 2001). Thus, consumers may be unlikely to utilise or adequately evaluate information in the context of routine and habitual behaviours rendering information provision less effective as a means of affecting change in such contexts. Achieving sustained change in food purchasing behaviour requires a move away from these traditional methods and a greater acknowledgement of the role of routines and habits in directing behaviour (van't Riet *et al.*, 2011). The subsequent sections focus on these elements of purchasing behaviour and relevant approaches for behaviour change.

2.5.2 Changing the Context

As food purchasing is considered a "*contextualised act*" (Buttle, 1992), contextual change provides a key opportunity to prompt behaviour change. A stable context drives habitual behaviours and thus is important for their maintenance. Disrupting the context can cause consumers to re-evaluate behaviour during which time they may be open to new information and new goals, which may prompt behaviour change (Verplanken *et al.*, 2008; Verplanken & Wood, 2006; Wood, Tam & Witt, 2005). Indeed, an exploration of personal accounts of life changes showed that 36% of successful behaviour change attempts involved a disruptive life event, such as a move to a new location, compared to only 13% in unsuccessful behaviour change reports (Heatherton & Nichols, 1994). Context stability may be of greater importance than frequency of performance as repeated behaviours were not seen to develop into habits when the context always differed (Danner *et al.*, 2008). A clear opportunity exists whereby contextual changes could be introduced alongside information provision to support healthier food purchasing behaviour (Verplanken & Wood, 2006). Disrupting an individual's context may prompt a conscious evaluation of relevant information rather than behaviour being automatically driven by contextual cues.

One approach that has been prominent in recent years is the utilisation of choice architecture or nudge theory. Choice architecture involves environmental changes that still allow individual choice but create an environment where consumers are encouraged to make the healthier choice or where the healthier choice is viewed as the easier choice (Thaler & Sunstein, 2008). In a food context, choice architecture aims to identify those cues within a food environment that either encourages purchase or consumption of unhealthier food options and/or promotes consumption of excess quantities. A choice architecture approach would involve adapting or replacing these

cues to encourage an alternative healthier behaviour, and has been shown to positively influencing healthier food choice (Rozin *et al.*, 2011). Changing the quantity or positioning of a healthier food product may also elicit social norm beliefs prompting its purchase without the need for engaging conscious cognitive processes (Salmon *et al.*, 2014).

The use of choice architecture is believed to be effective as it requires little conscious engagement and is less dependent on literacy or self-regulatory skills (Hollands *et al.*, 2013). Such initiatives can reduce both the physical and cognitive effort that is often required when trying to change behaviour, and thus may be applicable to a vast proportion of society. As choice architecture approaches are simply cuing consumers towards alternative healthier behaviours rather than requiring the use of conscious decision-making processes, it is proposed that they are more effective at addressing the routine and habitual elements of food purchasing behaviours. Furthermore, proponents of choice architecture suggest that its use can address health inequalities as they are applicable to all population groups and do not rely on education or financial resources (Hollands *et al.*, 2013). However, critics argue that they do not address some of the key causes of unhealthy food behaviours, such as poverty and education, and should only be used to complement additional initiatives that address such causes rather than being the sole policy approach (Bonell *et al.*, 2011). Thus, contextual changes provide a potential approach for supporting change in food purchasing behaviour but additional considerations may be required to ensure their effectiveness at facilitating change. Furthermore, context change alone may be unlikely to facilitate sustained change for all consumers and a combination of contextual and individual-focused approaches may be the optimal approach (Dobbs *et al.*, 2014; Verplanken & Wood, 2006).

2.5.3 Changing the Individual Response

Due to the significant environmental changes required and the difficulty in identifying individually-relevant cues (Quinn *et al.*, 2010; Wood *et al.*, 2005), contextual changes might not be a valid approach in all circumstances. Furthermore, despite a lack of contextual change people still manage to change undesirable behaviours that are significantly routinised or habitual. Such change is typically achieved through the force of self-control (Wood & Neal, 2007). Self-control refers to an individual's capacity to alter their pattern of response to particular stimuli and replace with a more

personally desirable response (Baumeister, 2002b), and is part of the deliberative cognitive system, or system two, that has been discussed previously. In the context of healthy food behaviour, it relates to the ability to override cues to particular patterns of food choice and replace with a healthier pattern of behaviour. Indeed, high levels of self-control are associated with healthier food behaviours, such as increased levels of healthy eating, less binge eating, and reduced alcohol consumption. In contrast, low self-control is typically associated with unhealthier food behaviours, such as increased consumption of foods that are high in sugar and fat (Friese & Hofmann, 2009; Oaten & Cheng, 2006). Additionally, impaired self-control is shown to increase consumption of unhealthier food items even in those that typically follow a healthy eating pattern (Kahan, Polivy & Herman, 2003; Vohs & Heatherton, 2000). Therefore, self-control capacity appears to influence the ability to adhere to healthy food behaviours.

Self-control capacity has been likened to a muscle in that it has a limited capacity that is diminished after repeated acts of self-control ensuring there is less available for subsequent tasks (Baumeister, 2002b). Periods of emotional distress and stress also draw on self-control resources as people cast aside their self-control in an attempt to improve their emotional state (Baumeister, 2002b). Thus, self-control capacity can become diminished which may reduce the individual capacity to maintain healthier behaviours. However, similar to a muscle, self-control can be increased through training and regular practice (Gailliot *et al.*, 2007; Muraven, Baumeister & Tice, 1999). Oaten and Cheng (2006) have illustrated a positive impact on healthier food behaviours following an eight-week period of self-control training. Building self-control capacity may offer an approach to supporting change in food purchasing behaviour by building capacity to override the individual response to cues to unhealthier food behaviours. However, it is important to note that such an approach may not be feasible for all as a food addiction disorder may limit individual capacity to control individual food behaviour (Gearhardt, Corbin & Brownell, 2009). Nevertheless, it is important to consider those behaviour change approaches that focus on self-control and are relevant to food purchasing behaviour. These include vigilant monitoring, counter-conditioning, and implementation intentions, and will now be discussed in further detail.

The first of these approaches is referred to as vigilant monitoring. This encourages active scrutiny of one's behaviour to identify unhealthy behaviours and ensure that

they are not completed simply by saying 'Don't do it' (Quinn *et al.*, 2010; van't Riet *et al.*, 2011). Quinn *et al.* (2010) found vigilant monitoring to be the most frequently used technique for inhibiting unwanted behaviours and it was also the most effective inhibitory technique even in comparison to stimulus or contextual control. However, it is important to acknowledge that all the techniques used in this study were only modestly successful at inhibiting unwanted behaviours so no one technique entirely dominated. Vigilant monitoring improves self-control capacity and the ability to override routine and habitual responses through conscious, intentional processes (Quinn *et al.*, 2010). However, natural fluctuations in self-control are likely to influence the ability to consistently monitor behaviour and override such responses (Muraven, Tice & Baumeister, 1998) meaning that reliance on self-control capacity alone may not lead to sustained behaviour change.

Continued vigilant monitoring may also have negative consequences for the consumer as it may lead to increased preoccupation with the unwanted behaviour and subsequently increase its performance (Polivy, 1998; Wenzlaff & Wegner, 2000). For these reasons, it has been suggested that vigilant monitoring will only have a significant and sustainable impact if combined with an additional approach, such as counter-conditioning (Quinn *et al.*, 2010; van't Riet *et al.*, 2011). Counter-conditioning aims to replace the individual response with an alternative healthier behaviour such that subsequent encounters of an existing behavioural cue will prompt the performance of the desired healthier behaviour rather than the old, undesired behaviour. Evidence from smoking cessation supports this approach where smokers are more successful at quitting if they replace smoking with a healthier behaviour, such as physical activity (Prochaska *et al.*, 1988). While there is limited evidence of its use in the context of changing food behaviours, successful dieters were able to replace hedonic thoughts with those related to weight control goals when exposed to a food cue illustrating its potential effectiveness (Papies, Stroebe & Aarts, 2007; Papies, Stroebe & Aarts, 2008). This suggests that counter-conditioning could be an effective technique to support food purchasing behaviour change.

Another behaviour change approach that draws on the importance of self-control is the use of implementation intentions or 'if-then' plans. Implementation intentions involve identification of a goal-relevant contextual cue and a relevant goal-directed response to this cue (Gollwitzer & Sheeran, 2009). Formation of implementation

intentions creates a connection between a particular cue and the desired response which allows for delegation of behavioural control to the identified behavioural cue. Implementation intentions make it easier for individuals to detect when to enact the desired behaviour (Webb & Sheeran, 2004) and allows for behaviours to be performed quickly and effectively without requiring engagement of the deliberative cognitive process (Gollwitzer & Sheeran, 2009). They were initially proposed as a means of achieving one's goals (Gollwitzer, 1999), but were subsequently recommended as a means of changing habits (Gollwitzer & Sheeran, 2006). Their effectiveness on goal attainment has been demonstrated for a variety of health behaviours and shown to be more effective than the sole use of intentions (Gollwitzer & Sheeran, 2006). Furthermore, implementation intentions are shown to protect against the decline in self-control associated with repeated behavioural performance and its negative impact on subsequent behaviour (Webb & Sheeran, 2003). As lower levels of self-control may reduce one's capacity to maintain behaviour change, the use of implementation intentions may bolster self-control and increase the potential to sustain change.

However, their effectiveness on changing routinised or habitual behaviours is less conclusive. While Cohen *et al.* (2008) found that implementation intentions were able to supress habitual responses, it is possible that they may only be effective against weaker habits (Gollwitzer & Sheeran, 2009; Webb, Sheeran & Luszczynska, 2009). Additional complementary approaches may be required to address stronger habitual behaviours, such as mental imagery or mental contrasting (Gollwitzer & Sheeran, 2009). As part of mental imagery, the individual forms a mental representation of performing the desired behaviour when stating their implementation intention. This combined approach was shown to significantly increase initiation of the desired behaviour (Knäuper *et al.*, 2009). The concurrent use of mental contrasting may also be effective. Mental contrasting encourages consumers to link their implementation intention with a vision of their desired future plus existing barriers. This also has been effective at changing both weaker and stronger habits when combined with implementation intentions (Adriaanse, de Ridder & de Wit, 2009; Oettingen, Pak & Schnetter, 2001). Thus, a number of approaches may facilitate behaviour change by drawing on the importance of self-control although it is possible that a combination of such approaches may be required to achieve sustained change.

2.5.4 Changing the Outcome

Behaviours are typically only repeated if they result in a positive outcome for the individual (Aarts, Verplanken & Van Knippenberg, 1998; Wood & Neal, 2007). Thus, there is potential to exploit this component to support behaviour change and focus on changing the behavioural outcome. Outcome rewards are shown to increase the learning of the cue-response relationship upon which routines and habits are founded (de Wit & Dickinson, 2009), and changing such rewards may offer a strategy for behaviour change. As outlined previously, food cost is often a key determinant of food choice (Cox *et al.*, 1998). Consequently, the use of financial incentives may be a means of supporting the purchasing of healthier foods. Incentives may reduce the financial risk of purchasing a new food encouraging a greater openness in consumers with restricted budgets and a positive experience may lead to its continued purchase (Gneezy, Meier & Rey-Biel, 2011). Thus, financial incentives may encourage the purchase of healthier foods in those with limited experiences and constrained budgets.

There has been a focus on the impact of discounted healthier options or the provision of food coupons on purchasing behaviour. The use of price discounts appears to have a positive impact on the purchase of healthier foods (Ni Mhurchu *et al.*, 2010; Toft *et al.*, 2012; Waterlander *et al.*, 2013a), including low income consumers (Cohen *et al.*, 2017; Polacsek *et al.*, 2017). However, there is also potential for an increase in the purchasing of less healthier foods (Waterlander *et al.*, 2013b) highlighting the need for a holistic approach. Furthermore, price discounts appear to be less effective when the consumer is under significant cognitive load, which is often the case during food shopping (Carroll, Samek & Zepeda, 2018). Thus, there may be limits to their effectiveness in supporting healthier food behaviours.

An alternative approach, but one that continues to focus on the behavioural outcome, is the use of negative reinforcement with much research again focusing on the financial impact on the consumer. This has resulted in examining the effectiveness of taxing unhealthier food options. There is some evidence to suggest that health-related taxes can increase the purchasing of healthier food items (Epstein *et al.*, 2010) although there are some concerns that such taxes are regressive and would unfairly penalise those living on low incomes (National Taskforce on Obesity, 2005; Madden, 2015). A suggested solution may be the introduction of an accompanying subsidy for healthier food items, such as fruit and vegetables. It is suggested that this combined

approach would lead to an increased consumption of subsidised healthier foods with a subsequent decline in the consumption of the unhealthier taxed foods (Madden, 2015). Importantly, it is proposed that greater differences are likely to be achieved in lower income groups if a combined approach is used which may negate the potential regressive nature of a health-related tax.

While financial (dis)incentives may be effective in the short-term, their impact on long-term behaviour change is questionable and may depend on the food product and consumer characteristics (Hawkes, 2009). The majority of studies examine their impact on behaviour for the study duration only with little insight into their long-term effect. However, Ni Mhurchu *et al.* (2010) did report that behaviour change was maintained twelve months after financial incentives, i.e. price discounts, were removed. As the use of financial (dis)incentives focuses on an external reward system, it is possible that (dis)incentivisation may negatively influence intrinsic motivation reducing the likelihood of behaviour maintenance once the (dis)incentive is removed (Gneezy *et al.*, 2011). Additionally, sales promotions may simply lead to substitution of a similar food product without the desired change in overall dietary intake (Hawkes, 2009). While rewards are an important part of the behavioural change process (Prochaska *et al.*, 1988), they don't need to be visible to the individual to have a beneficial effect (Lally, Chipperfield & Wardle, 2008). Thus, a focus on implicit rewards may be more beneficial, especially for habitual behaviours (Custers & Aarts, 2005; Wood & Neal, 2009). This approach ensures that there is not a conscious direct link between the behavioural response and reward which may improve the likelihood that it will be maintained once the reward is removed (van't Riet *et al.*, 2011). However, it is likely that complementary approaches are again required to achieve significant and sustained behaviour change, such as disincentivisation of unhealthier food products alongside concurrent nutrition education programme (French *et al.*, 2017; Hawkes, 2009; Olsho *et al.*, 2017; Waterlander *et al.*, 2013a). Thus, focusing on the behaviour outcome provides another approach for behaviour change but additional approaches may also be required.

2.5.5 Challenges for Behaviour Change

The previous sections have outlined the potential opportunities that exist to change food purchasing behaviour. However, there also exists a number of challenges which may hamper such efforts. Consequently, they are a necessary consideration and will

be addressed in this section. The lack of evidence on the role of individual differences in the development of routines and habits impedes behaviour change intervention development as it does not allow for sufficient insight into the appropriate mechanisms to change such behaviours (Gardner, 2015). Individual differences are reported for personal attributes such as identity, motivation, attitudes, and perceived self-control which are important determinants of behaviour (Ajzen, 1991; Biddle *et al.*, 1987; Glanz, Rimer & Viswanath, 2008). It is likely that such differences contribute to individual variation in the formation of routines and habits and individual propensity for behaviour change. A wide variation in formation time and strength level is apparent with a range of 18 – 254 days reported for habit formation illustrating the extent to which individuals differ (Lally *et al.*, 2010). Triandis' 'theory of interpersonal behaviour' (1977) proposes that individuals differ in the extent to which they rely on automatic versus reflective cognitive systems during decision making. Consequently, inherent individual idiosyncrasies are central in the development of routines and habits. A lack of understanding of their role may hamper the development of effective behaviour change initiatives (Gardner, 2015; Lally, Wardle & Gardner, 2011).

As discussed previously, contextual changes may disrupt routine and habitual elements of behaviour after which new behaviour may be enacted in response to new goals or relevant information (Verplanken *et al.*, 2008; Verplanken & Wood, 2006; Wood *et al.*, 2005). Thus, contextual change offers one approach of supporting healthier food purchasing behaviour. However, much of the research completed thus far have focused on larger environmental changes which are not feasible in all circumstances. Consequently, it may be effective to encourage individuals to identify and change individual cues to aid behaviour change. Such an approach is typically employed by those attempting to quit smoking where ashtrays and other smoking paraphernalia are removed (Bartlett, Sheeran & Hawley, 2014; Prochaska *et al.*, 1988). Similar techniques were reported by those attempting to change their eating habits where healthier snacks were brought into work to avoid the usual triggers for unhealthier options (Lally *et al.*, 2011).

Individual identification of relevant contextual cues, however, may not be straightforward. Wood and Neal (2009) define contextual cues as "*the responses that routinely precede habit performance, along with where, when, and with whom the habitual response typically is given*". Verplanken (2005) suggests that any

environmental feature can act as a contextual cue provided there is sufficient interaction. Typical examples of contextual cues include physical location, the presence of others, the time of day or week, or performance of particular behaviours. Adding further complexity, a particular habit may be directed by seemingly unrelated contextual cues. Diverse contexts may have certain common features that promote the transfer of learning between contexts leading to a common behavioural response (Barnett & Ceci, 2002). A variety of contextual cues may exist for a particular behaviour making it difficult for individuals to identify cues relevant to their own behaviour which introduces a significant challenge for behaviour change (Quinn *et al.*, 2010; Wood *et al.*, 2005). Thus, changing contextual cues at an individual level may be an opportunity to prompt behaviour change but the ease with which this can be achieved is currently unclear.

It is important to acknowledge that the consumer should remain as the focal point for any behaviour change intervention to enhance its potential effectiveness (Yardley *et al.*, 2015a). Consequently, intervention acceptability to the target audience is an important consideration. There is limited evidence on this topic in relation to food purchasing behaviour but existing evidence does illustrate a number of interesting points. Financial (dis)incentives, focusing on changing the behavioural outcome, appear to be an acceptable approach if they are viewed as effective and cost-effective (Giles *et al.*, 2015), although support may reduce if they are viewed as coercive, to undermine personal responsibility, or promote economic dependence of the recipient (Lunze & Paasche-Orlow, 2013). Less intrusive approaches, such as education, are viewed as more acceptable over those viewed as more restrictive, such as (dis)incentives (Diepeveen *et al.*, 2013; Heery *et al.*, 2014). A focus on commercial responsibility, rather than individual responsibility, is also viewed as more acceptable (Diepeveen *et al.*, 2013). However, it may be that a combination of different supports, including incentives, nutrition education, and unhealthy food restriction, is deemed most acceptable to aid healthier behaviour (Leung *et al.*, 2017).

Contextual changes, as discussed earlier, may provide an important opportunity to change food purchasing behaviour. However, the acceptability of such approaches to consumers is unclear. They have been criticised as potentially unethical as some suggest that they may remove individual autonomy from decision-making (Sparks & Burt, 2017). Thaler and Sunstein (2008) argue that all choices are influenced by the

context in which they are made and that contextual change simply aims to influence choices in a different manner. However, Hansen, Skov, and Skov (2016) contend that those responsible for implementing such contextual changes must also take responsibility for the consequences of altered choices. They argue that if contextual changes are made by someone other than the individual consumer, they may not be acceptable to the individual as they remove choice and may direct behaviour towards that which is not desired. Their acceptability may depend on the degree of contextual change, the transparency of any changes, and the potential alignment with individual goals (Hansen *et al.*, 2016). Indeed, intensive regulatory policies to address obesity were reported as less acceptable than informational policies or subsidies in a previous survey of the Irish public (Heery *et al.*, 2014). However, it is important to acknowledge that the majority of policies were viewed as acceptable, although differences were apparent by age, gender, and educational attainment (Heery *et al.*, 2014). Thus, the differing acceptability of behaviour change approaches may challenge their implementation, and is an important consideration in their design and implementation.

"*Change is difficult and requires sustained motivation and support*" (Kelly & Barker, 2016), thereby illustrating another challenge for behaviour change. As previously discussed, change can be achieved through employing self-control where the typical behavioural response is overridden and replaced a the desired response (Wood & Neal, 2007). However, this process is effortful and the continued employment of self-control can diminish individual capacity resulting in a reduced ability to override the routine or habitual response (Baumeister, 2002a; Muraven *et al.*, 1998). Furthermore, self-control capacity is reduced in times of emotional distress or stressful situations (Baumeister, 2002b) which may also result in a reliance on habitual or routine behaviours. Everyday life typically requires the employment of self-control at varying stages throughout the day (Baumeister, 2002b) which naturally depletes the resources available for changing individual behaviour. This may lead to behaviour change being viewed as effortful such that individuals do not attempt to change behaviour or discontinue the process after a specific period of time (Elwell *et al.*, 2013; McKenzie & Harris, 2013). Consequently, behaviour change may be a difficult process for some and one that requires sustained levels of self-control to achieve desired goals. This may not be possible for all individuals and consequently may present a substantial barrier to both initiation and maintenance of food purchasing behaviour change.

Employing a socioecological perspective, previous sections have illustrated the important influence that the food environment, encompassing the retail environment and the wider sociocultural landscape, has on food purchasing behaviour. Given such importance, the modern food environment presents a significant challenge to facilitating a change to healthier food purchasing behaviour. The planning of retail store location shapes individual accessibility to healthier foods with inadequate accessibility likely to contribute to unhealthier dietary patterns (Cooksey-Stowers, Schwartz & Brownell, 2017; Mackenbach *et al.*, 2017). Individuals from lower socioeconomic communities may not have access to private transport to access appropriate retail stores and, thus, may be more susceptible to the negative impact on food choice (Chrisinger, 2016; Hawkes, 2008). Insufficient regulation of the advertisting of unhealthier foods, especially aimed at children, negatively influences healthy food choice with calls for a dramatic change to combat its detrimental impact (HLPE, 2017). Many retail stores place a greater emphasis on the promotion of unhealthier foods via placement, pricing, and promotional activities (Furey *et al.*, 2017; Glanz *et al.*, 2012; Ravensbergen *et al.*, 2015; Sparks & Burt, 2017). Drawing on the evidence presented in previous sections, consumers from a lower socioeconomic background may be more susceptible to such in-store initiatives as their purchasing choices are made within a context of constraint in relation to nutrition knowledge, time, and financial budget (Miller & Branscum, 2012; Zachary *et al.*, 2013). While opportunities for change exist the food environment in which they must be made may act as a barrier and add further complexity to the behaviour change process, especially for those from lower socioeconomic backgrounds.

2.5.6 Behaviour Change Summary

This section has outlined the potential opportunities that exist to support a change towards healthier food purchasing behaviour. It is evident that nutrition education alone is not sufficient given the lack of in-depth processing of relevant information by individuals during routine or habitual behaviours. Rather, it is necessary to consider changing the context, individual response, or the outcome to achieve effective behaviour change. Drawing on the evidence outlined in this section, all are potentially effective for changing behaviour although it appears that a combination of approaches may be most appropriate. For example, disrupting individual behavioural patterns alongside facilitating employment of self-control address two facets of behaviour and

may be more likely to facilitate change. However, it is clear that further work is needed to explore the influence of these approaches on behaviour change, the potential of combining different approaches, and their subsequent impact on food purchasing behaviour. Furthermore, this section outlined the various challenges that exist which may also influence the potential effectiveness of a behaviour change initiative. However, a number of gaps still exist which prevent a full understanding of behaviour change. Addressing such gaps may allow for a deeper insight into behaviour change and improve the potential to facilitate food purchasing behaviour change.

Ensuring the theoretical underpinnings and content of a behaviour change initiative are appropriate is a crucial step in the design of an effective initiative (Glanz & Bishop, 2010). However, the mode in which the intervention will be delivered may also influence potential effectiveness and consequently is an important consideration (Craig *et al.,* 2008). The next section will discuss the existing evidence on the potential effectiveness of mobile apps to change behaviour and how this may be of relevance to changing food purchasing behaviour.

2.6 Mobile Apps as a Potential Behaviour Change Tool

Recent advances in mobile technology have led to their increasing use in the area of health behaviour (Research2Guidance, 2017). Indeed, a new area of health promotion and research has developed which is known as mHealth and focuses specifically on the use of mobile technology in health. mHealth refers to "*medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices*" (World Health Organization, 2011). While mHealth incorporates all potential uses of mobile devices in health, the potential for mobile apps is of particular interest in the context of food purchasing behaviour for this thesis. Mobile apps are software applications designed specifically for use on small, wireless computing devices, such as smartphones and tablets, rather than desktop or laptop computers. They offer additional opportunities for individual engagement and behavioural support as they "*take advantage of computer capabilities as well as the power of networking*" (Handel, 2011). They provide a novel approach as a tool for behaviour change and may enhance individual responsibility and promote a more participative consumer involvement in individual health (European Commission, 2014). Furthermore, they allow a wide range of

consumer interaction with minimal increasing costs which may result in more cost-effective approaches to behaviour change (Hebden *et al.*, 2012; Kerr *et al.*, 2013) and greater geographical reach (Graham, Ostrowski & Sabina, 2016).

Mobile apps are being increasingly used in health interventions and warrant further consideration in the context of food purchasing behaviour. This section will provide an overview of the existing evidence that supports their consideration as a tool for facilitating change towards healthier food purchasing behaviour. It will also outline the gaps present in the current literature which need addressing prior to their wider application in behaviour change interventions.

2.6.1 Mobile Apps and Food Purchasing Behaviour

Mobile apps are a relatively new phenomenon with the first mobile apps made publicly available in 2008. However, significant changes have been seen in their availability and use in the past decade with over three million apps currently available on Google Play, the largest app store (Statista, 2018). In 2017, 175 billion apps were downloaded globally resulting in an $86 billion consumer spend representing increases of 60% and 105% respectively since 2015 (App Annie, 2018). Furthermore, there is a high ownership of mobile devices across all social groups with ownership increasing annually (Anderson, 2015; Deloitte, 2014; eir, 2015), illustrating their potential use as a tool for change with those from a lower socioeconomic background. Consumers display a strong attachment for their mobile phone with one study estimating that phones are within a consumer's reach for over half the day (53%) and in the same room for the majority of their day (88%) (Dey *et al.*, 2011). Furthermore, consumers in the United Kingdom claim to spend approximately two hours each day using their mobile apps (App Annie, 2018). This close attachment allows for interaction at times of personal relevance in a natural setting which has previously been proposed as efficacious for supporting healthier behaviour (Heron & Smyth, 2011). This accessibility may be of importance for food purchasing as it can take place at different times and contexts.

The potential role of mobile apps as a tool for change has not gone unnoticed by consumers. An increasing number are looking to apps as a source of nutrition information and to aid behaviour change (Lieffers, Vance & Hanning, 2014; Schoeppe *et al.*, 2016). Consequently, a substantial proportion of the app market aims to address this consumer need with an estimated 325,000 health apps currently available

(Research2Guidance, 2017). Health apps have been used in a number of different ways to support healthier food behaviour. They have been used as an education tool to increase knowledge and skills and aid healthier food choice in multiple contexts, as a means of setting and monitoring dietary goals, and as a social support network through the provision of access to online peer forums (Coughlin *et al.*, 2015; DiFilippo *et al.*, 2015; Dunford *et al.*, 2014; Lieffers *et al.*, 2018; López *et al.*, 2017). A number of reviews have examined the effectiveness of apps on changing different food behaviours illustrating mixed, yet promising, results (Covolo *et al.*, 2017; DiFilippo *et al.*, 2015; Schoeppe *et al.*, 2016). These reviews suggest a trend towards effectiveness; however, heterogeneity in terms of study outcome, small sample sizes, and short study duration prevents definitive conclusions being drawn. Nevertheless, health apps warrant consideration in the context of food purchasing behaviour given the potential shown.

The evidence in relation to food purchasing behaviour, however, is very limited. Shankar *et al.* (2016) propose that apps are relevant to every stage of the purchasing process and may direct purchasing behaviour by prompting particular goals. However, the search for literature that examined the effectiveness of apps to support healthier purchasing behaviour identified only a small number of relevant studies illustrating a much under-researched area. 'MyNutriCart', an app developed by López *et al.* (2017), draws on individual preferences and household resources to create a shopping list that aligns with healthy eating guidelines. Initial results demonstrate that it may support healthier purchasing behaviour but family preferences and in-store accessibility of recommended food products continue to impede healthier purchasing. Another app, 'FoodSwitch', aims to support healthier purchasing through nutrition information provision and recommendation of healthier substitutions for particular food products (Dunford *et al.*, 2014). Its impact on purchasing behaviour is not clear and a reliance on nutrition provision may fail to address those routine and habitual elements that typically direct purchasing behaviour, as previously discussed (Wood & Neal, 2009). Addressing these elements is crucial if sustained behaviour change is to be achieved (van't Riet *et al.*, 2011). The 'SmartAPPetite' app aimed to facilitate healthier purchasing and consumption by reducing potential educational, behavioural, and economic barriers to accessing healthy, local food (Gilliland *et al.*, 2015). Users of this app self-reported a change towards healthier food purchasing and greater use of

the app appeared to facilitate increased behaviour change. Thus, existing evidence suggests that health apps may facilitate healthier food purchasing behaviour. However, given the small number of studies available, further research is necessary to provide a better understanding of how they may facilitate such change.

2.6.2 Potential Challenges and Considerations

Much research focuses on new technology development to facilitate behaviour change but Hingle and Patrick (2016) emphasise the need to utilise existing resources. They encourage the assessment of existing health apps as a primary step to maximise available resources. As previously discussed, it is necessary to address the routine and habitual elements of food purchasing behaviour to achieve sustained change. Stawarz, Cox, and Blandford (2015) illustrated that apps may be effective at supporting habit formation, but little is known on their ability to change existing consumer routines and habits. It is established that behaviour change interventions are more likely to be effective if they are based on relevant theory (Craig *et al.*, 2008; Glanz & Bishop, 2010). However, relevant theory is not always appropriately integrated into health app design (Pagoto *et al.*, 2013; Stawarz *et al.*, 2015; Wearing *et al.*, 2014; West *et al.*, 2012). Furthermore, it is unclear if existing health apps draw on existing theory and incorporate those techniques of relevance for addressing routine and habitual elements of food purchasing behaviour. Such insight is necessary to assess their potential in facilitating change towards healthier food purchasing behaviour.

A health app typically needs to be used for a specific period of time to ensure the individual is sufficiently 'exposed' to the behaviour change techniques necessary to facilitate change, although the specific time necessary may vary between behaviours (Michie *et al.*, 2017). However, ensuring the app is used for the required time is a key challenge experienced in app-led health interventions (Michie *et al.*, 2017). An imbalance between the integration of relevant theoretical content and user quality features may influence app use and the likelihood that it will be used for the necessary time period (Hingle & Patrick, 2016; Tang *et al.*, 2015). The perceived usefulness of the app is likely to be important as this has consistently been shown as significant in the acceptance of technology (Davis, 1989; Lowe, Fraser & Souza-Monteiro, 2015). Beyond such utilitarian value, the aesthetic appeal and perceived ease of use may influence use (Chang, Kaasinen & Kaipainen, 2012; Davis, 1989; Lowe *et al.*, 2015; Stoyanov *et al.*, 2015), plus the extent to which the app is viewed as enjoyable and

trustworthy (Bruner & Kumar, 2005; Lowe et al., 2015; Nysveen et al., 2005). This demonstrates that app use may be driven by more than theoretical content and its perceived value for behaviour change, but hedonic features may also be important. Such evidence illustrates the need to consider both functional and hedonic elements during app design although it appears that many developers fail to adequately consider both elements (Nicholas *et al.*, 2015; Reynoldson *et al.*, 2014).

There appears, however, limited research on those factors that influence health app use in the context of healthier food purchasing behaviour. Ball, Mouchacca, and Jackson (2014) reported that health apps were viewed as an appealing tool to support healthier food purchasing and that a higher perceived effort had a detrimental impact on their use. The provision of personally relevant information was seen as an important component for continued app use by Gilliland *et al.* (2015). However, such studies offer limited insight into the individual user experience, and the individual factors that may influence app use. Drawing on evidence from beyond the food purchasing context, continued app use may be influenced by variations in terms of nutrition knowledge, behaviour change orientation, previous experience, and self-efficacy (Chen, Cade & Allman-Farinelli, 2015; Franco *et al.*, 2016; Hsu & Lin, 2016; Lieffers *et al.*, 2017; Lowe *et al.*, 2015). However, there is a dearth of relevant literature to gain a complete understanding of the user's interaction with a health app. Furthermore, it is unclear the particular influence that personal and app-related characteristics may have on the user experience and continued app use. There is a need to better understand the individual user experience, in the context of food purchasing, to allow for improved app design and aid healthier purchasing behaviour.

2.6.3 Mobile App Summary

Mobile apps are a recent technological development that offers a novel approach to facilitating behaviour change. Their widespread ownership and constant accessibility further position them as a potential tool to facilitate change in food purchasing behaviour as they may address the reflective and automatic elements of behaviour. However, it is unknown if existing apps incorporate relevant theoretical components to facilitate such change, or indeed if they are viewed as acceptable by the intended user group and the factors that influence acceptance. It is necessary to understand the user's process of interaction with a health app to gain insight into those factors that impede or support continued use, and potentially facilitate sustained behaviour

change. Such evidence is necessary to ensure their use as a behaviour change tool is appropriate in relation to food purchasing behaviour, and to inform the design of future apps and related dietary interventions.

2.7 Conclusions

Unhealthier dietary patterns are a leading cause of premature death and chronic disease development. The design and implementation of initiatives that support a change towards healthier consumption patterns are necessary to support improved health outcomes. This is especially necessary for those from lower socioeconomic backgrounds to address existing dietary and health inequalities. As introduced in chapter one, and built upon in this chapter, food purchasing is an important step in the food choice process and influences the foods available for consumption in the home. Consequently, it offers an opportunity to intervene in the food choice decision-making process and support healthier food behaviours, and subsequent health outcomes.

Drawing on a socioecological model, as outlined in figure 2.1, this chapter illustrated the complex combination of individual, social, and environmental influences that shape personal goals and subsequent food purchasing behaviour. Such complexity results in purchasing behaviours that are contextualised acts shaped by personal and context-related characteristics. In order to address this complexity and accommodate salient goals, individuals rely on system one cognitive processes, such as heuristics, routines, and habits, during food purchasing rather than more effortful cognitive processes. While this may provide efficiency to the consumer, it may result in less optimal decision-making during food shopping and impede a change towards healthier purchasing behaviour. A move towards using more deliberative cognitive processes may be necessary to attain healthier food goals. The precise role of habit in purchasing was further questioned. Due consideration must be given to the role of routinised scripts and deliberative cognitive processes in the purchasing process.

As discussed in section 2.5, multiple opportunities exist that may facilitate healthier purchasing behaviour. Drawing on such evidence, a focus on supporting the individual to change their response and their personal purchasing context offers a feasible strategy for behaviour change that empowers the individual in a way that may be considered acceptable. As discussed in section 2.6, apps offer a potential tool to facilitate such change. However, this is an undeveloped area, especially in relation to

routinised behaviours such as food purchasing. A better understanding of the interplay between app technology and behaviour change, in this specific context, is necessary to progress the existing theoretical understanding of app-led change and inform intervention design.





Flaherty, S. J. 2019. Disrupting routines, facilitating control: exploring a change towards healthier food purchasing behaviour using a health app. PhD Thesis, University College Cork.

Please note that Chapter 3 (pp.63-89) is unavailable due to a restriction requested by the author.

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Chapter 4

Methods

4.1 Overview

The purpose of this chapter is to develop and explain the research objectives for the primary research that was undertaken as part of this thesis, and the research design chosen to address these objectives of interest. Building on the literature and findings presented in chapters two and three, the initial section of this chapter will summarise the existing knowledge base that underpinned the development of these objectives. After presenting a brief introduction to research philosophies, the philosophical perspective adopted in this thesis is discussed alongside its influence in shaping the methods subsequently employed. An overview of the research design is provided in this chapter but the specific data collection and analytical methods employed during each subsequent research phase will be presented in the relevant chapters, five to eight.

4.2 Introduction and Research Objectives

The importance of supporting healthier food consumption patterns was established in chapter one as a means of reducing the risk of premature death and disability as well as addressing negative related social and economic outcomes (Institute for Health Metrics and Evaluation, 2013; Stanaway et al., 2018). As food purchasing represents a significant stage of the food choice process (Sobal *et al.*, 1998), facilitating healthier purchasing behaviour offers an effective approach of supporting healthier consumption patterns (Story *et al.*, 2008). However, facilitating healthier purchasing behaviour may not be straight-forward. A complex range of factors influence food purchasing behaviour at the individual, sociocultural, and environmental levels (Stokols, 1996; Story *et al.*, 2008). Such factors shape individual food purchasing goals which drive behaviour in a particular context. However, as the context changes so do the saliency of different factors which may change individual goals and the behaviour or actions employed to attain such goals. Any attempt to change food purchasing behaviour must be cognisant of the individual context and the influence of these different factors and personal goals on behaviour.

Individuals are likely to employ both reflective and automatic cognitive networks during food purchasing (Rothman *et al.*, 2009) with contextual and personal characteristics shaping the extent to which each network is used (Strack *et al.*, 2006). The central importance of reflective cognitive networks was emphasised in chapter three where self-control was viewed as important in directing healthier behaviour and

mediating the influence of competing goals. This illustrates the need to employ behaviour change strategies that acknowledge both reflective and automatic cognitive networks to support healthier purchasing behaviour. A number of appropriate approaches were outlined in chapter two which may be effective at addressing these routine and habitual elements of behaviour. Changing the behavioural context (Thaler & Sunstein, 2008; Verplanken & Wood, 2006; Wood *et al.*, 2005) or the individual outcome through positive or negative reinforcement may be effective (Gneezy *et al.*, 2011; Ni Mhurchu *et al.*, 2010). A focus on the individual response by building self-control capacity also offers an effective approach to enable overriding of unhealthier patterns of behaviour and replacing with behaviour driven by more desirable healthy food goals (van't Riet *et al.*, 2011; Wood & Neal, 2007). Indeed, drawing on the findings presented in chapter three, building self-control capacity may be a crucial component of supporting healthier food behaviours. Employing such approaches alongside the building of nutrition-related human capital resources, such as nutrition knowledge and cooking skills, addresses both cognitive networks.

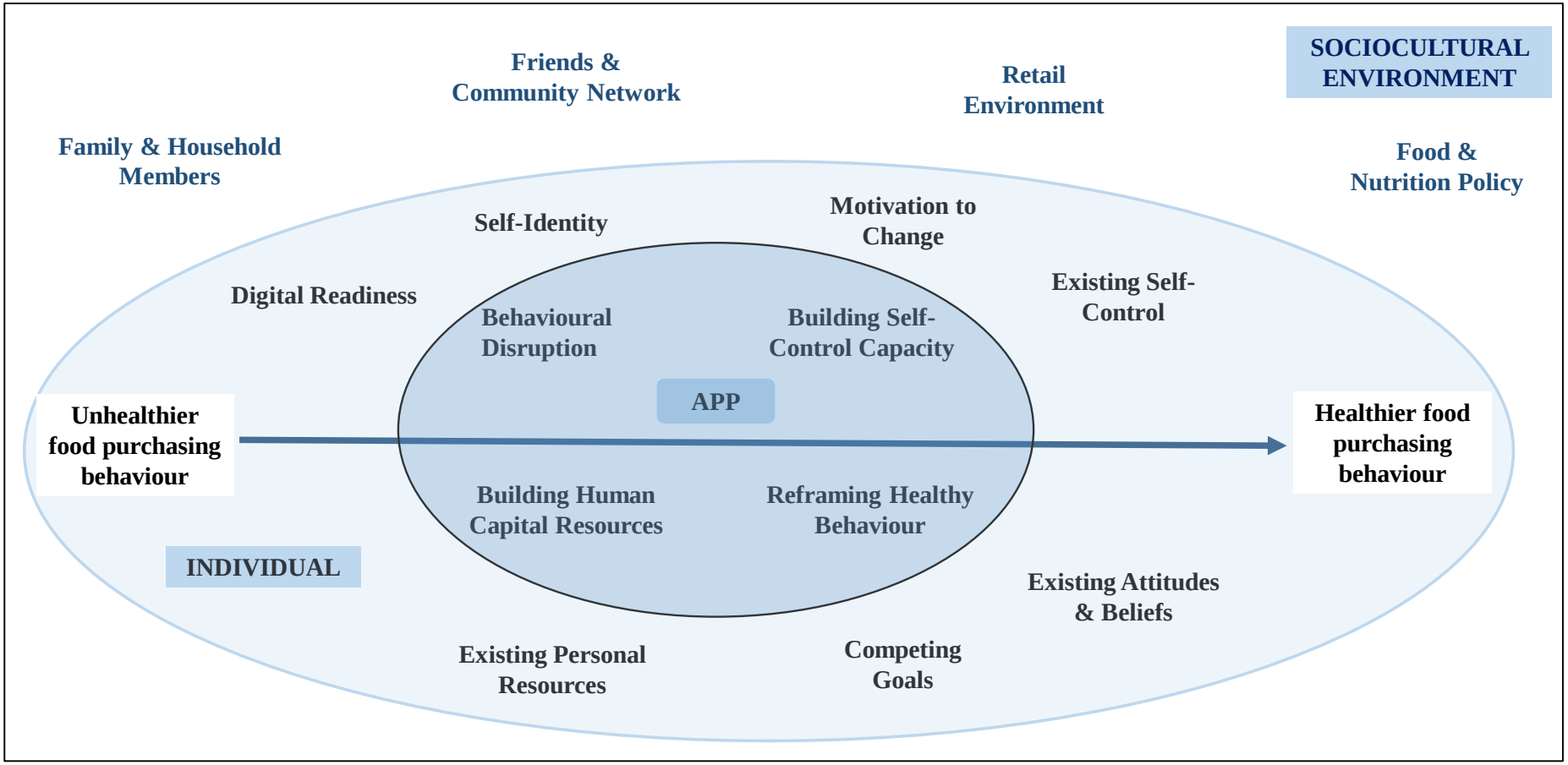
It is anticipated that healthier purchasing behaviour may be achieved by simultaneously disrupting undesirable behavioural patterns, building personal resources, such as nutrition-related human capital and self-control, and reframing behavioural outcomes. This combined strategy may direct individuals towards more conscious, reflective food purchasing behaviour that is guided by healthy food goals and informed by nutrition-related personal resources. However, little research has been undertaken to explore the impact of such an approach in relation to food purchasing behaviour. Such insight would allow for a better understanding of the processes of behaviour change and assess if the theoretical underpinnings of this change strategy is appropriate and effective for food purchasing behaviour change (Craig *et al.*, 2008; Glanz & Bishop, 2010). This dearth of evidence represents an important gap in the literature which must be addressed to progress our understanding of behaviour change. This may subsequently inform the design of effective strategies to support healthier food purchasing behaviour.

In exploring the extant literature in relation to behaviour change, it was evident that the mode through which change is supported is also an important consideration (Craig *et al.*, 2008). This necessitates an exploration of potential tools to identify those appropriate for delivery of the proposed behaviour change strategy. As discussed in

chapter two, mobile apps offer a potential tool for behaviour change and a useful means of examining the influence of the proposed behaviour change strategy on food purchasing behaviour. However, gaps in the literature are evident with little insight into the capacity of existing health apps to facilitate behaviour change (Hingle & Patrick, 2016) or those factors that influence whether an app is accepted by the individual and used for the time period necessary to facilitate change (Michie *et al.*, 2017). It is important to gain an improved understanding of the user's interaction with the app during the process of food purchasing behaviour change to contribute to the theoretical understanding of this process of interaction and practically contribute to future app design. This will allow insight into the role that the app itself plays during behaviour change, and how it may influence the potential effectiveness of the proposed strategy for change.

Drawing on the literature presented in this section and previous chapters, a conceptual model (Figure 4.1) was developed to illustrate the proposed behaviour change process, and those factors that may influence behaviour change and the acceptance of an app as a facilitator. The innermost dark blue sphere represents the app and the integrated behaviour change strategies that are proposed to support the individual to move from the undesirable, unhealthier behaviour towards healthier food purchasing behaviour. Individual-level factors, including motivation to change, digital readiness, competing goals, and existing personal resources may influence this process, and are represented in the middle light blue sphere. These factors may influence the extent to which the combination of strategies are effective at supporting change and/or app acceptance. The outermost area represents the sociocultural environment in which behaviour change takes place which may also influence behaviour change and app acceptance.

Figure 4.1 Representation of the Behaviour Change Process



It is evident that a number of gaps in the literature exist in relation to supporting healthier food purchasing and the use of an app as a tool to facilitate such change. Addressing such gaps would further our understanding of the processes of behaviour change in relation to both reflective and automatic cognitive networks, and the role of a health app as a facilitator of change. Consequently, the overarching aim of this thesis is to contribute to the theoretical understanding of the interplay between mobile app technology and behaviour change in the context of highly routinised and habitual behaviour, with food purchasing as the behaviour of interest.

As previously outlined in chapter one, four research objectives were specified:

1: Examine the individual-level determinants of a healthy eating habit and the extent to which personal goals and self-control are linked to a healthy eating habit.

2: Examine the capacity of existing apps to support healthier food purchasing behaviour through the integration of features that disrupt undesirable purchasing patterns, build personal resources, and reframe behavioural outcomes.

3: Explore the personal and app-specific factors that influence the acceptance and continued use of health apps in those individuals attempting to change their food purchasing behaviour.

4: Explore the lived experience of using an app, and the recommended behaviour change techniques, to change food purchasing behaviour and the personal, social, and environmental factors that influence this experience.

The first objective, to examine the individual-level determinants of a healthy eating habit, has been addressed in chapter three. The remainder of this chapter will focus on the methods employed to address the remaining three research objectives.

4.3 Research Philosophy

Prior to outlining the research design for this thesis, it is necessary to discuss the different philosophical perspectives that exist as they are an important consideration in research design and may influence and direct subsequent methodological decisions (Cohen & Crabtree, 2008). An inter-relationship exists between the researcher's epistemological stance, the theoretical perspective adopted, and the methodology and methods used (Crotty, 1998; Saunders, Thornhill & Lewis, 2009), which highlights the important connection between these elements. Thus, it is important as a researcher

to reflect and outline one's philosophical stance as it informs the way in which knowledge creation is viewed and how such knowledge can be investigated (Johnson & Clark, 2006; Lincoln & Guba, 1985). This section will discuss the different facets of research philosophy and their potential role in directing research design; the philosophical perspective adopted by the researcher will be outlined in section 4.5 alongside the research design.

Axiology relates to the researcher's own values and acknowledges the influence that they may have on the research process (Saunders *et al.*, 2009). Personal values may inform the judgments or decisions made throughout the research process, including the research question of interest, the research design chosen to address this question, and subsequent decisions or interpretations during data collection and analysis (Heron, 1996). Thus, as noted by Cohen and Crabtree (2008) "*researcher motivations and preconceptions shape all research*". Ontology is concerned with the nature of reality and what constitutes that reality (Gray, 2018). It focuses on researchers' assumptions on the existence of being, which has subsequent implications on the perception of knowledge creation (Saunders *et al.*, 2009). Saunders *et al.* (2009) cite objectivism and subjectivism as the main ontological perspectives. Objectivism "*represents the position that social entities exist in reality external to social actors*". In contrast, subjectivism posits that multiple realities exist which are created from the actions and perceptions of social actors and consequently in constant change (Gray, 2018; Saunders *et al.*, 2009).

"*While ontology embodies understanding* ***what is****, epistemology tries to understand* ***what it means to know***" (Gray, 2018). In order words, epistemology is concerned with what knowledge is considered possible and acceptable (Crotty, 1998). Understanding your epistemological perspective is viewed as central for research design and ensuring that the measures chosen are appropriate to address the research questions of interest (Gray, 2018; Maynard, 1994). Traditionally, two dominant epistemological perspectives are considered: positivism and interpretivism. Positivism aligns within the objectivist ontological paradigm where reality is viewed as external to the researcher and may be captured through the use of independent, objective means (Saunders *et al.*, 2009). Interpretivism, in comparison, falls within subjectivism where reality is created through social interactions and knowledge or meaning is

"*constructed not discovered*" (Gray, 2018). This results in different constructions of meaning which influences the ways in which it may be captured.

The three most common philosophical perspectives, in the health and social sciences at least, are outlined in table 4.1, which is drawn from Saunders *et al.* (2009). The table outlines the different ontological, epistemological, and axiological influences on each research philosophy and the impact that this has on research design. Further details on these philosophical perspective are presented in the following sections.

Table 4.1 Comparison of Research Philosophies (Adapted from Saunders *et al.*, 2009)

	Positivism	**Interpretivism**	**Pragmatism**
Ontology: *the researcher's view of reality of being*	External. Objective. Independent of social actors.	Multiple realities. Socially constructed. Subjective. May change over time.	Multiple realities. View chosen based on question.
Epistemology: *the researcher's view regarding what constitutes knowledge*	Only observable phenomena provide credible data.	Subjective meanings and social phenomena. Context an important focus.	Either or both observable phenomena and subjective meanings are credible data.
Axiology: *the researcher's view of the role of values in research*	Value-free and objective. Researcher independent of the data.	Value-bound and subjective. Researcher cannot be separated.	Values important. Researcher adopts both subjective and objective views.
Typical Data Collection Methods	Highly structured. Quantitative.	In-depth investigations, qualitative.	Mixed or multiple method designs.

Positivism, as noted earlier, considers there to be a single, objective reality that can be measured through direct observation (Gray, 2018). Thus, positivist research inquiry draws primarily from the natural sciences and focuses only on that which can be empirically quantified and measured (Saunders *et al.*, 2009). A further importance is placed on conducting research that is considered value-free and the positivist researcher is viewed as being independent from the data and "*neither affects nor is affected by the subject of the research*" (Remenyi *et al.*, 1998). However, this striving

for value-free research is criticised (Saunders *et al.*, 2009). As outlined earlier, personal values influence every stage of the research process, including the research question chosen; thus it is impossible for research to be completely value-free and a focus on acknowledging its implications are necessary. The emphasis on objective facts and single truths has also been criticised. This has resulted in a move towards post-positivism which continues to hold that there is an independent, objective reality but acknowledges that all methods of observation are fallible and a clear explanation of reality may never be gained (Onwuegbuzie, Johnson & Collins, 2009).

Interpretivism is diametrically opposed to positivism and does not consider there to be a direct relationship between individuals and the world, but rather that the world is interpreted by each individual (Gray, 2018). Interpretivism is typically the philosophical perspective underpinning much qualitative and social research, as it focuses on "*how the social world is interpreted, understood, experienced, produced or constituted*" (Mason, 2002). Thus, it aims to understand rather than to predict, as is often the goal in positivist research. Furthermore, the interpretivist researcher "*looks for culturally derived and historically situated interpretations of the social life-world*" (Crotty, 1998), thereby acknowledging the importance of the context in which one resides and the potential implications that this may have on reality construction (Lyons & Coyle, 2007). In conflict with positivism, interpretivist research is not considered value-free but it acknowledges the influence that the researcher has on research design. It further recognises that the researcher is not independent of the participant or the phenomenon of interest and may shape perceptions through their involvement as a researcher (Saunders *et al.*, 2009).

Pragmatism, however, offers an alternative philosophical perspective where the most important consideration is the research question (Saunders *et al.*, 2009) and subsequent research design should not be limited by potential philosophical constraints (Tashakkori & Teddlie, 1998). Indeed, Tashakkori and Teddlie (1998) advise that research philosophies do not exist as separate entities but exist along a continuum on which the researcher must locate themselves: "*at some points the knower and the known must be interactive, while at others, one may more easily stand apart from what one is studying"*. Thus, it is not necessary to align oneself with a single epistemological stance and obediently adhere to its conventions but one should choose that approach which is viewed as most valuable and appropriate (Saunders *et*

al., 2009). The underlying premise of pragmatism is that focusing on a single research method is not of value (Mertens, 2005), and all approaches are relevant for understanding or addressing the research question (Creswell, 2013). The pragmatist researcher focuses "*not on whether a proposition fits a particular ontology, but whether it suits a purpose and is capable of creating action*" (Gray, 2018). Thus, pragmatism offers an intermediate theoretical perspective where the researcher can draw upon a range of methodologies as considered most appropriate and valuable for the research question of interest (Gray, 2018; Saunders *et al.*, 2009).

This section provided a brief introduction to the different research philosophies of primary interest in the social and health sciences, and outlined their potential influence on research design. This thesis was grounded in pragmatism, where the research objectives guided research design, as the researcher's previous experience has highlighted the complexity of food behaviour and behaviour change. Such complexity has prompted the researcher to move away from strict adherence to one perspective, and instead focus on those approaches which are most valuable for the question of interest. Further details on research design and the underlying philosophical perspectives will be discussed further in section 4.5. Prior to this, however, it is necessary to discuss the population of interest for this research which was also an important consideration for research design.

4.4 Population of Interest

The population of interest is an important consideration for research design as it may influence those research methods considered appropriate. The population of interest for this thesis is women from a lower socioeconomic background. Women were chosen as they typically hold primary responsibility for food acquisition and preparation in the home (Ball *et al.*, 2011; Checkout, 2017; Inglis *et al.*, 2005; Lake *et al.*, 2006; Vaughan *et al.*, 2017). As the research objectives of this thesis focus on food purchasing behaviour, it was necessary to choose that population group with relevant experience and most likely to provide the best insight into this behaviour (Nicholls, 2009a). A focus on a lower socioeconomic population was chosen as they typically report unhealthier food consumption patterns and may benefit from an app-led dietary intervention (Bender *et al.*, 2014; McCartney *et al.*, 2013; Miller Jr *et al.*, 2017; Vandelanotte *et al.*, 2016). Recent evidence further suggests that this socioeconomic

group may benefit from a tailored approach to dietary interventions that acknowledge, and design for, the specific context which they inhabit (Coupe, Cotterill & Peters, 2018). Thus, further evidence for this specific socioeconomic group is needed to inform future intervention design. However, a focus on this population group necessitates particular considerations in relation to research design.

One of the key considerations when undertaking research with individuals from a lower socioeconomic background is the challenges faced during recruitment. Individuals from disadvantaged communities are typically less likely to participate in research studies for a variety of reasons, such as mistrust in research organisations (Giuliano *et al.*, 2000), lack of awareness of research studies (Joseph, Kaplan & Pasick, 2007), and lower literacy levels which may impede a complete understanding of the research process (Ford *et al.*, 2008). A random sampling approach is typically an ineffective means of recruiting sufficient numbers and alternatives are required (Bonevski *et al.*, 2014). Targeted approaches are typically required where specific locations or settings are chosen where higher numbers of the target population will be present. Partnerships with community organisations who have access to the population group of interest are shown to be a beneficial approach (Dumka *et al.*, 1997; UyBico, Pavel & Gross, 2007) which may address some of the mistrust and lack of awareness that prevents participation (Schnirer & Stack-Cutler, 2012). In their study examining food purchasing behaviour, Ni Mhurchu *et al.* (2009) employed face-to-face, in-store recruitment alongside postal mailing which helped to maximise the numbers of participants from disadvantaged communities. However, it is important to acknowledge that such targeted approaches are unlikely to achieve a representative sample but must be considered a pragmatic approach to meet specific recruitment needs (Bonevski *et al.*, 2014).

Snowballing is another commonly used approach to access 'hard to reach' population groups. Snowballing seeks to "*take advantage of the social networks of identified respondents to provide a researcher with an ever-expanding set of potential contacts*" (Atkinson & Flint, 2001). It typically involves enrolling existing participants to identify and recruit subsequent potential participants (Saunders *et al.*, 2009). However, it is open to bias, in relation to selection and gatekeeper bias, which may lead to an over-emphasis on particular social networks (Bonevski *et al.*, 2014). Thus, there is a need to consider the influence of such bias if this approach is employed. Typically,

snowballing is viewed as being of most benefit in exploratory, qualitative research where sample representativeness is not a requirement, although concerns related to bias still need to considered (Atkinson & Flint, 2001). It is further evident from the literature that no one recruitment method is likely to be adequate and that multiple strategies may be required to recruit sufficient numbers from a lower socioeconomic population group (Bonevski *et al.*, 2014; de Brey & González, 2005).

Many of the factors that influence recruitment may continue to have an influence beyond this point and have an impact on data collection measures and retention rates. Lower literacy levels may necessitate a greater focus on non-written measures, such as interviews rather than surveys, where a particular standard of literacy is not required for participation (Schnirer & Stack-Cutler, 2012). If written data are to be collected or information is provided, the use of simple and inclusive language is necessary (Flory & Emanuel, 2004). This is also crucial for ensuring that participants are fully aware of the requirements and consequences of participation such that informed consent can be obtained (Crow *et al.*, 2006). Another key consideration is the need for flexibility, in terms of data collection. Individuals from a lower socioeconomic group may have competing demands for their time which may negatively impact their availability to meet with researchers (Spoth *et al.*, 1996). A flexible approach may alleviate this issue somewhat. The outlined approaches may ensure that participants are better able to engage with the research process which should improve the quality of data collected and aid participant retention.

As outlined at the beginning, the population of interest for this thesis is women from a lower socioeconomic background with a presentation of the rationale underlying this focus. This section has outlined the different challenges and considerations of importance when researching with this population group, and, by drawing on the relevant literature, have illustrated means of addressing such challenges. These considerations were a crucial component of research design and continued to inform data collection and analysis throughout the duration of the research process. Further details are provided in the next section on research design and in the relevant methods sections of chapters six to eight.

4.5 Research Design

A research design is the "*logic that links the data to be collected to the initial questions of study*" (Yin, 1994) and "*the overarching plan for the collection, measurement and analysis of data*" (Gray, 2018). As outlined previously, this thesis is grounded in a pragmatic philosophical perspective where the research questions guide research design. Drawing on this pragmatic perspective, each research objective is viewed separately and the subsequent research design is chosen based on that which is viewed as most appropriate. A pragmatic approach is of clear value to the area of social research as it allows the complexity of human behaviour to be explored rather than imposing strict adherence to a specific perspective. As outlined in table 4.1, pragmatism does not impose a specific methodological approach but allows for the adoption of one specific methodology or a combination of approaches as deemed most appropriate by the researcher. Thus, different methodologies and methods are employed during this research to best address each research objective. As there is often confusion in the literature on the distinction between methodology and methods, they are defined here to provide clarification. Methodology provides a "*theory of how research should, or ought, to proceed given the nature of the issue it seeks to address*" (Hammell, 2006) while methods focus on the specific data collection procedures employed to gather the data required (Crotty, 1998).

The research consisted of four different phases. Previous research and best practice were drawn upon to identify the most appropriate methods for each phase. Table 4.2 outlines the methods employed during each research phase. Phase one comprised a secondary analysis of national survey data related to food choice and health. Structural equation modelling was employed to examine individual-level determinants of a healthy eating habit and the extent to which personal goals and self-control are linked to a healthy eating habit, as described in chapter three.

Table 4.2 Thesis Research Design

Phase	Methods
Phase 1 Examine individual-level determinants of a healthy eating habit.	**Data:** National Adult Nutrition Survey Food Choice Questionnaire (2008-2010).
	Analysis: Structural Equation Modelling.
Phase 2 Examine capacity of existing apps to support healthier food purchasing behaviour.	**Data:** 11 health apps (from original sample of 800) that met researcher-developed inclusion criteria.
	Procedure: Assessment Criteria (evidence-based, researcher-developed) to assess quality of nutrition content, and integration of user quality components and relevant behaviour change techniques.
	Analysis: Spearman's Correlations. Qualitative Content Analysis.
Phase 3 Explore personal and app-specific factors that influence app acceptance and continued use.	**Recruitment:** Purposive targeting of community groups.
	Participants: 12 women from a lower SES background.
	Procedure: Used two apps separately for two weeks.
	Data Collection: • Nutrition Knowledge Questionnaire – Researcher Administered (Pre-App Use). • Semi-Structured Interview (Post-App Use).
	Analysis: Inductive Thematic Analysis.

Phase 4 Explore the lived experience of using an app to change food purchasing behaviour, and the factors that influence this experience.	**Recruitment:** • In-Store Face-to-Face. • Snowballing.
	Participants: 10 women from a lower SES background.
	Procedure: Used one app for at least eight weeks.
	Data Collection: Baseline: • Accompanied Shop using Think-Aloud and Researcher Observations. • Semi-Structured Interview. • Questionnaire (Self-Completed). Interim: • Grocery Till Receipts. • Reflective Account (Verbal or Written). Follow-Up: • Accompanied Shop using Think-Aloud and Researcher Observations. • Semi-Structured Interview. • Questionnaire (Self-Completed).
	Analysis: • Inductive Thematic Analysis. • Interpretative Phenomonological Analysis.

A comparative descriptive analysis of existing health apps was undertaken in phase two. Assessment criteria were developed by drawing on the relevant literature and used to assess the quality of nutrition content, and the integration of user quality components and relevant behaviour change techniques. A pragmatic perspective was taken in this phase and both observable phenomena and subjective meanings were considered to constitute credible data (Saunders *et al.*, 2009). The number of behaviour change techniques that were integrated into each app was considered observable data, and represented the capacity of the app to support healthier purchasing behaviour. A pre-defined taxonomy of behaviour change techniques was used to assess their integration (Michie *et al.*, 2013) with little interpretation from the researcher. It was acknowledged that not all content could be quantified and additional features may influence the behaviour change process. A qualitative assessment of was also undertaken involving a subjective interpretation of features that were not considered part of the pre-defined taxonomy but may influence the behaviour change process, such as language used. Further details are provided in chapter five.

Phase three comprised a phenomenological study which explored the lived experience of using different health apps over two weeks. Participants were recruited through existing community groups and semi-structured interviews were conduted to explore their experience of health app use and the personal, social, and environmental factors that may influence their experience. Data were analysed using inductive thematic analysis. Further details are provided in chapter six. Phase four was also a phenomenological study, which employed multiple data-collection methods at various time-points, to explore in-depth the experience of using a health app for a minimum of eight weeks and its impact on healthy food purchasing behaviour. Participants were recruited using in-store face-to-face techniques and snowballing. An accompanied shop, incorporating think-aloud and researcher observations, was undertaken at baseline, followed by a semi-structured interview, and self-completed questionnaire administration. Participants were asked to share their grocery till receipts for the study duration with the research team, and were asked to record a verbal account of their initial experience at the midway point. At follow-up, an accompanied shop, incorporating think-aloud and researcher observations, was again undertaken. A semi-structured interview was conducted subsequently followed by self-completed questionnaire administration. Data were analysed via two perspectives: theroretical

thematic analysis to examine engagement with the app, and interpretative phenomenological analysis (IPA) to examine behaviour change over time. Further details are outlined in chapters seven and eight, respectively.

An interpretivist perspective was taken for phases three and four as it was viewed as the most appropriate means of understanding the individual lived experience. The interpretivist researcher aims to understand the world as viewed from the perspective of the research subject and to understand a particular phenomenon rather than influence or change it (Saunders *et al.*, 2009). Interpretivism draws on a constructionist epistemological framework which views reality as socially constructed and one in which different interpretations are possible depending on the individual context (Lyons & Coyle, 2007; Saunders *et al.*, 2009). Interpretivism emphasises the importance of the cultural, historical, and social context in which one resides and the potential implications of this context on reality construction (Lyons & Coyle, 2007). As this research focused on a specific population group, women from a lower socioeconomic background, an interpretivist approach would allow for an in-depth insight into the individual experiences while acknowledging the influence of contextual factors.

4.6 Statement of Reflexivity

"*A researcher's background and position will affect what they choose to investigate, the angle of investigation, the methods judged most adequate for this purpose, the findings considered most appropriate, and the framing and communication of conclusions*" (Malterud, 2001). Thus, it is necessary to outline my academic and professional background and discuss how they shaped the research process. My academic background is in the area of public health nutrition. My undergraduate degree was in Nutritional Sciences and I have completed an MSc in Sport and Exercise Nutrition and a Masters in Public Health. I also have almost ten years of professional experience where I have worked in both the public and not-for-profit sector in the area of public health nutrition, specifically with disadvantaged communities. This experience includes a combination of research, community development, and advocacy. I have worked directly with community members and also with a variety of local and national stakeholders with the aim of supporting improved population health.

This combination of academic and professional experience has provided a strong knowledge base of the complex range of factors that influence food choice in different population groups and the multiple barriers that individuals may face in maintaining healthier food consumption patterns. It has also highlighted the nuanced differences that may exist between individuals in the choices made and the factors influencing such choices. Working directly with community members and community development workers illustrated the importance of understanding an experience from the perspective of the individual and the gap that exists between the individual's experience and that of a researcher or an individual external to the community. This experience directed the use of a phenomenological approach during the final two phases of research which focuses on understanding the individual experience and the broader contextual factors of importance. However, it also acknowledges that this experience is an interpretation by the researcher as they can never fully enter the individual's experience. It also highlights the need to acknowledge the role of one's beliefs, knowledge, and assumptions as they shape both interaction with participants and subsequent interpretation of findings.

Social desirability bias, the tendency to behave in a particular way that is viewed as socially desirable but differs from the individual's true behaviour (Miller *et al.*, 2008), is a common challenge in dietary research, and is something that has revealed itself in my previous work. A certain morality is attached to food behaviours and individuals often feel the need to justify particular actions, especially in relation to unhealthier food behaviours. It was important to try to minimise this bias as much as possible throughout the study to allow a true insight into the lived experience. Consequently, a lack of judgement and empathy was important during each interaction to ensure participants felt comfortable sharing their experiences. A friendly, informal, and open manner was expressed at all times to minimise any perceived power imbalance between the researcher and the participant and build a trusted relationship with participants. The importance of the individual experience, even perceived negative experiences, was also emphasised during each interaction to build a more trusting relationship. Such traits have been developed through previous experience of working with individuals from disadvantaged backgrounds and understanding the complex lives that individuals may lead.

While my academic and professional background has provided a broad foundation for data interpretation during analysis, it is also acknowledged that there are likely gaps in this knowledge that may influence interpretation. In order to address this, there was continual discussion with my supervisory team during each analysis stage where findings were presented and discussed in light of relevant literature. Findings were constantly challenged during these discussions which encouraged a critical reflection on my own assumptions and how they shaped data interpretation. Supervisors also recommended particular areas of the literature to review and aid in theme refinement. This opened up new avenues for data interpretation and encouraged a continued personal reflection during analysis and writing up, which improved the analytical process and the abstraction of data into more transferable themes.

This section has outlined the researcher's background and the role that it has played in shaping the research process, both the theoretical perspective undertaken and interaction with participants during data collection. It is hoped that acknowledging personal beliefs and values and employing a critical and reflective approach throughout the research process has positively shaped the research process and allowed for the in-depth insight desired of the individual experience.

4.7 Ensuring a Rigorous Research Process

Maintaining a rigorous research process is a core component of good quality research. However, rigour and good quality research are typically assessed differently in quantitative and qualitative research. Quantitative researchers typically talk about quality in terms of validity and reliability (Saunders *et al.*, 2009). Validity relates to the extent to which results are genuine and represent reality and is "*concerned with the integrity of the conclusions that are generated"* (Bryman & Bell, 2007b; Saunders *et al.*, 2009). Reliability is more concerned with consistency of findings and if the methods used are likely to provide consistent results (Saunders *et al.*, 2009). Given that this thesis is predominantly qualitative in nature, such measures are of limited relevance in assessing its quality of research. However, during phase two a deductive content analysis of health apps was undertaken and these measures of quality were of relevance. Standardised measures were drawn from the literature to assess app content which aimed to improve the validity of results. For the purpose of reliability, apps were independently scored by additional reviewers using the same assessment

framework. Adjustments were made where discrepancies were identified to ensure consistency of findings. Further details are provided in chapter five.

As previously outlined, there is a need to consider quality differently for qualitative research as they are built upon different philosophical assumptions. As outlined in table 4.1, positivism considers that a single, objective reality exists. Thus, positivists propose that appropriate methods of data collection can accurately capture this reality that will remain consistent over time. In contrast, multiple realities that are socially constructed are proposed to exist by interpretivists and pragmatists (table 4.1). While particular measures may allow insight into representations of such realities, other realities may also exist that are equally credible (Bryman & Bell, 2007a). Thus, measures of reliability and validity, as earlier described, are typically considered inappropriate in the latter situation. To this end, the quality of qualitative research is typically judged in terms of its authenticity and trustworthiness (Bryman & Bell, 2007a; Lincoln & Guba, 1985). Trustworthiness has been further defined as credibility, transferability, dependability, and confirmability by Lincoln and Guba (1985). These quality measures aim to judge the consistency and believability of qualitative research, and thus act as parallel measures of reliability and validity. However, they are underpinned by different epistemological perspectives meaning that they are of relevance to qualitative research (Schwandt, Lincoln & Guba, 2007). However, as noted by Nicholls (2009a), there is no single set of criteria that can feasibly assess quality in all forms of qualitative research. Rather, it is important that the set of quality criteria used is appropriate for the research being undertaken, adheres to epistemological perspectives, and allows sufficient flexibility to enable the open and exploratory approach often followed in qualitative research (Nicholls, 2009a).

A qualitative approach was employed during phases three and four, and suitable measures were integrated to ensure a rigorous research process and good quality research. The set of strategies developed by Nicholls (2009a) was drawn upon to inform study design and ensure a rigorous research process. This set builds on the work of Lincoln and Guba (1985) but also incorporates additional strategies that provided a distinct framework for assessing quality at each stage of the research, both data collection and analysis. Table 4.3 outlines these strategies and the means in which they were integrated into the research design to ensure a rigorous research process.

Table 4.3 Strategies for Ensuring a Rigorous Research Process (based on Nicholls, 2009a)

Strategies Employed During Research Study		
Category	**Category Definition (Nicholls, 2009a)**	**Actions Taken by Researcher**
Researcher Responsiveness	Active management where researcher uses knowledge and experience to guide project, but allows direction of study to be driven by participant(s).	The interview topic guides that were used in phases three and four were informed by a review of relevant literature and developed in collaboration with the supervisory team. This approach ensured that the researcher was sufficiently knowledgeable of the topic of interest and could actively guide the project. In order to ensure responsiveness, interviews were semi-structured which allowed for discussion of additional topics as directed by the participant. Sufficient time and support was given during each interview to allow discussion of broader topics ensuring a participant-led approach. A semi-structured approach also allowed the researcher to draw on relevant knowledge to guide the discussion appropriately based on participant feedback ensuring relevant factors were discussed.
Verification Strategies	Researcher is continually checking and confirming findings. Continual movement between data collection, analysis, literature, recruitment and theory.	A constant review of findings, including codes, themes, and relationships, was undertaken to ensure that they adequately represented the data. Codes, themes, and relationships were modified if, upon further review, they were considered an inappropriate representation or due to the creation of new codes and themes. Initial findings were discussed with the supervisory team in the context of relevant theoretical perspectives, and relevant literature was used to refine themes and situate findings in a relevant theoretical context.
Methodological Coherence	Clear link between question, philosophy, methodology and method	Overall, a pragmatic perspective was adopted where the research objective guided research design at each phase. Interpretivism was the underlying philosophy for phases three and four as consumer behaviour is viewed as socially constructed and thus considered to exist as multiple realities. Phenomenology was the core methodology employed during these phases

		as it aims to understand the essence of an individual's experience (Patton, 2002); thus it aligns with the interpretivist perspective illustrating methodological coherence. The subsequent methods employed for data collection and analysis were reviewed to ensure they aligned within the phenomenological methodology and best answered the research objective of interest, again ensuring methodological coherence. This guided the focus on capturing the behaviour in a natural setting and the use of a variety of data collection methods to best explore behaviour and behaviour change (Patton, 2002). The use of thematic analysis and interpretative phenomenological analysis to direct data analysis were chosen as they best addressed the research objectives and aligned with the phenomological approach.
Sampling Sufficiency	Ensuring efficient and effective saturation of data. Sufficient to cover all aspects of phenomenon. Evidence that negative cases used.	Data collection continued until theoretical data saturation was achieved, where no new themes were emerging, and an appropriate mix of participants were recruited. In phase three, theoretical data saturation was considered to be achieved after ten participants as no new themes were apparent in the final two interviews. Participant recruitment was subsequently discontinued. In phase four, recruitment took place over a six-month period and was discontinued at this point as the follow-up period would coincide with Christmas which was considered an atypical period for food purchasing behaviour. Data were analysed throughout this time period and saturation was deemed to have been achieved as a good insight into the lived experience was captured and no new themes emerged in the final interview. Negative cases were integrated as participants were followed up, in both phases, even if they had negative or neutral experiences of behaviour change and app use.
Concurrent Text Generation and Analysis	Researcher moving from what is known to what is unknown. Text generation and analysis begin at outset.	Interviews were transcribed as soon as possible after data collection, either by the researcher or an external transcription agency. Transcripts were checked against the audio data by the researcher. This allowed familiarisation of data at an early stage of the research which also allowed analysis to commence in a timely manner, prior to completion of data collection.
Thinking Theoretically	Gradual movement towards theoretical understanding of	An inductive approach to data analysis was adopted during phases three and four, and further details on this approach are outlined in chapters six to eight. Constant communication with

	data. New data guiding development of next steps. Building inductively.	the supervisory team during the analytical stage ensured that a more abstract, theoretical focus was applied and findings were embedded in a relevant theoretical framework. Findings guided subsequent phases of research, both in terms of methods employed to capture the consumer experience and the theoretical lens applied during analysis. For example, phase three highlighted the relevance of consumer engagement as a relevant theoretical lens through which to examine the app user's experience. This was subsequently applied in phase four where the data were examined through this particular theoretical lens.
Post-hoc Strategies to Test Rigour		
Credibility	Findings compatible with participants' perceptions. Achieved with prolonged engagement in the field, persistent observation, triangulation of data and methods, and peer debriefing (sharing developing analysis with peers).	Sufficient time was assigned to data collection with each participant. In phase three, the average interview time was 43 minutes and ranged from 25 to 54 minutes. In phase four, approximately 2½ to 4 hours of data were available per participant. These allowed in-depth insight into participants' perceptions ensuring credibility. In phase four, additional data collection methods were employed, including the use of think-aloud protocol and researcher observations during accompanied shops, and reflective records, to capture a holistic perspective of the participant's experience of behaviour change. The decision to integrate additional measures was based upon a review of literature in the consumer behaviour and health behaviour area, which are discussed in further detail in chapters seven and eight. During all phases, findings were discussed with the supervisory team at each step in the context of relevant theoretical perspectives. This supported credibility as it allowed the researcher to embed the findings appropriately in the extant literature.
Transferability	Possible to relate developed theories from one context to another. Evidence of detailed, description and purposive sampling.	Purposive sampling was applied across both phases three and four, where strict eligibility criteria were used for participant recruitment. Specific details on sampling and recruitment are provided in chapters six to eight. The aim of purposive sampling was to recruit those most likely to use and benefit from an app-led initiative to support healthier purchasing behaviour. It is proposed that this would best represent the natural setting for delivery of an app-led initiative which may allow for transferability of findings to a similar population

		group. The alignment of findings with existing theory was used as a means of transferring findings to a broader context. Detailed descriptions of the individual experience was captured during each phase through the use of different methods. This was supplemented by demographic, socioeconomic, attitudinal, and nutrition knowledge/literacy to understand the individual context and its influence on purchasing behaviour and behaviour change. This added further richness and depth to the data.
Dependability	Evidence of consistency and accuracy in data collection, text generation and analysis. An audit trail of decision making and evidence of peer inquiry audit	A protocol was created during the research design phase which detailed recruitment and data collection procedures, and this was adhered to throughout phases three and four to ensure dependability of data. Particular guidelines for thematic analysis (Braun & Clarke, 2006) and interpretative phenomenological analysis (Smith, Flowers & Larkin, 2009) were followed, as detailed in the methods sections of chapters six to eight. A close adherence to these guidelines ensured a consistent and accurate approach was maintained. Field notes were kept by the researcher throughout data collection and analysis for both phase three and four. These notes included a descriptive account of contextual factors during recruitment and data collection. For example, details were noted on recruitment days of customer interest in the research, any informal feedback from consumers (respondents and non-respondents), general customer footfall in the store, and occurrence of local events. During data collection, notes were kept on in-store customer numbers, presence of staff in-store (e.g. stacking shelves), and any comments made by the participant that were not audio-recorded. This helped to ensure a consistent account of the purchasing context was captured for each participant. The researcher also included reflective notes on the participant, such as their demeanour during data collection, i.e. quiet, chatty, or stressed. Notes also included a reflection on the researcher's role and if the accompanied shop and interview were appropriately conducted and if particular factors may have influenced data collection, such as any difficulty in guiding the interview or remaining close to the participant during the accompanied shop. These field notes also kept an account of decisions made at each stage of the research to ensure a rationale could be subsequently provided.

Confirmability	Clear evidence that outcomes are derived from texts, not a selective reading. Transparent decision trail and evidence of reflexivity.	A clear record of analytical decisions was documented ensuring that a reflexive approach was taken and researcher bias was minimised. Findings were continually discussed with the supervisory team which resulted in a constant review of themes and their alignment with the data. Data and analysis (codes and themes) were reviewed if there was a lack of clarity upon discussion with the supervisory team. Examples were drawn from across the participant set when writing up, as outlined in the findings sections of chapters six to eight. This aimed to illustrate that analysis was based on the full dataset rather than a selection.
Authenticity	Appropriate strategies for true reporting of participant's ideas	Multiple readings and repeated review of data throughout analysis allowed for in-depth insight into the participant's experience. Findings were continually reviewed and discussed with the supervisory team which supported the refinement of themes and relationships to accurately reflect the data. This discussion also informed the presentation of such findings, as seen in chapters six to eight, to ensure that they accurately reflected the key themes of the participants' experiences and their alignment with relevant theory and literature.

4.8 Methods Summary

The purpose of this chapter was to clarify the research objectives of this thesis and to outline and justify the research design taken to address these objectives. The research objectives were initially presented in chapter one. These have been expanded upon in this chapter where, by drawing on the literature and findings presented in chapters two and three, the rationale for such objectives was presented. The researcher's pragmatic philosophical perspective which underpinned the research design was outlined which aimed to justify the decisions taken when designing the research process. This chapter aimed to provide an introduction to the methodology that was employed during thesis research, and outline the theoretical underpinning of research design and implementation. The purpose of this chapter was not to detail specific methods for data collection and analysis. In line with the format of this thesis, where chapters are presented in an extended publication format, the research methods that were employed during each phase of the research are outlined in chapters five to eight. The methods sections of these subsequent chapters provide specific details on the methods that were employed for data collection and analysis, while providing justification for their use and illustrating their alignment with the pragmatic theoretical perspective.





Flaherty, S. J. 2019. Disrupting routines, facilitating control: exploring a change towards healthier food purchasing behaviour using a health app. PhD Thesis, University College Cork.

Please note that Chapters 5, 6, 7 & 8 (pp.116-239) are unavailable due to a restriction requested by the author.

CORA Cork Open Research Archive http://cora.ucc.ie

Chapter 9
Discussion

9.1 Introduction

The overarching aim of this thesis is to contribute to the theoretical understanding of the interplay between mobile app technology and behaviour change in the context of highly routinised and habitual behaviour, with food purchasing as the behaviour of interest and women from a lower socioeconomic background as the population of interest. As detailed previously, there are four objectives connected to this aim:

1: Examine the individual-level determinants of a healthy eating habit and the extent to which personal goals and self-control are linked to a healthy eating habit.

2: Examine the capacity of existing apps to support healthier food purchasing behaviour through the integration of features that disrupt undesirable purchasing patterns, build personal resources, and reframe behavioural outcomes.

3: Explore the personal and app-specific factors that influence the acceptance and continued use of health apps in those individuals attempting to change their food purchasing behaviour.

4: Explore the lived experience of using an app, and the recommended behaviour change techniques, to change food purchasing behaviour and the personal, social, and environmental factors that influence this experience.

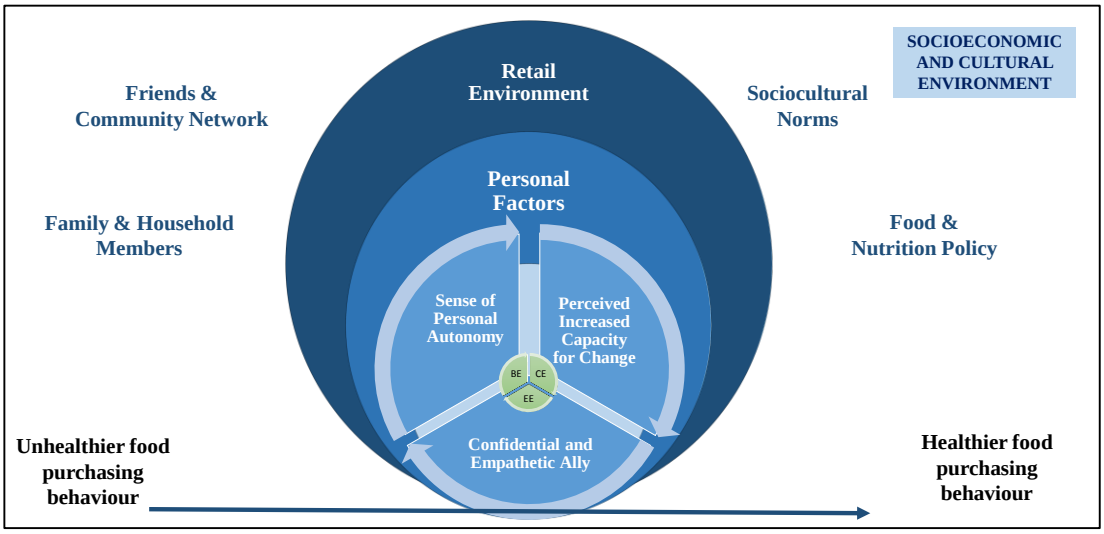
An in-depth discussion of the individual findings has been presented throughout this thesis, and their particular contribution to the thesis aim. The present chapter will draw on these previous chapters to outline their collective contribution to this aim, and how they progress the theoretical understanding of the interplay between app technology and behaviour change, and demonstrate the importance of integrating engagement theory in the process of behaviour change. The chapter is presented as such. A summary of the key findings is first presented which draws on previous chapters to outline the collective contribution to the extant literature. The specific implications of these findings for theory is subsequently presented, and the original contribution of this research. Drawing on these findings, recommendations for policy and practice are considered alongside potential directions for future research. The strengths and limitations of the thesis research are then discussed.

9.2 Summary of Research

The focus of this thesis, facilitating change towards healthier food purchasing behaviour, demanded that habits and routines were substantially considered in the initial stages of the research process. The initial literature review prompted a reconsideration of the role of habits and routines in food purchasing which was built upon in subsequent research phases which demonstrated that self-control and personal goals are central to maintaining a healthy food routines, including in the retail space. This thesis contributes to the theoretical understanding of behaviour change as it progresses our understanding of the cognitive processes in play for those complex behaviours enacted in modern food environments of fluctuating stability.

Strategies for behaviour change need to be appropriate for the cognitive processes in play for the behaviour of interest. Therefore, any support tool offered to facilitate behaviour change in the context of highly routinised behaviours will need to trigger such deliberative cognitive processes to form and maintain a healthier food routine. As demonstrated in this thesis, health apps may offer a solution as they can disrupt highly routinised behaviours, such as food purchasing, and facilitate the use of more deliberative cognitive processes, such as self-control and critical reflection. However, the cognitive processes associated with an individual's use of the app was critical to facilitating such change, as presented in figure 9.1. Particular intrinsic expressions represented a positive user experience that appeared to prompt continued engagement with the app, which was essential to support behaviour change for many users. Thus, the behavioural, cognitive, and affective processes of engagement underpinned the capacity to facilitate the relevant shift in cognition required, from less conscious to deliberative cognition, and to support the desired change towards healthier food purchasing behaviour.

Figure 9.1 User Engagement as a Central Component of Behaviour Change



The recognition of engagement theory as a crucial component expands the existing understanding of the interplay between app technology and behaviour change in the context of interest. This thesis research suggests that behaviour change in this new technological space requires a broadening of the lens which shifts attention away from primarily focusing on the cognitive processes of relevance, such as the move towards more conscious deliberation. Rather, this new technological space requires the integration of the behavioural, cognitive, and affective processes that are the critical components of engaging with a health app. Thus, understanding change of a highly routinised and habitual behaviour in this new technological context requires the progression of behaviour change theory to fully encompass those affective, behavioural, and cognitive processes of relevance. This contributes to the existing understanding of behaviour change in the context of app technology, which may aid the improved design of relevant health apps and behaviour change initiatives to support healthier food behaviours, and subsequent health outcomes. These initial paragraphs have illustrated the collective contribution of these findings to the overall aim of this thesis. The remainder of this section will provide a more detailed discussion of the contribution to each of the research objectives, as previously outlined, and highlight the convergence across research phases.

9.2.1 Examining Individual-Level Determinants of a Healthy Eating Habit

In addressing objective one, examination of individual-level determinants of a healthy eating habit illustrated the importance of self-control and personal goals to support healthier food behaviours enacted in complex environments of flux. This questions the existing literature and highlights the role of deliberative, conscious cognitive processes in forming and maintaining healthy food behaviours. This directed the researcher to view food purchasing as a highly routinised behaviour in which deliberative cognitive processes are embedded, and which are necessary to navigate the complexity of modern retail environments. This had important implications in terms of the conceptualisation of healthy food purchasing behaviour adopted for subsequent phases and the cognitive processes of salience. The need for such conscious deliberation was further demonstrated in the final phase, where self-control was necessary to override particular cues for conflicting goals in the retail environment to maintain a healthier purchasing routine. An individual's broader goal system architecture was crucial in this space as it shaped the potential for goal conflict and the necessity of conscious deliberation and self-control. This builds on the model of healthy eating habit presented in chapter three and suggests the potential to expand this model to encompass the different goal configurations that may be in place.

9.2.2 Capacity of Existing Apps to Support Healthier Food Purchasing Behaviour

In response to objective two, the potential capacity of existing apps to support healthier food purchasing behaviour was outlined, although a number of considerations in terms of behaviour change and app engagement are apparent. Some existing apps may support healthier purchasing behaviour as they integrate a combination of relevant behaviour change techniques. It was also apparent that food purchasing behaviour was not their primary focus but outcome goals, such as weight-loss, were often the main objective which may not be congruent with personal health goals and may reduce their perceived value. Indeed, a lack of congruency with higher-order goals, or one's self-concept, prompted a reduction in engagement with the app. Thus, this pervasive emphasis on weight-loss may warrant reconsideration to ensure apps are viewed as consistent with personal goals and valuable to aid behaviour change. Furthermore, the content analysis of health apps illustrated that there was a substantial focus on the integration of behaviour change techniques that aided self-regulation of food behaviour, such as self-monitoring and goal-setting (Bardus *et al.*, 2016; Burrows *et*

al., 2015). Whilst such techniques appeared effective at supporting a change towards healthier purchasing behaviour in later phases of the research, they may not be optimum for all. Additionally, a considerable number of behaviour change techniques were not integrated into any health app. This suggests that existing apps have the potential to support healthier purchasing behaviour but there is an opportunity to broaden their capacity which may support change in a wider group of individuals. Thus, this research has revealed that apps may be deficient in terms of the breadth of health goals considered, and the behaviour change techniques that are integrated.

The content analysis highlighted that the nutrition information in existing health apps may be inadequate. Four of the eleven apps included in the final sample integrated nutrition information that was not considered evidence-based. Even in those apps that did integrate good quality nutrition information, further improvements are considered necessary. It appeared that a certain level of nutrition literacy was required to interpret and apply the information to individual behaviour change. It is proposed in the literature that app use, in the absence of such knowledge, may result in unrealistic and unhealthy food practices with a potential negative impact on health outcomes (Franco *et al.*, 2016; Lieffers *et al.*, 2017). The importance of nutrition literacy was further illustrated in phase three where higher nutrition literacy was associated with increased app engagement as it fostered individual confidence and competence which supported a greater sense of autonomy. Such findings illustrate the need to improve the nutrition information in health apps such that they build nutrition knowledge and skills to aid engagement and behaviour change. A greater involvement of nutrition and dietetic health professionals has been proposed by other authors as a means to address this issue (Con & De Cruz, 2016; Franco *et al.*, 2016). The creation of a quality indicator, that illustrates integration of good quality, evidence-based nutrition information, may also be beneficial. This may act as a simple cue for app users as they search for health apps and direct individuals towards apps of improved quality.

9.2.3 Factors Influencing Acceptance and Continued use of Health Apps

The third objective aimed to explore those factors that influence the acceptance and continued use of health apps. Understanding those factors that contribute to positive and sustained engagement experiences are of importance as they appear to dovetail with positive dispositions to behaviour change. Exploring the lived experience in phase three considered why an app might be acceptable to the consumer, and identified

an appropriate theoretical lens through which this interaction could be explained; thus, consumer engagement was brought to the forefront. Engagement was expressed at an intrinsic level as a sense of personal autonomy, an increased perceived capacity to change, and viewing the app as a confidential and empathetic ally. Such expressions were underpinned by configurations of behavioural, cognitive, and emotional engagement. App features that facilitated the expression of these intrinsic experiences were considered to result in optimum engagement. Such findings suggest that engagement dimensions do not exist in isolation but may mediate, moderate, and influence one another to contribute to overall engagement. This aligns with the call made by Calder *et al.* (2016b) to take a more holistic view of engagement and modify the means in which engagement is measured. The need for a more holistic perspective was also illustrated by the presence of negatively valenced dimensions of engagement. The valence of engagement dimensions influenced the particular configuration of engagement and subsequently the individual intrinsic expression. However, it was evident that personal characteristics, such as coping self-efficacy, may influence the particular impact of dimension valence on engagement. This further emphasises the need to take an inclusive perspective of engagement to best understand this process.

An individual's involvement, in relation to healthy food, was also identified as an important influence on app engagement. The present research illustrated that motivation to change acted as a driver of engagement, which aligns with the current literature which views involvement as an antecedent of engagement (Dessart, 2017; Leckie *et al.*, 2016). However, examining app engagement across time in this research highlighted the role of situational involvement beyond this initial phase of engagement. Variations in healthy food goal saliency resulted in fluctuating levels of situational involvement which appeared to contribute to changes in engagement intensity, or strength, across time. Such findings suggest that situational involvement may act as a trigger for the different phases of the engagement process, which are proposed by Brodie *et al*. (2013) and Hollebeek (2011b). Findings further challenge the current conceptualisation of dormancy as an inactive state of engagement. The existing literature is mostly concerned with the absence of behavioural engagement as reflective of dormancy but the thesis findings suggest that cognitive and emotional engagement may be present during proposed dormant periods. Thus, the current conceptualisation of dormancy may be incomplete and warrants further consideration.

The importance of individual characteristics was apparent. Differences in self-efficacy, time orientation, nutrition literacy, and personal goals appeared to have particular influences on both behaviour change and engagement. Such findings emphasise the importance of integrating tailored features into health apps to enable app users to adapt the app and ensure that it is congruent with personal goals, existing nutrition-related human capital resources, and self-concept. It was illustrated that a lack of congruency with personal goals may result in cognitive dissonance and subsequently prompt disengagement from a health app. Indeed, the importance of tailoring in health apps is acknowledged in the literature and viewed as a means of minimising the risk of disengagement and facilitating an appropriate strategy for behaviour change (Lyzwinski *et al.*, 2018; Perski *et al.*, 2017; Solbrig *et al.*, 2017). Furthemore, individual habits and routines are inherently idiosyncratic as they are formed and maintained in contexts of personal relevance (Gardner, 2015; Lally *et al.*, 2010). This further illustrates the need for a tailored approach to ensure such idiosyncracies are accommodated. However, adequate tailoring may be challenging as it requires the time and effort of the user (Chang & Chen, 2009; Piller *et al.*, 2005) with consequences for perceived benefits and costs. Further consideration is required on the optimal level of tailoring and how this may be best achieved.

9.2.4 Exploring the Lived Experience of Using a Health App to Change Food Purchasing Behaviour

The final research objective aimed to explore the impact of using an app to support a change towards healthier food purchasing behaviour. As previously outlined, the app facilitated a disruption of existing purchasing routines and prompted more reflective food purchasing behaviour where individuals drew on nutrition-related human capital resources and healthy food goals to a greater extent to direct purchasing behaviour. The app appeared to be of more relevance in the planning stages of food purchasing rather than actively used during shopping in the retail store. This may reflect the complexity of the retail store, and the need for consumers to invest in planning and deliberative cognitive processes prior to entering the retail environment. Thus, by encouraging the use of deliberative cognitive processes at the planning stage, the app may reduce the direction of heuristic and habitual decision-making in-store.

This finding questions the capacity of existing apps to directly influence in-store behaviour. It may be that the particular apps used in this research were more

appropriate for facilitating change in the planning phase, or that this participant group were most interested in changing their behavioural patterns during these purchasing stages. It may also be that there was simply a lack of active behavioural engagement with the app in the retail store. As previously outlined, engagement can occur in the absence of active, visible use of an app. It may be that there was engagement with the app in-store but in a less visible form, such as cognitive or emotional engagement. Further research may gain a better understanding of app use at all stages of the purchasing process and where consumers may benefit most from using a health app.

While the app supported a more conscious approach to food purchasing, it was evident that self-control was necessary to sustain healthier purchasing behaviour in the existing food retail environment. Facilitating a more conscious approach to food purchasing made individuals more aware of the range of cues available in the retail environment. As many of these cues were perceived to direct behaviour towards unhealthier food purchasing, there was a need to employ self-control to override conflicting goals. This finding aligns with the research presented in chapter three which proposed self-control as a mediator of those goals that competed with healthy eating goals, such as emotional and food hedonism goals, to maintain a healthy eating routine. This suggests that additional initiatives alongside the use of health apps may be necessary to support healthier food purchasing behaviour. Adaptations to the retail space to make the healthier choice an easier choice (Thaler & Sunstein, 2008) may reduce the need for self-control and aid sustained behaviour change. However, this is likely to require a shift in the mindsets of retailers, alongside evidence to support the value of such an approach to their retail business.

It was further evident that many participants viewed unhealthier foods as more enjoyable, in line with the literature (Luomala *et al.*, 2004; Raghunathan *et al.*, 2006), and viewed them as more relevant to addressing goals relating to emotional needs and fulfilling socially-constructed maternal roles. An increased focus on the pleasure of healthy eating in health campaigns and initiatives has been proposed elsewhere as a means of supporting healthier food behaviour and reducing the need for self-control (Cornil & Chandon, 2016; Landry *et al.*, 2018). Opportunities may exist to encourage individuals to associate bodily states with healthier food behaviour and employ the traditional techniques of marketing to support healthier food behaviours (Petit *et al.*,

2016; Pettigrew, 2016). However, little evidence exists in the area of food purchasing behaviour and requires further investigation.

An individual's broader goal system was shown to influence the behaviour change process and the extent to which conscious, reflective cognitive processes were employed to direct behaviour change. A counterfinality configuration of means-goals, where fulfilment of one goal undermines the attainment of another (Kruglanski *et al.*, 2015), necessitated the use of conscious reflection during decision-making to resolve potential goal conflict in the present research. This builds on the earlier findings from phase one which illustrated the important role of self-control as a mediator of potentially conflicting personal goals to maintain healthier food routines. It suggests that the role of self-control as a necessary mediator may vary depending on an individual's higher-order goals and the influence that they exert on lower-order goals. Consequently, self-control may have a more important role for those individuals expressing a counterfinality configuration of means-goals. This illustrates the need to look beyond the immediate focal goal of behaviour and adopt a broader perspective of those goals that direct behaviour and behaviour change. It further suggests a potential opportunity to expand the original model proposed in chapter three to one that incorporates the broader goal system and examines its influence on the behavioural model. Such an approach may allow an improved understanding of individual behaviour and how best healthier food behaviours may be supported in future population health interventions.

It was interesting to note the emphasis attached to the individual's perceived responsibility to change rather than advocating for change in the retail environment. Participants appeared to understand the strategies used by retailers to prompt the purchasing of unhealthier food items but viewed them as a natural obstacle that must be overcome to maintain healthier behaviour. This aligns with the pervasive attitude that unhealthier behaviours are due to individual irresponsibility or failings in morality or willpower rather than broader environmental determinants (Delaney & McCarthy, 2014; Mazzocchi *et al.,* 2015; Thomas-Meyer, Mytton, & Adams, 2017). Such attitudes may have arisen from the traditional focus on the medical model of health, where individuals are seen as rational agents of change, or due to political discourse and action in relation to health promotion activities (Adler and Stewart, 2009; Brown, Maslen, & Savulescu, 2018). Such discourse may have also contributed to the

perception that environmental changes threaten personal autonomy and freedom of choice (Bos *et al.*, 2015; Diepeveen *et al.*, 2013), thereby directing individuals to adopt responsibility for behaviour change. It is important to consider such attitudes in the design of future dietary health initiatives as they may influence their acceptance by the public (Mazzocchi *et al.*, 2015). It further highlights a need to change the public discourse in relation to responsibility for behaviour change and move away from individual blame towards acknowledgement of the influence of broader determinants which may foster a greater acceptance of environmental change.

This section has outlined the key findings of this thesis research and their alignment with the extant literature. Consequently, it has been possible to illustrate how such findings add to the existing literature and progress our understanding of the interaction between app technology and behaviour change. The next sections will more explicitly describe the specific contribution of the presented findings to theory and research, and subsequently the implications for practice and policy.

9.3 Theoretical Implications and Original Research Contribution

Exploring the lived experience of using a health app to support food purchasing behaviour change highlighted a number of points of interest that contribute to the extant literature. Relevant theoretical implications, for behaviour change and user engagement, have already been outlined in the respective chapters. A brief overview is provided in this section outlining the specific contribution of this research.

The present research adds to existing knowledge in relation to the impact of goal hierarchies on behaviour change. Healthy food goals were connected to differing higher-order goals which influenced the broader goal system and the presence of conflicting goals. It is acknowledged in the literature that different goal configurations may result in goal facilitation or conflict which can impact behaviour change differently (Gebhardt, 2008; Lindeman & Stark, 1999; Turner-McGrievy *et al.*, 2014). The present research progresses this knowledge to propose that an individual's goal system architecture will influence the extent to which the conscious, reflective cognitive system is employed to direct behaviour change. The presence of a counterfinality configuration, where fulfilment of one goal undermines the attainment of another (Kruglanski *et al.*, 2015), appeared to prompt a greater employment of reflection during food purchasing as individuals attempted to resolve conflicting goals.

This builds on the model presented in chapter three, and progresses our knowledge of the influence of goal systems on behaviour change and the need for self-control to act as a mediator for maintainence of healthier food routines. There is a need to achieve a greater understanding of goal systems and the interplay in terms of moderation and mediation effects among individual goals resulting in specific behavioural outcomes.

The present research also contributed to the literature in relation to user engagement. Potential interactions between engagement dimensions may exist which results in differing individual experiences as underlying configurations vary. This progresses the existing conceptualisation of engagement and proposes an interim space between engagement dimensions and subsequent outcomes, i.e. the intrinsic expression of engagement at an individual level. The presence of negatively valenced dimensions of engagement further challenges the traditional view of engagement as positively valenced. The researcher joins Bowden *et al.* (2016) to call for a greater acknowledgement of negatively valenced dimensions as simultaneous contributors to overall engagement. These findings build on the work of Calder *et al.* (2016a) and highlights the need to employ context-specific means of measurement to adequately capture the engagement process. The majority of engagement-related research adopts a quantitative approach where dimensions of engagement are related to specific contexts. However, by exploring the lived experience, intrinsic expressions of the individual were identified which directly relate to how different configurations of engagement are expressed by the user. Identifying such nuance was only possible through the use of qualitative methods, and subsequently qualitative research is considered a crucial approach to examine engagement in context. Consequently, a greater use of qualitative and mixed-methods is proposed to gain the necessary insight into the dynamic engagement process.

The present research suggests that involvement may not just act as a driver of engagement but may influence the intensity of engagement expressed at various times and trigger transition between engagement phases. This highlights the salience of the current conceptualisation of the position of situational involvement in the engagement process. There is little distinction made in the engagement literature between enduring and situational involvement. However, as outlined in earlier chapters, these terms relate to different concepts. Consequently, distinction in research is necessary to clarify their particular roles in the engagement process. Furthermore, findings

challenge the existing definition of dormancy in relation to user engagement. It is presently defined as "*temporary states of inactive, passive engagement by users who may have previously interacted*" (Dolan *et al.*, 2016b). However, the researcher proposes that this current conceptualisation fails to acknowledge the presence of cognitive or emotional engagement during periods of perceived dormancy. There is a need to examine more than behavioural engagement during dormancy, as has been the primary focus to date (Alexander *et al.*, 2018; Brodie *et al.*, 2013; Dolan *et al.*, 2016a), which may offer deeper insight into the expression of different dimensions across time and their contribution to the overall engagement process.

9.4 Recommendations for Practice

The present research provides insight into those features of importance in the design of health apps which may support continued engagement and subsequent healthier food behaviour. As previously outlined, engagement may be supported by fostering a sense of personal autonomy, facilitating perceived increased capacity to change behaviour, and creating a sense of a confidential and empathetic ally. Integrating those features that facilitate such intrinsic experiences may be an important aspect of app design. While designing for such features may differ between user groups given the importance of individual user characteristics, there are some elements that appear of common importance. There is a need to move beyond the current focus on the individual user and design apps that acknowledge the wider household context. This will allow individuals to manage family relationships and address the multiple needs that exist within a household.

Ensuring sufficient choice and control over one's behaviour change process was important for experiencing a sense of autonomy which highlights the importance of integrating features that can be tailored to the individual user. There is insufficient evidence on best practice in terms of such tailoring and consideration must be given on how best this may addressed without excessive user burden (Chang & Chen, 2009; Lyzwinski *et al.*, 2018; Piller *et al.*, 2005; Solbrig *et al.*, 2017). Findings suggest that designing an app that creates a sense of a confidential and empathetic ally will positively influence continued engagement with an app. This may be achieved by integrating appropriate language and ensuring that the phrases and terminology used are relevant for the intended user group and the tone or manner in which it is delivered

is viewed as empathetic and supportive. The language deemed appropriate will differ depending on the intended user group and should be considered during design.

The important influence of individual user characteristics on app engagement was demonstrated across different research phases. This emphasises the need for a person-centered approach to app development (Yardley *et al.*, 2015b) to ensure appropriate characteristics are identified for the context of interest and used to inform future app design. This must be considered a necessary step for the design of future health apps. Furthermore, the importance of individual differences must be highlighted to health professionals that recommend the use of health apps to patients. Recent evidence suggests that there is a greater interest from health professionals in using health apps as a means of facilitating healthier food behaviours (Chen *et al.*, 2017; Timon, 2018). Given the importance of personal characteristics on engagement, and potential effectiveness, there is a need for health professionals to consider the individual user and their capabilities and needs before recommending an app. Such factors should be considered in advance whilst ensuring that additional support is provided, or recommended, if necessary.

The present research highlights the need to better differentiate between habits and routines within population health, both in literature and practice. They relate to different behavioural concepts and must be viewed as such if dietary health initiatives are to be appropriately designed and implemented. Interventions are typically more successful when designed with a valid theoretical underpinning (Craig *et al.*, 2008). Thus, understanding the role of habitual and deliberative components of healthy food behaviours is crucial for fostering effective change. Following from this, findings illustrate the complex individual goal systems that may exist and can influence the behaviour change process. Such complexity must be acknowledged by health promotion professionals to, again, ensure that dietary health initiatives are appropriately designed for effective change. Consequently, these findings further highlight the need for greater integration of behavioural science in population health to support effective change (Kelly & Barker, 2016; Public Health England, 2018).

9.5 Recommendations for Policy

The research presented in this thesis suggests that health apps may play a role in supporting healthier food purchasing behaviour by encouraging more conscious

decision-making which enables individuals to critically reflect on purchasing and ensure healthier food choices are made. One of the aims of the national health framework, *Healthy Ireland – A Framework for Improved Health and Wellbeing 2013–2025* (Department of Health, 2013), is to build community and personal responsibility where individuals are empowered to make healthier choices at all stages of life. Drawing on the evidence presented in this thesis, health apps may support such empowerment if they facilitate a move towards a greater employment of reflective cognitive processes. Furthermore, evidence suggests that health apps may be an appropriate tool for supporting behaviour change in lower socioeconomic groups and help address the health inequalities that exist (Graham *et al.*, 2016). Reducing health inequalities is another core goal of the national health framework, *Healthy Ireland*. The present findings suggest that apps may facilitate change in women from a lower socioeconomic background and are potentially viewed as an acceptable tool for change. Thus, health apps may be able to further contribute to addressing existing health inequalities. However, it was also apparent that certain factors may act as barriers, such as lower levels of nutrition literacy and self-efficacy. It is necessary that such factors are taken into consideration if there is wider implementation of their use and additional supports are put in place to ensure that health apps are accessible and effective for all population groups.

While the researcher views health apps as potential tools to support healthier food behaviours, it was also evident that they may not be sufficient to support a sustained change in behaviour in all consumers. Changes to the retail store may minimise the need for self-control which can act as a barrier for sustained change when insufficient capacity is available. Access to health professionals or weight-management programmes may help those with lower nutrition literacy or self-efficacy who desire additional personal support to facilitate sustained change. Thus, a combination of approaches may be necessary. Indeed, Rutter *et al.* (2017) call for a shift from individual-level interventions to system-level responses to address the complexity of behaviour change. However, Sniehotta *et al.* (2017) argue that such a distinction is a "*false dichotomy*" and that individual-level interventions can play a significant role in population health programmes. The importance of both top-level, structural changes and bottom-up, individual-led interventions are acknowledged in the Healthy Ireland framework which advocates for "*a sustained and comprehensive portfolio of*

initiatives". The app may contribute to such bottom-up interventions, although it is necessary to consider the broader food and sociocultural environments in which decisions are made. A combination of approaches is necessary to support sustained behaviour change and achieve the desired outcomes for population health, although consideration must be given to current public acceptance of different population health interventions, as detailed earlier.

9.6 Directions for Future Research

The findings and related discussion presented in this thesis offer opportunities for future research. This exploratory research revealed a number of interesting implications for engagement theory. As previously discussed, such insight was possible through the use of in-depth qualitative methods that allowed capture of those nuanced elements of user engagement. The researcher suggests that future research should examine the integration of qualitative methods to further explore engagement. This adds to the call made by Calder *et al.* (2016a) for context-specific methods of measurement that allows insight into the dynamic engagement process. While Calder *et al.* (2016a) propose a mixed-methods approach in their paper, this may not be feasible for all because of the resources required. However, there is potential to explore additional methods of measurement that incorporate more qualitative methods which can capture the nuance desired. The present research provides a starting point on how this may be achieved and could be explored further.

In line with the extant literature, there appeared to be a belief that unhealthier foods are more enjoyable (Luomala *et al.*, 2004; Raghunathan *et al.*, 2006) and best placed to address emotional goals and fulfil maternal identity roles. There is a need to address such beliefs to support sustained change in food purchasing behaviour. This may reduce the need to employ self-control to override conflicting goals and support healthier decision-making. As previously outlined, there is potential to draw on traditional techniques of marketing to challenge existing beliefs and associate healthier foods with eating pleasure (Pettigrew, 2016). The use of multisensory imagery and a focus on self-caring, rather than self-regulation, may prompt healthier food consumption patterns (Cornil & Chandon, 2015; Vogel & Mol, 2014). However, there appears to be little research on this approach in relation to food purchasing behaviour.

Given its potential, there is a need to explore this topic further and examine how it may be best utilised to support healthier food purchasing behaviour.

It was evident that existing apps do not primarily focus on food purchasing behaviour with only a small number of apps integrating related features. However, it was shown that apps, if designed properly, can support a change towards healthier food purchasing behaviour. Consequently, there is scope to broaden the capacity of existing apps to further support behaviour change, and disrupt the in-store shopping experience. Future research could explore the integration of additional or alternative behaviour change techniques that may aid goal progression and the complex nature of food purchasing behaviour. The present research indicated that existing apps may be of more relevance to the planning stages of food purchasing. As the retail store is also an important space for decision-making, there may be capacity to integrate features of relevance for this stage of food purchasing (Shankar *et al.,* 2016). Future research could explore those app features that may be of value in the retail space and which would support the individual to make healthier choices at each stage of the purchasing process. It was also evident that environmental changes may be necessary to achieve sustained behaviour change. It may be beneficial to work in partnership with retailers to identify the optimal combination of initiatives, encompassing both app and environmental changes, to support sustained healthier behaviour.

9.7 Strengths and Limitations of the Research

A key strength of the thesis research was employing a phenomenological perspective to gain insight into the lived experience of food purchasing behaviour and behaviour change. Phenomenology aims to understand the 'essence' of an experience by gathering rich descriptions of individual experiences in a natural setting (Patton, 2002). Given the dearth of evidence available in this particular research area, examining the lived experience provided a valuable source of knowledge that is not currently held by researchers. Furthermore, there is much focus on the use of quantitative measures in food research but as stated by Alexandra Wanjiku Kelbert at the 2018 City Food Symposium, "*trends and macro effects often don't tell us much about what specific phenomena look like, feel like, or how and why people make the choices they do*" (Centre for Food Policy, 2018). Employing a phenomenological perspective allowed insight into individual choices and how behaviour is embedded in

everyday life and the real-life challenges that exist. It is necessary to understand reality as it is, rather than how we wish or perceive it to be, to truly empower individuals and identify effective solutions for behaviour change and population health (Centre for Food Policy, 2018). The methods employed in this thesis research enabled such insight which allows for translation into potentially effective dietary interventions.

The specific limitations of each research phase have been outlined in the relevant chapters. This section will discuss the limitations apparent across the different phases of the research and their potential influence on the overall findings. The introduction of self-selection bias is an important limitation as factors that influence an individual's choice to participate may influence the subsequent research outcome (Robinson, 2014), such as their experience of behaviour change or engagement with a health app. In the present research, participants were more likely to reflect a health-conscious group of individuals with the majority reporting their weight status in the healthy BMI category and possessing adequate levels of nutrition knowledge. Such characteristics may influence their process of behaviour change, such as goal-setting, and their ability to benefit from particular behaviour change techniques and tools, such as health apps. Self-selection of participation may also be associated with differences in individual characteristics, such as involvement, knowledge, and personality, which may differentiate participants from the broader population (Tarquinio *et al.*, 2015). The latter point may be of particular relevance to the final research phase where the need to think-aloud during shopping trips may attract a more extroverted personality.

Self-selection may result in a participant sample that is different from the population of interest. While qualitative research does not aim for validity in the same way as quantiative research, it is still important that data are reflective and transferable to the population of interest. As described earlier, participants appeared to represent a more health-conscious group which may limit the relevance of thesis findings to the wider lower socioeconomic population. However, the sample is likely to represent those individuals most likely to use a health app in a real-life setting, thus providing an important insight into this sub-sample for future intervention design. For example, this process of self-selection may suggest that individuals with lower nutrition literacy are not likely to avail of a app-led dietary intervention and alternative measures may be necessary; however, further research is necessary to confirm this. Despite the potential limitation of self-selection bias, findings continue to provide an in-depth insight into

the interplay between app technology and the behaviour change process for women from a lower socioeconomic group with similar characteristics and thus is useful for informing future app design and dietary health interventions.

This research focused solely on food purchasing behaviour as a means of supporting healthier dietary patterns and subsequent health outcomes. Such a focus was necessary given the time and resources available to the researcher and the need to capture an in-depth insight into this specific behaviour change process. It is acknowledged that food purchasing is just one behaviour that influences dietary patterns, and indeed that dietary patterns are only one determinant of health. Sobal *et al.* (1998) detail nine different stages of the food and nutrition system with purchasing (acquisition) constituting only one of these stages, thereby highlighting the "*complex patterns of streams*" (Sobal *et al.*, 1998) that influence dietary behaviours and health outcomes. The limitation of focusing on individual food behaviour as a means of improving health outcomes is also acknowledged. In line with Dahlgren & Whitehead (2007), the research recognises the broader determinants of health, including community networks, living and working conditions, and one's sociocultural and economic environment. This research did not aim to address multiple determinants but hoped to contribute to the existing understanding of individual behaviour change and the role that it may play as part of a broader set of public health initiatives. The researcher acknowledges the limitations of the chosen approach in terms of improving population health and recommendations for policy and practice are made within such a context.

It is also important to discuss the challenges experienced in recruiting women from lower socioeconomic backgrounds and the potential impact on the presented findings. The challenge of recruiting individuals from disadvantaged communities to participate in research was recognised at the research design phase (Bonevski *et al.*, 2014; Pescud *et al.*, 2015). Consequently, recruitment methods were employed that were considered most effective based on the existing evidence, and included partnerships with community organisations (Dumka *et al.*, 1997; UyBico *et al.*, 2007), face-to-face, in-store recruitment (Ni Mhurchu *et al.*, 2009), and snowball techniques (Atkinson & Flint, 2001). However, it was very difficult to recruit women that were aged under thirty years. At the outset, it was considered important to recruit a varied sample of women to ensure sufficient insight could be given across age groups. However, this was not possible. As previously outlined, community workers suggested that health

apps may not be of interest to this age group owing to insufficient motivation to change behaviour, financial constraints, and restricted access to wireless internet. This limited the ability to examine similarities and differences in findings across age groups, which may have added further to the existing literature.

One of the research design components that potentially contributed to the difficulty in recruitment was the strict eligibility criteria for participation. The aim of the eligibility criteria was to represent a natural setting and recruit those women that were most likely to use and benefit from a health app. However, strict inclusion criteria may have hindered recruitment of individuals from this group. Such recruitment difficulties resulted in a longer period of time and resources spent on recruitment during phases three and four. This required an extension of the time period for in-store data collection and subsequent re-negotiation with retail managers. It was fortunate that all retail managers were very accommodating and further difficulties were not experienced in terms of retail store access during this extended time period. A more flexible approach to eligibility may have improved recruitment but this was not considered preferable in as it did not represent the perceived natural setting. It was considered preferable to persist in recruiting a homogenous sample which would provide a more accurate experiential account and deeper insight into the context of interest.

9.8 Conclusions

The research presented in this thesis has contributed to the existing understanding of the interplay between app technology and behaviour change, in the context of food purchasing behaviour. By examining the individual-level determinants of a healthy eating habit, the importance of deliberative cognitive processes was revealed. This progresses the extant knowledge on behaviour change in the context of complex food behaviours in modern food environments, and the importance of accommodating a shift towards the use of conscious deliberation. Primary research illustrated that existing apps may facilitate a more conscious, reflective approach to food purchasing, which aids healthier behaviour, by disrupting existing purchasing patterns through multiple techniques for change. By examining the lived experience of using a health app to support healthier purchasing behaviour, the present research has contributed to the existing knowledge base in relation to behaviour change and app user engagement. It has prompted a broader conceptualisation of behaviour change in the app technology

space, where the behavioural, cognitive, and affective processes of engagement also need to be considered alongside the cognitive processes of behaviour change. Furthermore, findings offer a number of practical insights into the future design of health apps and related behaviour change interventions. The remaining gaps in the literature, and those that warrant consideration in future research, have been highlighted, which offers opportunities to build on the knowledge gained in this thesis and further contribute to the theoretical understanding of app technology and behaviour change.

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Appendices

Appendix 5.1: Content Analysis Assessment Criteria

App Name:

Developer:

Version:

Most Recent Update:

Downloaded for Coding (Date):

Total Score:

Behaviour Change Score:

Nutrition Score:

MARS Score:

Section 1: Behaviour Change Assessment Criteria

Insert a score of 1 where the presence of the behaviour change technique is evident.

Number	Behaviour Change Technique	Strategy Focus	Score
12.4	Distraction	Performance Cue, Individual Response	
15.2	Mental rehearsal of successful performance	Performance Cue, Individual Response	
15.4	Self-talk	Performance Cue, Individual Response	
7.1	Prompts/cues	Performance Cue	
7.2	Cue signalling reward	Performance Cue	
7.3	Reduce prompts/cues	Performance Cue	
7.5	Remove aversive stimulus	Performance Cue	
11.3	Conserving mental resources	Performance Cue	
12.1	Restructuring the physical environment	Performance Cue	
12.2	Restructuring the social environment	Performance Cue	
12.3	Avoidance/reducing exposure to cues for the behaviour	Performance Cue	
12.5	Adding objects to the environment	Performance Cue	
13.2	Framing/reframing	Performance Cue	
1.1	Goals Setting (behaviour)	Individual Response	
1.2	Problem Solving	Individual Response	
1.3	Goal Setting (outcome)	Individual Response	
1.4	Action Planning	Individual Response	
2.3	Self-monitoring of behaviour	Individual Response	
2.4	Self-monitoring of outcome(s) of behaviour	Individual Response	
2.6	Biofeedback	Individual Response	
4.2	Information about antecedents	Individual Response	

4.3	Re-attribution	Individual Response	
8.2	Behaviour substitution	Individual Response	
9.3	Comparative imagining of future outcomes	Individual Response	
14.7	Reward incompatible behaviour	Individual Response	
15.1	Verbal persuasion about capability	Individual Response	
15.3	Focus on past success	Individual Response	
3.1	Social Support (unspecified)	Contingencies	
3.2	Social Support (practical)	Contingencies	
3.3	Social Support (emotional)	Contingencies	
6.3	Information about others' approval	Contingencies	
7.4	Remove access to the reward	Contingencies	
10.1	Material incentive (behaviour)	Contingencies	
10.2	Material reward (behaviour)	Contingencies	
10.3	Non-specific reward	Contingencies	
10.4	Social reward	Contingencies	
10.5	Social incentive	Contingencies	
10.6	Non-specific incentive	Contingencies	
10.7	Self-incentive	Contingencies	
10.8	Incentive (outcome)	Contingencies	
10.9	Self-reward	Contingencies	
10.10	Reward (outcome)	Contingencies	
10.11	Future punishment	Contingencies	
14.1	Behaviour cost	Contingencies	
14.2	Punishment	Contingencies	

14.3	Remove reward	Contingencies	
14.5	Rewarding completion	Contingencies	
14.6	Situation-specific reward	Contingencies	

Section 2: User Quality Assessment (Mobile App Rating Scale)

Circle the number that most accurately represents the quality of the app component you are rating. Please use the descriptors provided for each response category.

A: Engagement – fun, interesting, customisable, interactive (e.g. sends alerts, messages, reminders, feedback, enables sharing), well-targeted to audience

1. Entertainment: Is the app fun/entertaining to use? Does it use any strategies to increase engagement through entertainment (e.g. through gamification)?

1 Dull, not fun or entertaining at all

2 Mostly boring

3 OK, fun enough to entertain user for a brief time (< 5 minutes)

4 Moderately fun and entertaining, would entertain user for some time (5-10 minutes total)

5 Highly entertaining and fun, would stimulate repeat use

2. Interest: Is the app interesting to use? Does it use any strategies to increase engagement by presenting its content in an interesting way?

1 Not interesting at all

2 Mostly uninteresting

3 OK, neither interesting nor uninteresting; would engage user for a brief time (< 5 minutes)

4 Moderately interesting; would engage user for some time (5-10 minutes total)

5 Very interesting, would engage user in repeat use

3. Customisation: Does it provide/retain all necessary settings/preferences for apps features (e.g. sound, content, notifications, etc.)?

1 Does not allow any customisation or requires setting to be input every time

2 Allows insufficient customisation limiting functions

3 Allows basic customisation to function adequately

4 Allows numerous options for customisation

5 Allows complete tailoring to the individual's characteristics/preferences, retains all settings

4. Interactivity: Does it allow user input, provide feedback, contain prompts (reminders, sharing options, notifications, etc.)? Note: these functions need to be customisable and not overwhelming in order to be perfect.

1 No interactive features and/or no response to user interaction

2 Insufficient interactivity, or feedback, or user input options, limiting functions

3 Basic interactive features to function adequately

4 Offers a variety of interactive features/feedback/user input options

5 Very high level of responsiveness through interactive features/feedback/user input options

5. Target group: Is the app content (visual information, language, design) appropriate for your target audience?

1 Completely inappropriate/unclear/confusing

2 Mostly inappropriate/unclear/confusing

3 Acceptable but not targeted. May be inappropriate/unclear/confusing

4 Well-targeted, with negligible issues

5 Perfectly targeted, no issues found

A. Engagement mean score =

B: Functionality – app functioning, easy to learn, navigation, flow logic, and gestural design of app

6. Performance: How accurately/fast do the app features (functions) and components (buttons/menus) work?

1 App is broken; no/insufficient/inaccurate response (e.g. crashes/bugs/broken features, etc.)

2 Some functions work, but lagging or contains major technical problems

3 App works overall. Some technical problems need fixing/Slow at times

4 Mostly functional with minor/negligible problems

5 Perfect/timely response; no technical bugs found/contains a 'loading time left' indicator

7. Ease of use: How easy is it to learn how to use the app; how clear are the menu labels/icons and instructions?

1 No/limited instructions; menu labels/icons are confusing; complicated

2 Useable after a lot of time/effort

3 Useable after some time/effort

4 Easy to learn how to use the app (or has clear instructions)

5 Able to use app immediately; intuitive; simple

8. Navigation: Is moving between screens logical/accurate/appropriate/ uninterrupted; are all necessary screen links present?

1 Different sections within the app seem logically disconnected and random/confusing/navigation is difficult

2 Usable after a lot of time/effort

3 Usable after some time/effort

4 Easy to use or missing a negligible link

5 Perfectly logical, easy, clear and intuitive screen flow throughout, or offers shortcuts

9. Gestural design: Are interactions (taps/swipes/pinches/scrolls) consistent and intuitive across all components/screens?

1 Completely inconsistent/confusing

2 Often inconsistent/confusing

3 OK with some inconsistencies/confusing elements

4 Mostly consistent/intuitive with negligible problems

5 Perfectly consistent and intuitive

B. Functionality mean score = _____

C: Aesthetics – graphic design, overall visual appeal, colour scheme, and stylistic consistency

10. Layout: Is arrangement and size of buttons/icons/menus/content on the screen appropriate or zoomable if needed?

1 Very bad design, cluttered, some options impossible to select/locate/see/read device display not optimised

2 Bad design, random, unclear, some options difficult to select/locate/see/read

3 Satisfactory, few problems with selecting/locating/seeing/reading items or with minor screensize problems

4 Mostly clear, able to select/locate/see/read items

5 Professional, simple, clear, orderly, logically organised, device display optimised. Every design component has a purpose

11. Graphics: How high is the quality/resolution of graphics used for buttons/icons/menus/content?

1 Graphics appear amateur, very poor visual design - disproportionate, completely stylistically inconsistent

2 Low quality/low resolution graphics; low quality visual design – disproportionate, stylistically inconsistent

3 Moderate quality graphics and visual design (generally consistent in style)

4 High quality/resolution graphics and visual design – mostly proportionate, stylistically consistent

5 Very high quality/resolution graphics and visual design - proportionate, stylistically consistent throughout

12. Visual appeal: How good does the app look?

1 No visual appeal, unpleasant to look at, poorly designed, clashing/mismatched colours

2 Little visual appeal – poorly designed, bad use of colour, visually boring

3 Some visual appeal – average, neither pleasant, nor unpleasant

4 High level of visual appeal – seamless graphics – consistent and professionally designed

5 As above + very attractive, memorable, stands out; use of colour enhances app features/menus

C. Aesthetics mean score = _____

D: Information – Contains high quality information (e.g. text, feedback, measures, references) from a credible source. Select N/A if the app component is irrelevant.

13. Accuracy of app description (in app store): Does app contain what is described?

1 Misleading. App does not contain the described components/functions. Or has no description

2 Inaccurate. App contains very few of the described components/functions

3 OK. App contains some of the described components/functions

4 Accurate. App contains most of the described components/functions

5 Highly accurate description of the app components/functions

14. Goals: Does app have specific, measurable and achievable goals (specified in app store description or within the app itself)?

N/A Description does not list goals, or app goals are irrelevant to research goal (e.g. using a game for educational purposes)

1 App has no chance of achieving its stated goals

2 Description lists some goals, but app has very little chance of achieving them

3 OK. App has clear goals, which may be achievable.

4 App has clearly specified goals, which are measurable and achievable

5 App has specific and measurable goals, which are highly likely to be achieved

15. Quality of information: Is app content correct, well written, and relevant to the goal/topic of the app?

N/A There is no information within the app

1 Irrelevant/inappropriate/incoherent/incorrect

2 Poor. Barely relevant/appropriate/coherent/may be incorrect

3 Moderately relevant/appropriate/coherent/and appears correct

4 Relevant/appropriate/coherent/correct

5 Highly relevant, appropriate, coherent, and correct

16. Quantity of information: Is the extent coverage within the scope of the app; and comprehensive but concise?

N/A There is no information within the app

1 Minimal or overwhelming

2 Insufficient or possibly overwhelming

3 OK but not comprehensive or concise

4 Offers a broad range of information, has some gaps or unnecessary detail; or has no links to more information and resources

5 Comprehensive and concise; contains links to more information and resources

17. Visual information: Is visual explanation of concepts – through charts/graphs/images/videos, etc. – clear, logical, correct?

N/A There is no visual information within the app (e.g. it only contains audio, or text)

1 Completely unclear/confusing/wrong or necessary but missing

2 Mostly unclear/confusing/wrong

3 OK but often unclear/confusing/wrong

4 Mostly clear/logical/correct with negligible issues

5 Perfectly clear/logical/correct

18. Credibility: Does the app come from a legitimate source (specified in app store description or within the app itself)?

1 Source identified but legitimacy/trustworthiness of source is questionable (e.g. commercial business with vested interest)

2 Appears to come from a legitimate source, but it cannot be verified (e.g. has no webpage)

3 Developed by small NGO/institution (hospital/centre, etc.) /specialised commercial business, funding body

4 Developed by government, university or as above but larger in scale

5 Developed using nationally competitive government or research funding (e.g. Australian Research Council, NHMRC)

19. Evidence base: Has the app been trialled/tested; must be verified by evidence (in published scientific literature)?

N/A The app has not been trialled/tested

1 The evidence suggests the app does not work

2 App has been trialled (e.g., acceptability, usability, satisfaction ratings) and has partially positive outcomes in studies that are not randomised controlled trials (RCTs), or there is little or no contradictory evidence.

3 App has been trialled (e.g., acceptability, usability, satisfaction ratings) and has positive outcomes in studies that are not RCTs, and there is no contradictory evidence.

4 App has been trialled and outcome tested in 1-2 RCTs indicating positive results

5 App has been trialled and outcome tested in > 3 high quality RCTs indicating positive results

D. Information mean score = _____ *

* Exclude questions rated as "N/A" from the mean score calculation.

Section 3: Nutrition Content Assessment

Does the nutrition content adhere to current guidelines and recommendations, as set out in the Irish Food Pyramid Guidelines?

N/A No nutrition content included

0 Nutrition content is inadequate, incorrect, or inappropriate for use

1 Nutrition content is adequate, correct, and appropriate for use

Section 4: Qualitative Assessment

Record any other comments on the assessment of the mobile app that are not adequately covered under other sections.

Is the app available to use offline?

0 No content is available for use offline

1 Some of the content is available for use offline but the usability of the app is limited

2 The majority, or all, of the content is available for use offline with minimal negative impact on the usability of the app

Appendix 6.1 Ethical Approval Confirmation

UCC
Coláiste na hOllscoile Corcaigh
University College Cork Ireland

Oifig an Leas Uachtaráin Taighde agus Nuálaíochta
Office of the Vice President for Research and Innovation

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+353 (0)21 4903500
vpresearch@ucc.ie
www.ucc.ie

Sarah Jane Flaherty
Department of Food Business & Development
Room 2.37, O'Rahilly Building
University College Cork

18 October 2018

Dear Sarah Jane

Thank you for submitting your research project, Log 2016-143 entitled "Exploring the potential role of mobile apps to support healthier food purchasing behaviour.") to SREC for ethical perusal. I am pleased to say that we see no ethical impediment to your research as proposed and we are happy to grant approval. Approval date was 14 February 2017.

We wish you every success in your research.

Yours sincerely,

Mike Murphy,
Chair of Social Research Ethics Committee

Professor Anita R. Maguire BSc PhD CChem MRSC
Vice President for Research and Innovation

Ollscoil na hÉireann, Corcaigh
National University of Ireland, Cork

Appendix 6.2: Participant Information Sheet

Purpose of the Study. We are interested in peoples' experiences of using mobile apps around food and for food shopping and learning about the important parts of mobile apps for different people.

What will the study involve? We will ask you to use two mobile apps for one week each. You will use one app for the first week only and then a different mobile app for the second week only. We will send you a message with a web-link to download each of the mobile apps. Both mobile apps are free so you will not need to pay for anything. We will help you if there are any problems downloading the mobile apps. At the end of the two weeks, Sarah Jane will meet you to talk about your experiences of using the two mobile apps. This interview should take about 45 minutes. This interview will be recorded so we can make sure we have all the important information.

Do you have to take part? No. Taking part is voluntary which means that only you decide if you want to take part. Even if you agree to take part now, you can still decide to leave before or during the interview. After the interview, you still have 2 weeks to leave & we will delete all your information.

What will happen to the information which you give? All information will be kept confidential which means that it won't be shared with anyone outside of the project. It will be kept safely for 10 years and it will then be destroyed. We will join your information with all the other information we collect to learn more about peoples' experiences of using mobile apps and how we can make mobile apps better. Our findings will be written into a research paper which may be published online and we may also present our findings at different meetings in Ireland and abroad. We may use some of the sentences that you share with us in our papers and presentations but we will never share your name or any personal information that might identify you.

What if there is a problem? We will give you our contact details and you will be able to contact us if there are any problems at any time.

Who has reviewed this study? The Social Research Ethics Committee of UCC has reviewed and approved this study.

Any further queries? If you are interested in taking part or need more information, you can contact **Sarah Jane Flaherty:** (Redacted).

Appendix 6.3: Initial Email Contact with Community Workers

Dear [contact name],

My name is Sarah Jane and I am currently completing a PhD in UCC where I'm looking at mobile apps and the role they may play in supporting people to make a change towards healthier food behaviours, specifically food shopping behaviour. In the next phase of this research, we are looking to speak with women aged 18-50 years about their experiences of using different mobile apps. I'm getting in touch with you as I was hoping that we may be able to work with you to advertise this study with relevant groups in your community to recruit interested individuals.

I've attached an information sheet on the study outline. We will be asking interested participants to use two specific mobile apps for one week each. After this two-week period, we will invite them for an interview to discuss their experiences of using the mobile apps and explore some of the personal and mobile-specific factors which may have influenced their experience. This study may be of interest to those who would like to change their eating behaviour and need some additional support or tools.

If you are able to support this work, I would ask that you advertise the information sheet in your centre or share the information sheet with relevant groups. Any individuals interested in taking part can contact me directly and my contact details are given on the information sheet. If particular groups are interested, I can meet with these groups to give a brief overview of the study and answer any questions they may have. If you wish to discuss this further, I am happy to meet with you or discuss over the phone.

If you are able to support this study, please do let me know so that I can discuss the next steps with you and answer any questions that you may have.

Thank you very much in advance for your time, and please do contact me if there are any questions.

Appendix 6.4: Screening Questionnaire

Date	
Location	
Number	

1. Do you currently own a smartphone that is capable of downloading apps, such as Facebook, Twitter, Snapchat? Yes No

2. Have you downloaded a mobile app before, such as Facebook, Twitter, Snapchat?
   Yes No

3. Are you currently using any of the following mobile apps:

weightmate	Yes	No
Make My Plate	Yes	No
My Diet Coach	Yes	No

4. Do you do most, or at least half, of the food shopping in your household?
   Yes No

5. What of these age groups are you in?

   18 – 30 years 31 – 40 years

   41 – 50 years 51+ years

6. Which of these phrases are most relevant to you, at the moment?
   a. I currently do not eat a healthy diet and I am not thinking about starting.
   b. I currently do not eat a healthy diet but I am thinking about starting.
   c. I currently eat a healthy diet but not on a regular basis.
   d. I currently eat a healthy diet but I have only begun to do so in the last 6 months.
   e. I currently eat a healthy diet and I have done so for longer than 6 months.

7. Have you been diagnosed with any of the following health conditions?
   Inflammatory Bowel Disease (such as Crohn's Disease, Ulcerative colitis)

   Coeliac Disease
   Eating Disorder (Anorexia, Bulimia)
   High Blood Pressure
   High Cholesterol
   Heart Disease
   Diabetes
   Osteoporosis

   Any other health condition that you think is important to tell us about?

8. Are you currently pregnant?
   Yes No

9. What is the job type of the main earner in your household?

   What is their employment status, at the moment?

   a. At Work
   b. Self-employed
   c. Engaged on home duties/Assisting relative

d. Retired from employment e. Unemployed f. Other
10. Are you the main earner in your household? Yes No If answer is no, then ask: What is your own employment status, at the moment? a. At Work b. Self-employed c. Engaged on home duties/Assisting relative d. Retired from employment e. Unemployed f. Other
11. Do you have any children? Yes No If yes, what age are they? 0 – 10 years 11 – 17 years 18 – 25 years 26+ years
12. Who lives in your household? Adults (number & relationship to participant): Children (number & relationship to participant):

For the researcher:

If not eligible: Unfortunately you are not eligible to take part in this study but thank you for your time today.

If the individual is eligible, acquire contact details and assure participant that these will only be used for this study, and we will not share this information with anyone. Provide participant with information sheet.

If eligible: Can I take some contact details for you, and I'll get in touch in the next few days to talk about the next steps. Your contact information will only be used for this study and we won't share it with anyone else. Here's more information on the study (provide participant with Information sheet), and let me know if you have any questions.

Contact Information:

Name:

Number:

Email:

Appendix 6.5: Consent Form

I……agree to participate in Sarah Jane Flaherty's research study.

The purpose and nature of the study has been explained to me in writing.

I am taking part voluntarily.

I understand that no professional clinical support will be provided, from a doctor or dietician, during the study. I confirm that I do not have a health condition that prevents me from taking part.

I give permission for my interview with Sarah Jane Flaherty to be audio-recorded.

I understand that I can leave the study at any time before it starts or while I am taking part.

I understand that I can leave the study two weeks after the interview, in which case the material will be deleted.

I understand that my name or personal details will not be shared in future papers or presentations.

I understand that sentences from my interview may be quoted in future papers or publication if I give permission below:

(Please tick one box:)

I agree to quotation/publication of extracts from my interview □

I do not agree to quotation/publication of extracts from my interview □

Signed: Date:

PRINT NAME:

Appendix 6.6: Nutrition Knowledge Questionnaire

Name: _____

Date: _____

Do you know your height & weight? Will you share this information with us?

Height: Weight:

I don't want to share this information

For each of the following sentences, please circle whether you think it is true, false, or if you don't know or are not sure of the answer.

1	A high intake of plant foods combined with a low salt intake may protect against high blood pressure	True	False	Don't Know
2	Adequate calcium intake may reduce the risk of osteoporosis	True	False	Don't Know
3	Choosing salt-reduced foods provides no health benefits	True	False	Don't Know
4	Dietary fibre from wholemeal foods combined with an adequate intake of drinking water prevents constipation	True	False	Don't Know
5	Choosing wholemeal bread provides no health benefits	True	False	Don't Know
6	A high intake of saturated fat can protect against heart disease	True	False	Don't Know
7	Low sugar intake may decrease the risk of dental cavities	True	False	Don't Know
8	Milk and milk products such as cheese and yoghurt are the best sources of iron	True	False	Don't Know
9	Meat, poultry and fish are the best sources of calcium	True	False	Don't Know

10	Fruit is a poor source of vitamin C	True	False	Don't Know
11	Wholegrain breads are good sources of fibre	True	False	Don't Know
12	Saturated fats are found in large quantities in butter, lard and dripping	True	False	Don't Know
13	Dark green and orange vegetables like spinach, broccoli, carrots and pumpkin are low in vitamin A	True	False	Don't Know
14	Bread, cereal, fruit and vegetables should make up the smallest part of our diet	True	False	Don't Know
15	It is better for health to choose lean meat (with little visible fat)	True	False	Don't Know
16	It is better for health to limit those foods which contain high levels of sugar such as soft drinks, cordial and biscuits	True	False	Don't Know
17	It is recommended that adults have some milk, cheese or yoghurt every day	True	False	Don't Know
18	It is recommended that we eat fat and oil in limited amount	True	False	Don't Know
19	Adults should choose full-fat milk instead of semi-skimmed or skimmed milk	True	False	Don't Know
20	Meat, fish, chicken and eggs should make up the largest part of our diet	True	False	Don't Know

Appendix 6.7: Interview Topic Guide

Opening	
[Participant's name], Thank you very much for giving up your time to come chat with me today. During the interview I would like to ask you some questions about your typical shopping experience and also about your experience of using the two mobile apps over the last two weeks. Before we begin I would like to let you know that everything you say here today will be kept confidential, which means that it won't be shared with anyone that isn't involved in the project. If we use any sentences from the interview at a later stage, your name will not be shared or any personal information that might identify you. Also, you can stop the interview at any stage or if you decide in the next two weeks that you don't want your information to be used, you can let me know and I will delete your information. Is all of this ok? If it's ok with you, I would like to record our conversation so that I can listen to it afterwards and make sure that I have all the important information and that I have understood you correctly. Is this ok with you? Also, I want to say that it's important to know that there are no right or wrong answers. We want you to share your own experiences and opinions, and that is what we are interested in. If you don't understand anything at any stage or if I don't explain something properly, just let me know and I can go through it again. Is this ok?	
So I just want to begin by talking a bit about your own experiences with food and food shopping.	
1. Can you tell me a bit about your food shopping?	
Probes	a. What motivates you? How do you decide what to buy? What influences your choices? b. What are the different steps involved in food shopping for you? For example, do you use a shopping list?
2. What do you consider healthy eating is about? What does it mean to you?	
Probes	a. Was this influenced by either of the mobile apps? If yes, how did the mobile app influence this? b. How do you think a mobile app could help your understanding? c. Is eating healthily something that is important to you? Why is this?
3. In relation to food shopping & cooking, would you say you feel confident?	
Probes	a. Do you feel you can fully understand food labels & cooking recipes? Did the mobile apps influence this? b. What do you think would make you feel more confident? How could a mobile app help?

Now, I just want to talk with you about your experiences of using both mobile apps over the past two weeks. So for the beginning, we'll just talk about both mobile apps together and afterwards we can talk about each of the mobile apps separately. Is this ok?	
4. Thinking about both of the mobile apps, how would you describe your overall experience of using these mobile apps over the last two weeks?	
Probes	a. Were they useful? Were they easy to use? Did you enjoy using them? b. How did you use them in everyday life? How often did you the mobile apps? c. Did you use either of them to help with your food shopping? Why? How? d. Before using the apps, how did you think you would use them? Was this what happened, or how was it different? e. What was your previous experiences of using mobile apps? Had you used food or health apps before? f. Would you say that you are confident in using mobile apps? Has this changed since using these mobile apps, or were you confident before? g. Do you have any concerns about using mobile apps? What are they?
5. Now, I just want to talk about [insert name of first mobile app used]. How would you describe your overall experience of using this mobile app?	
Probes	a. How did you use this mobile app? b. Did you use it to help with food shopping? How? Why? c. Did you find this app useful? Why was this the case? d. Did you find the app easy to use? Why was this the case? e. Was the language appropriate and easy to understand? f. What, if any, changes could be made to the app to improve your experience? g. Do you think you would use the app again? Why?
6. Now, I just want to talk about [insert name of second mobile app used]. How would you describe your overall experience of using this mobile app?	
Probes	a. How did you use this mobile app? b. Did you use it to help with food shopping? How? Why? c. Did you find this app useful? Why was this the case? d. Did you find the app easy to use? Why was this the case? e. Was the language appropriate and easy to understand? f. What, if any, changes could be made to the app to improve your experience? g. Do you think you would use the app again? Why?
7. Is there anything else that you would like to tell me about your experience of using the mobile apps over the last two weeks? Is there anything that I have not talked about but you think is important?	

Appendix 7.1: Ethical Approval

ucc
Coláiste na hOllscolle Corcaigh, Éire
University College Cork, Ireland

Oifig an Leas - Uachtaráin Taighde agus Nuálaíochta
Office of the Vice President for Research and Innovation

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E vpresearch@ucc.ie
www.ucc.ie

Sarah Jane Flaherty
Room 2.23a
O'Rahilly Building Western Road
University College Cork

7 April 2017

Dear Sarah Jane,

Thank you for submitting your research (project Log 2017-036 entitled: "Exploring the potential role of mobile apps to support healthier food purchasing behaviour.") to SREC for ethical perusal. I am pleased to say that we see no ethical impediment to your research as proposed and we are happy to grant approval without conditions. Approval date was 3 April 2017.

We wish you every success in your research.

Yours sincerely,

Mike Murphy,
Chair of Social Research Ethics Committee

Professor Anita R. Maguire BSc PhD CChem MRSC
Vice President for Research and Innovation

Ollscoil na hÉireann, Corcaigh
National University of Ireland, Cork

Appendix 7.2: Information Sheet for Retailer Managers

Purpose of the Study:

We are interested in peoples' experiences of using mobile apps for their food shopping and if mobile apps can help people make healthier food choices.

What will the study involve?

For the first phase, we would like to gather information from a broad sample of customers on their use of mobile apps, food shopping, and general household information. For the second phase, we will invite a sample of interested customers to use a mobile app for eight weeks and we will look at their shopping and food choice behaviour over this time. We will meet with participants twice in the supermarket over an eight-week period. In the first meeting, we will ask them to wear a microphone during their regular food shop and we will walk around with them so that we can get a better understanding of their food choices. After this shop, we will ask them to complete a questionnaire and then chat with them about their use of mobile apps and some of the factors that influence their food choices. We will then give them a healthy eating mobile app to use for eight weeks. At the end of the eight weeks, we will meet with them again in the supermarket and chat with them about their experiences over the previous eight weeks. We will accompany them on their food shop again, using the microphone, to see if there has been any change in their food choices. It will run between May to October 2017.

What are we asking retailers to do?

We would like your permission to set up a table in the supermarket on agreed dates to collect the above information from customers. For the second stage, we would like your permission to access the supermarket with participants to examine their shopping behaviour.

Any further questions?

Sarah Jane Flaherty (Contact Details Redacted)

Appendix 7.3: Consent Form for Retail Managers

I……agree to participate in Sarah Jane Flaherty's research study.

The purpose and nature of the study has been explained to me in writing.

I am taking part voluntarily.

I give permission for participants to use microphones in the supermarket during data collection.

I understand that personal details or store information will not be shared in future publications, unless agreed in advance.

Signed: Date:

PRINT NAME:

Appendix 7.4: Screening Questionnaire

Date	
Location	
Number	

Please circle your answers to the questions below. If you don't want to answer a question, leave it blank. If you don't understand a question, let me know.

1. Do you currently own a smartphone that is capable of downloading apps, such as Facebook, Twitter, Snapchat? Yes No

2. Have you downloaded a mobile app before, such as Facebook, Twitter, Snapchat?
   Yes No

3. Have you used or are you currently using:
   Make My Plate Yes No
   My Diet Coach Yes No

4. Do you do most, or at least half, of the food shopping in your household?
   Yes No

5. Where do you typically do the majority of your food shopping?

6. Do you usually do one weekly food shop? Yes No
   On what day, do you usually do your weekly shop?

7. Do you currently need to wear prescription glasses or contact lenses when you do your food shopping?
   Glasses Contact Lenses

8. Which of these age groups are you in?
   18 – 30 years 31 – 40 years
   41 – 50 years 51+ years

9. Which of these phrases are most relevant to you, at the moment?
   a. I currently do not eat a healthy diet and I am not thinking about starting.
   b. I currently do not eat a healthy diet but I am thinking about starting.
   c. I currently eat a healthy diet but not on a regular basis.
   d. I currently eat a healthy diet but I have only begun to do so in the last 6 months.
   e. I currently eat a healthy diet and I have done so for longer than 6 months.

10. Have you been diagnosed with any of the following health conditions?

You don't need to tell us which condition you have but just circle Yes at the end if you have any of them.

Inflammatory Bowel Disease (such as Crohn's Disease, Ulcerative colitis)
Coeliac Disease
Eating Disorder (Anorexia, Bulimia)
High Blood Pressure
High Cholesterol
Heart Disease
Diabetes
Osteoporosis

Yes No

11. Are you currently pregnant?

Yes No

12. Please circle if you agree or disagree with the following phrases.

I don't think much about my food shopping

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

Compared with other household decisions, my food shopping choices are not very important

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

Health means a lot to me

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

I care a lot about health

1	2	3	4	5	6	7
Entirely disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Entirely agree

13. What is the job of the main income earner in your household?

Are they currently:

a. At Work
b. Self-employed, with paid employees
c. Self-employed, without paid employees
d. Engaged on home duties/Assisting relative
e. Retired from employment
f. Unemployed
g. Other

14. Are you the main income earner in your household? Yes No

If no, are you currently:

a. At Work/ Self-employed
b. Engaged on home duties/Assisting relative
c. Retired from employment
d. Unemployed
e. Other

15. Do you have any children? Yes No

If yes, what age are they? (please circle all that apply)

0 – 10 years 11 – 17 years

18 – 25 years 26+ years

16. Who lives in your household?

Adults (number & relationship to you):

Children (number & relationship to you):

Thank you!

……

Are you interested in being involved in future research with us? If yes, please fill in your name and contact details below:

Name: _____

Phone Number: _____

Appendix 7.5: Participant Information Sheet (Screening)

Purpose of the Study:

We are interested in peoples' experiences of using mobile apps for their food choices in the supermarket and at home.

What will the study involve?

We are asking people to answer some questions on their use of mobile apps, food shopping, and general household information. This should take about 5 minutes. You can fill in the answers yourself or else we can fill it in with you. If you don't want to answer a question, just leave it blank. If you don't understand something, let us know and we can explain it a bit better.

What will happen to the information that I share?

All information will be kept confidential and will not be shared with anyone outside of the research team. We will join your information with all the other information we collect to learn more about using mobile apps. Our findings will be written into a research paper which might be online and we may share our findings at different meetings in Ireland and abroad. Your name or personal information will never be shared outside of the research team. All information will be kept for a period of 10 years after which time it will be destroyed. You can still decide in the next 2 weeks that you don't want to take part – just let us know and we will delete your information.

Who has reviewed this study? The Social Research Ethics Committee of UCC has reviewed and approved this study.

Any further questions?

Sarah Jane Flaherty (Contact Details Redacted)

Appendix 7.6: Consent Form (Screening)

I……agree to participate in Sarah Jane Flaherty's research.

The purpose and nature of the study has been explained to me in writing.

I am taking part voluntarily.

I understand that I still have two weeks to decide if I don't want my information to be used, in which case all my information will be deleted.

I understand that my information will be joined with the other information collected and may be used in future papers and presentations but my name or any personal details will not be shared outside of the research team.

Signed: Date:

PRINT NAME:

Appendix 7.7 Study Invitation

Hello [insert name].

My name is Sarah Jane and I'm a researcher in UCC. You took part in our study recently and told us that you might be interested in taking part in future studies. I'm just contacting you to tell you about a new study that we have coming up that you might be interested in.

We're interested in peoples' experiences of using mobile apps around food so we're looking for women to use a specific healthy eating mobile app for 8 weeks and tell us about their experiences. At the start, we'd like to join you on one of your weekly shops and chat with you about your typical food shopping and your use of mobile apps. This would take about 45 minutes on top of your usual shop. It would take place in the supermarket and we would have fridge space for you to keep your shopping fresh.

We'd then give you a link to download the mobile app which you can then use for the 8 weeks. After about a month, we'd ask you to record some of your thoughts on your phone and share them with us – so how you are getting on with the mobile app or whatever you think is important to tell us about. We'd also like people to share their grocery till receipts with us for the 8 weeks and we would give you envelopes to send them to us.

At the end, we'd like to join you again on one of your shops and chat with you about your experiences over the 8 weeks. This would be the same as the start and should take 45 minutes after your main shop. Everyone taking part in the study will be given a One4All voucher for €75 to say thanks for taking part.

If you have any questions, call, text, or emails Sarah Jane on (contact details redacted).

Appendix 7.8: Information Sheet (Participation)

Mobile Apps & Food Choice

We're looking for women to take part in our study on Mobile Apps & Food Choice. Here is more information on the study & get in touch if you are interested in taking part or have any questions.

What is the study about?

We are interested in peoples' experiences of using mobile apps around food & food shopping.

What will I have to do?

We want you to use a healthy eating mobile app for 8 weeks and tell us about your experiences afterwards. I will meet with you twice in your usual supermarket: once before we give you the mobile app and again at the end of the 8 weeks.

In the first meeting, I will walk around with you during your regular food shop. I will ask you to wear a microphone and ask you to talk to me as we are walking around so that I can get a better understanding of your food choices. After this shop, I will ask you to fill in a questionnaire and have a chat about your use of apps and your food choices. I will then send you a text message with a link to download the mobile app.

I would like you to keep your shopping till receipts for the 8 weeks and share them with me. If you are not happy to do this, that's ok and just let me know. Half-way during the study I would like you to record a voice-record on your phone about your experiences of using the mobile app. I will show you how to do this. If you don't want to do this, that's ok and just let me know.

At the end of the 8 weeks, I will meet with you again for your regular food shop and walk around with you and ask you to talk with me as we are walking around. I will ask you to complete a questionnaire and chat about your experience of using the mobile app over the 8 weeks. I will record these sessions so that I can make sure I have all the important information. At the end of the 8 weeks, I will give you a €75 One4All voucher to say thanks for taking part.

Do I have to take part?

No. Taking part is voluntary which means that only you decide if you want to take part. Even if you agree to take part now, you can still decide to leave anytime during the study. You also have 2 weeks after our final meeting to leave & I will delete all your information. You don't have to answer anything that you don't want to or share information that you don't want to. It's not a problem if you don't want to do some parts of the study, like the voice record or sharing your till receipts, and just let me know. You can even tell me this at any point during the 8 weeks and it won't stop you from being able to take part or receiving the voucher.

What will happen to the information I give you?

All information will be kept confidential which means it won't be shared with anyone outside of the project. We may use some of the sentences that you share with us in our papers and presentations but we will never share your name or any information that might identify you. It will be kept safely for 10 years and will then be destroyed. We will join your information with the other information we collect to learn more about using mobile apps. Our findings will be written into a research paper which might be online and we may share our findings at different meetings in Ireland and abroad.

What if there is a problem?

I will give you our contact details and you will be able to contact us if you have any problems at any time.

Who has reviewed this study?

The Social Research Ethics Committee of UCC has reviewed and approved this study.

Any questions? Call, text, or email

Sarah Jane Flaherty **(Contact Details Redacted)**

Appendix 7.9 Supermarket Observation Guide

Store Name: **Date:** **Time:**

1. **Does the retail store offer adequate opportunities for the customer to purchase a healthy basket of items?**

- Are there adequate healthy foods available, i.e. fresh fruit & vegetables, fresh meats? What is the quality of these foods, i.e. appealing, poor quality? Is there adequate variety?
- How are these food items displayed? Are they in a prominent position in the store? A prominent position on a shelf? How does their placement compare to less healthy foods?
- What is the price of these food items? Are there 'budget-friendly' options available? If yes, are they promoted as such, or how are they promoted?
- Are any of these food items on promotion? If yes, what type of promotions are being used? How do they compare to the promotions for less healthy items?
- Are there health promotion messages or nutritional information available in the store? What type of information is provided? Is it accessible?

2. **What features are in place in the store that may divert people from eating healthily?**

- What is the space give to less healthy items in comparison to healthier foods?
- How are these food items displayed? Are they in a prominent position in the store? A prominent position on a shelf? How does their placement compare to healthier foods?
- What is the price of these food items? Are there 'budget-friendly' options available? If yes, are they promoted as such, or how are they promoted?
- Are any of these food items on promotion? If yes, what type of promotions are being used? How do they compare to the promotions for healthier food items?
- Where are people typically gathering? What areas of the store are busy with people? Which parts of the store do people typically spend more time?
- Are there other features of the store environment that appear important and may influence consumers purchasing of healthier food items?

Appendix 7.10: Consent Form (Participation)

I……agree to participate in the Sarah Jane Flaherty's study.

The purpose and nature of the study has been explained to me in writing.

I am taking part voluntarily.

I understand that no professional clinical support will be provided, from a doctor or dietician, during the study. I confirm that to the best of my knowledge I do not have a health condition that prevents me from taking part.

I give permission for my accompanied shops to be recorded, using a microphone, and for my interviews to be audio-recorded. I agree to share my food shopping receipts for as long as I am in the study.

I understand that I can leave the study at any time before it starts or while I am taking part. I understand that I can leave the study two weeks after the final interview, in which case the material will be deleted.

I understand that I will receive a voucher for participating in this study even if I withdraw at any stage or decline to answer specific questions.

I understand that my name, personal details, or personal images will not be shared in future papers or presentations. I understand that sentences from my interview may be quoted in future papers or publication if I give permission below: (Please tick one box)

I agree to quotation/publication of extracts from my interview □

I do not agree to quotation/publication of extracts from my interview □

Signed: Date:

PRINT NAME:

Appendix 7.11: Accompanied Shop Protocol

Pre-Shop Instructions:

For our study, we are interested in what people are thinking about & looking at while doing their food shopping. We are asking people to think aloud while they are shopping. So what this means is that we want you to say out loud what you are thinking when you are going around the supermarket. You don't have to plan what you are going to do or explain to me what you are going to say, but the most important thing is that you keep talking during your shop and just say what is coming into your head. You can imagine that I'm your friend and you're just telling me everything that you are thinking while you're doing your shopping. If you are quiet for a while, I will ask you kindly to keep talking and thinking aloud. Is this ok? And just act how you normally would during your shopping trip, so there is no need to change anything but just do your shop as you normally would. Is this ok? Have you any questions about what you have to do?

During the shop, the following steps will be followed:

- Sign language and non-verbal gestures will be used to encourage participants to continue talking.
- If the participant stops talking for longer than 10-20 seconds, the following prompts will be used to encourage talking:
    - Can you continue talking, and telling me what you are thinking?
    - Can you continue thinking out loud, please?
    - Can you keep telling us what you thinking as you are shopping, please?
- The researcher will not provide any support to the participant to make their food choice, even if requested by the participant.
- The microphone will be removed from the participant before payment at the till to ensure no unnecessary personal details, such as bank card details, are captured.

Appendix 7.12: Baseline Interview Schedule

<table>
<tr><td colspan="2">[Participant's name], Thank you very much for giving up your time to come chat with me today. During the interview I would like to ask you some questions about your typical shopping patterns and your experiences of mobile apps. Before we begin I would like to let you know that everything you say here today will be kept confidential, which means that it won't be shared with anyone that isn't involved in the project. If we use any sentences from the interview at a later stage, your name will not be shared or any personal information that might identify you. Also, you can stop the interview at any stage, just let me know and I will delete your information. Is all of this ok? If it's ok with you, I would like to record our conversation so that I can listen to it afterwards and make sure that I have all the important information and that I have understood you correctly. Is this ok with you? Also, I want to say that it's important to know that there are no right or wrong answers. We want you to share your own experiences and opinions, and that is what we are interested in. If you don't understand anything at any stage or if I don't explain something properly, just let me know and I can go through it again.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">So I want to begin by talking a bit about your own experiences with food & food shopping.</td></tr>
<tr><td colspan="2">1. Can you tell me a bit about your food shopping over your life?</td></tr>
<tr><td>Probes</td><td>a. What influences your household food choices? How do you decide what to buy? Has this changed over time? How? Why has it changed?
b. Who influences your household food choices? Family members? What is your own say? Has this changed over time? How? Why has it changed?
c. What are the different steps for you when you go shopping, e.g. do you use a list; plan meals? Has this changed over time? How? Why has it changed?
d. Are you happy with your current shopping patterns? Is there anything that you would like to change? Why?</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">2. Was this recent shop (accompanied shop) a typical shop for you? If not, what was different? Was there anything unusual? Why was this the case?</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">3. Have you tried to change your food behaviour/patterns before? Can you tell me a bit about your experience of trying to change your behaviour?</td></tr>
<tr><td>Probes</td><td>a. What approaches have you taken? What happened? Was it successful? Why?
b. What helped or stopped you from making a change? Why was this the case, do you think?
c. Have you ever tried to change your food shopping behaviour? Can you tell me a bit more about this? Why did you want to change? What happened?</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">4. What does healthy eating mean to you? Can you tell me about the sorts of foods that you consider to be healthy? Why is this the case?</td></tr>
</table>

Probes	a. Can you tell me about how you would choose something healthy when you are food shopping? Why is this the case? b. Do you try to use the nutrition labelling on foods to help you choose foods in the supermarket? Do you think the labelling on food is useful? Why is this the case? c. What do you think people need to know to be able to buy and eat healthy food? Is there anything you'd like to be able to know or do but can't? d. Do you think cooking and knowing how to cook is important in being healthy? Why is this the case? e. Do you feel as if you are able to buy healthy foods? What sorts of things are holding you back from buying healthy foods? Why is this the case? f. Why do you think some people are healthy and other people aren't?
	Questions for parents: a. How important do you think buying healthy food to have in the house is for your children? Why is this? b. Do you think much about nutrition when you're deciding what food to give your kids? c. Do you find it easy to give your kids healthy foods? Why is this the case? d. Do you think having children changes the food you buy? Why is this? e. Would you give your children different food from yourself?
Now, I just want to talk with you about your experiences of mobile apps. Is this ok?	
5. Can you tell me a bit about your experience with mobile apps?	
Probes	1. What do you think of them? What do you use them for? 2. Have you used mobile health apps before? What was your experience like? Why was this the case? What did/do you use them for? 3. Do you feel confident using mobile apps? Have you any concerns with using mobile health apps?
6. Is there anything else that you would like to tell me? Is there anything that I have not talked about but you think is important?	

Appendix 7.13: Baseline Questionnaire

Name: _____

Date: _____

Please answer the following questions as best as you can. If you don't want to answer a question, just leave it blank. If you don't understand a question, just let me know.

Section A

1. Thinking of your time at the supermarket today, please rate your hunger on the scale below (1 not hungry at all to 10 extremely hungry)

1 2 3 4 5 6 7 8 9 10

Not Extremely

Hungry Hungry

At All

2. Please indicate for each of the five statements which is closest to how you have been feeling over the *last two weeks*. Notice that higher numbers mean better well-being. Example: If you have felt cheerful and in good spirits more than half of the time during the last two weeks, circle number 3.

Over the last two weeks:	All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
I have felt cheerful and in good spirits.	5	4	3	2	1	0
I have felt calm and relaxed.	5	4	3	2	1	0
I have felt active and vigorous.	5	4	3	2	1	0
I woke up feeling fresh and rested.	5	4	3	2	1	0
My daily life has been filled with things that interest me.	5	4	3	2	1	0

3. Please indicate for each of the three statements which is closest to how you were feeling while in the supermarket today. Notice that higher numbers mean better well-being. Example: If you felt cheerful and in good spirits more than half of the time today, circle number 3.

		All of the time	**Most of the time**	**More than half of the time**	**Less than half of the time**	**Some of the time**	**Not at all**
In the supermarket:	I felt cheerful and in good spirits.	5	4	3	2	1	0
In the supermarket:	I felt calm and relaxed.	5	4	3	2	1	0
In the supermarket:	I felt active and vigorous.	5	4	3	2	1	0
Please indicate for each of the two statements which is closest to how you are feeling today							
Today:	I woke up feeling fresh and rested.	5	4	3	2	1	0
Today:	My daily life is filled with things that interest me.	5	4	3	2	1	0

1. Obesity represents a very serious problem for Irish people.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
☐	☐	☐	☐	☐

5. How important do you think healthy eating is compared to other lifestyle behaviours, such as physical activity and not smoking?

Very Important	Important	Neither important nor unimportant	Unimportant	Not at all Important
☐	☐	☐	☐	☐

6. Thinking about your own health, please rate how serious a risk you consider each of the following to be for your health on a scale of 1 to 5, where 1 is not at all serious, and 5 is very serious.

	Not at all serious		Neither		Very Serious
Your weight	1	2	3	4	5
Your eating habits	1	2	3	4	5
Your stress level	1	2	3	4	5

7. How easy or difficult would it be to make improvement to the way you eat?

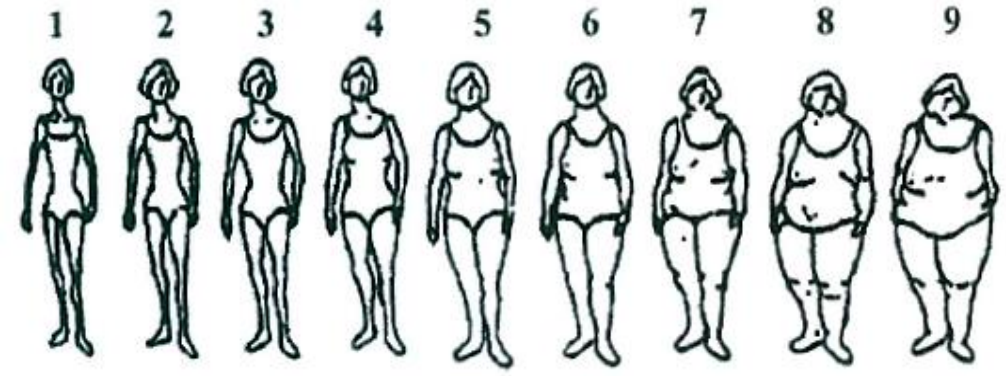
Very easy	Quite easy	Quite difficult	Very difficult	No changes necessary
☐	☐	☐	☐	☐

8. How is your health in general?

Very bad	Bad	Fair	Good	Very good
☐	☐	☐	☐	☐

9. Do you know your height & weight? Will you share this information with us?
   Weight:
   Height:
   I don't know this information/I don't want to share this information

10. From the following contour drawings, please select which body type you feel is closest to your own



11. Please circle whether you agree or disagree with each of the sentences below.

	Strongly Agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
I feel nervous about using mobile health apps	**5**	**4**	**3**	**2**	**1**
Technical terms sound confusing to me	**5**	**4**	**3**	**2**	**1**
Using a mobile app for my food shopping would be a hassle	**5**	**4**	**3**	**2**	**1**
For me, the time and effort involves in using a mobile app for food shopping is high	**5**	**4**	**3**	**2**	**1**
I regularly use mobile apps related to food or health	**5**	**4**	**3**	**2**	**1**
I use a lot of different mobile apps	**5**	**4**	**3**	**2**	**1**

Section B. Please read the text below and answer the questions that follow.

Eating well and staying fit are important to health. Good nutrition allows healthy growth and development for children and teens. A healthy diet may prevent long-term diseases such as heart disease, high blood pressure, type 2 diabetes, some cancers, malnutrition, osteoporosis, and others. It may also increase your chances for a longer life. Good nutrition can also help maintain a healthy weight. When we eat food and drink beverages, we consume calories along with other nutrients. Calories are a vital source of energy for the body, but it is important to take in the right amount. Taking in too few can lead to weight loss, while taking in too many may lead to weight gain.

Some foods are high in calories and low in other nutrients. These foods are considered *energy-dense*. You could eat a few energy dense foods and meet your calorie needs, but not get enough vitamins, minerals, and other important nutrients. A better idea would be to eat a variety of foods that are *nutrient-dense,* or foods that provide many vitamins, minerals, and other needed nutrients, but are low in calories, such as fruits and vegetables. According to the *2016 Irish Department of Health Guidelines,* a healthy diet emphasizes vegetables, salad, fruit, wholemeal and wholegrain cereals, reduced/ low fat dairy products, lean meats, poultry (without skin), fish, beans, eggs, and nuts. A healthy diet is also low in some nutrients, such as saturated fat, *trans* fat, cholesterol, sodium, and added sugars, and low in foods and drinks high in sugar and salt.

1. To lose _____, a person may need to eat fewer calories.
    a. weight
    b. cancer
    c. fruits
    d. fitness

2. Good _____ may prevent chronic diseases like high blood pressure.
    a. eggs
    b. diabetes
    c. nutrition
    d. chicken

3. A person who eats too few nutrients may develop _____.
    a. fat
    b. malnutrition
    c. deafness
    d. vitamins

4. Some nutrients, like _____ should be limited in a healthy diet.
   a. fruits
   b. vegetables
   c. niacin
   d. cholesterol

5. An example of an energy-dense food is _____.
   a. Milk chocolate (260 calories per 50g)
   b. Grilled turkey breast (132 calories per 85g)
   c. Seedless grapes (50 calories per 80g)
   d. Raw carrot (19 calories per 80g)

6. Nutrient-dense foods such as _____ should be consumed more often.
   a. Milk chocolate (260 calories per 50g)
   b. French fries (224 calories per 80g)
   c. Blueberries (52 calories per 80g)
   d. Bagel (227 calories per 86g)

7. The starch in a slice of bread is a type of _____.
   a. fat
   b. vitamin
   c. carbohydrate
   d. protein

8. Foods like oil and butter are often a source of _____.
   a. vitamin C
   b. carbohydrate
   c. iron
   d. fat

9. The _____ found in orange juice is a type of carbohydrate.
   a. sugar
   b. calcium
   c. protein
   d. folate

10. A good source of _____ is found in foods like eggs, chicken and fish.

a. starch

b. protein

c. fibre

d. sugar

11. Butter, lard, and cheddar cheese all provide high amounts of _____ fat.

a. polyunsaturated

b. saturated

c. monounsaturated

d. trans saturated

12. Because they are a good source of _____, vegetarians might eat kidney beans.

a. vitamin D

b. vitamin B-12

c. fat

d. protein

Household Food Measures

Sometimes we eat food in the right amounts and sometimes we choose smaller or larger portions. For each food pictured, choose what you think is the right portion size.



1. Pictured is one pint of milk. Is this:
   a. More than one portion?
   b. Less than one portion?
   c. About right for one portion?



2. Pictured is a 100g beef burger. Is this:
   a. More than one portion
   b. Less than one portion?
   c. About right for one portion?



3. Pictured is approximately one cup of cooked rice on this plate. Is this:
   a. More than one portion?
   b. Less than one portion?
   c. About right for one portion?



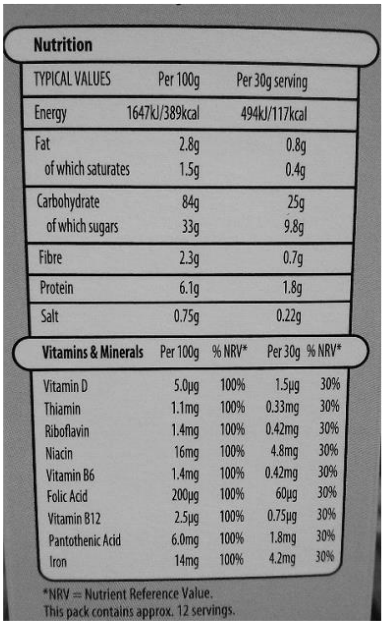
4. Pictured is half a grapefruit. Is this:
    a. More than one portion?
    b. Less than one portion?
    c. About right for one portion?



5. Pictured is 95g spaghetti on the plate at left. Is this:
    a. More than one portion?
    b. Less than one portion?
    c. About right for one portion?



5. Pictured is a 262g sirloin steak. Is this:
    a. More than one portion?
    b. Less than one portion?
    c. About right for one portion?



Nutrition

TYPICAL VALUES	Per 100g	Per 30g serving
Energy	1647kJ/389kcal	494kJ/117kcal
Fat	2.8g	0.8g
of which saturates	1.5g	0.4g
Carbohydrate	84g	25g
of which sugars	33g	9.8g
Fibre	2.3g	0.7g
Protein	6.1g	1.8g
Salt	0.75g	0.22g

Vitamins & Minerals	Per 100g	% NRV*	Per 30g	% NRV*
Vitamin D	5.0µg	100%	1.5µg	30%
Thiamin	1.1mg	100%	0.33mg	30%
Riboflavin	1.4mg	100%	0.42mg	30%
Niacin	16mg	100%	4.8mg	30%
Vitamin B6	1.4mg	100%	0.42mg	30%
Folic Acid	200µg	100%	60µg	30%
Vitamin B12	2.5µg	100%	0.75µg	30%
Pantothenic Acid	6.0mg	100%	1.8mg	30%
Iron	14mg	100%	4.2mg	30%

*NRV = Nutrient Reference Value.
This pack contains approx. 12 servings.

The food label at left is taken from the back of a container of a box of chocolate cereal.

1. How many calories will you consume if you ate 3 servings of this cereal?
    a. 351 calories
    b. 562 calories
    c. 700 calories
    d. 1167 calories

2. One teaspoon of sugar is approximately 4g. If you ate a 60g serving of this cereal, rounded to the nearest teaspoon, how many teaspoons of sugar would you be consuming?
    a. 1 teaspoon of sugar
    b. 5 teaspoons of sugar
    c. 9 teaspoons of sugar
    d. 18 teaspoons of sugar

3. 5 micrograms (µg) of vitamin D every day is recommended for everyone aged 5 to 50 years. How many grams of this cereal would you need to eat to reach the recommended level of vitamin D intake?
    a. 30g
    b. 60g
    c. 80g
    d. 100g

4. How many grams of saturated fat would you consume in one serving of this cereal?
    a. 9.8 grams
    b. 0.8 grams
    c. 2.8 grams
    d. 0.4 grams

5. Which of the following nutrients is not found on this food label?
    a. Vitamin C
    b. Iron
    c. Niacin
    d. Folic Acid

6. The recommended fibre intake per day for an adult is 25g or more. If you are advised to increase your fibre intake, is this food a good choice?
    a. Yes
    b. No

This is a list of foods. Using the chart below, write the name or number of each food in the food group in which it belongs.

1. Apple	2. Cheese	3. Chickpeas	4. Tomato
5. Milk	6. Potato	7. Sweetcorn	8. Banana
9. Noodles	10. Bread	11. Natural yoghurt	12. Rice
13. Orange juice	14. Chicken	15. Beef burger	16. Salad dressing

Grains	Vegetables	Fruits	Meat, Poultry, Fish and Beans	Dairy	Fats & Oils

Appendix 7.14 Study Completion Interview Schedule (Generic)

<table>
<tr><td colspan="2">[Participant's name], Thank you very much for giving up your time to come chat with me today. During the interview I would like to ask you some questions about your experiences over the last eight weeks. Before we begin I would like to let you know that everything you say here today will be kept confidential, which means that it won't be shared with anyone that isn't involved in the project. If we use any sentences from the interview at a later stage, your name will not be shared or any personal information that might identify you. Also, you can stop the interview at any stage or if you decide in the next two weeks that you don't want your information to be used, you can let me know and I will delete your information. Is all of this ok? If it's ok with you, I would like to record our conversation so that I can listen to it afterwards and make sure that I have all the important information and that I have understood you correctly. Is this ok with you?Also, I want to say that it's important to know that there are no right or wrong answers. We want you to share your own experiences and opinions, and that is what we are interested in. If you don't understand anything at any stage or if I don't explain something properly, just let me know and I can go through it again.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">1. So, I just want to start by talking a bit about your food shopping experiences over the last eight weeks; can you tell me how you got on?</td></tr>
<tr><td>Probes</td><td>a) How would you describe your experience? Was it good or bad?
b) Have you seen any changes since the beginning of the study, for example in your shopping or food choices? What were these changes? Are you happy with these changes? Why is this the case?
c) Do you think the mobile app helped with these changes? Why do you think this? What did the mobile app do?
d) Do you think you'll be able to keep these changes going over the next few months? What do you think might help or stop you from keeping these changes going? Why? How do you think an app might help?</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">2. (The following question will discuss specific points from earlier data collection stages)
In your reflective record/during your recent food shop, I noticed that….., can you tell me a bit more about this?</td></tr>
<tr><td>Probes</td><td>a) Why was this the case?
b) What influenced this?</td></tr>
<tr><td colspan="2"></td></tr>
</table>

3. Can you tell me, what does healthy eating mean to you now? What foods do you consider to be healthy now?	
Probes	a) Do you think this has changed since the start of the study? What has changed? Why has this changed, do you think? b) Do you think the app has influenced this? Why? How has it? c) Since the start of the study, do you notice any differences in how you choose healthy food when you're shopping? What are these differences? Why has this happened, do you think? What has helped you? d) Do you use the labels on food when you're choosing foods in the supermarket? Why? Is this different from the beginning? How is it different? Why have you made this change? e) Are you normally happy with the foods you buy during your usual food shop? Do you feel as if you are able to buy healthy foods? What sorts of things are holding you back from buying healthy foods?
4. Now, I just want to talk with you specifically about the mobile app. Can you tell me about your experience of using the mobile app?	
Probes	a. Can you show me the mobile app on your phone, and maybe talk me through how you used it? What parts of it you liked or not? Why was this the case? Would you tell your friends to use it? Why? b. How did it compare to other mobile apps? Why was this the case? c. What, if any, changes could be made to the app to improve your experience? d. Will you continue to use the mobile app? Why?
5. Can you tell me about your experience of taking part in this study?	
Probes	a. How did being part of a study make you feel? Did it make any difference to your behaviour, do you think? What was the difference? Why? b. Why did you get involved in the study at the beginning? Do you think it met these expectations? (if relevant).
6. Is there anything else that you would like to tell me? Is there anything that I have not talked about but you think is important?	

Appendix 7.15: Study Completion Interview Schedule (Tailored)

<table>
<tr><td colspan="2">[Participant's name], Thank you very much for giving up your time to come chat with me today. During the interview I would like to ask you some questions about your experiences over the last eight weeks. Before we begin I would like to let you know that everything you say here today will be kept confidential, which means that it won't be shared with anyone that isn't involved in the project. If we use any sentences from the interview at a later stage, your name will not be shared or any personal information that might identify you. Also, you can stop the interview at any stage or if you decide in the next two weeks that you don't want your information to be used, you can let me know and I will delete your information. Is all of this ok? If it's ok with you, I would like to record our conversation so that I can listen to it afterwards and make sure that I have all the important information and that I have understood you correctly. Is this ok with you? Also, I want to say that it's important to know that there are no right or wrong answers. We want you to share your own experiences and opinions, and that is what we are interested in. If you don't understand anything at any stage or if I don't explain something properly, just let me know and I can go through it again.</td></tr>
<tr><td colspan="2">1. So, I just want to start by talking a bit about your food shopping experiences over the last eight weeks; can you tell me how you got on?</td></tr>
<tr><td>Probes</td><td>a) How would you describe your experience? Was it good or bad? How did it feel?
b) Have you seen any changes in your shopping or food choices? What changes? Are you happy with these changes? Why?
c) Do you think the mobile app helped with these changes? Either planning or in the shop? How/Why?
d) You mentioned eating more fruit & veg and less sweets – tell me more about this? How is the app helping?
e) Have the last few weeks been fairly typical or how has it been different? You said you were away a lot and it was harder to stick to it – can you tell me a bit about this? Was the app useful at all – why?
f) Do you think you'll be able to keep these changes going over the next few months? What do you think might help or stop you from keeping these changes going? Why? How do you think an app might help?</td></tr>
<tr><td colspan="2">2. Specific discussion points</td></tr>
<tr><td>Probes</td><td>a) You mentioned in your reflective record that you had to make variations to the recipes in the app – why? Was this difficult or easy? Did that influence your use of the app or eating healthier?
b) You work shift work so did this have an impact on making a change – why? Does the app fit with this or what could an app do?
c) How does it compare to previous experiences of trying to change your behaviour? Last time you mentioned that you didn't like restricting yourself or counting calories – how did you find this approach? Why? What changes would you make?
d) You said one of the biggest problems was being consistent – did the app help? Why?</td></tr>
<tr><td colspan="2">3. When we last met, we spoke about what healthy eating meant to you and what foods you consider healthy - can you tell me what does healthy eating means to you now? What foods do you consider to be healthy now? Has this changed since the start? Why?</td></tr>
</table>

Probes	a) Do you think the app has influenced this? Why? How has it? b) Since the start of the study, do you notice any differences in how you choose healthy food when you're shopping? What are these differences? Why has this happened, do you think? What has helped you? c) At the beginning, you said that you would look at labels on foods – is this still the case? Has it changed at all (more/less or looking at different things?) How is it different? Why have you made this change? Did the app help? How? d) Are you normally happy with the foods you buy during your usual food shop? Do you feel as if you are able to buy healthy foods? What sorts of things are holding you back from buying healthy foods?
4. Now, I just want to talk with you specifically about the mobile app. Can you tell me about your experience of using the mobile app?	
Probes	a. Can you show me the mobile app on your phone, and maybe talk me through how you used it? What parts of it you liked or not? Why? b. Did your use change over time? Why? c. How did it compare to other mobile apps? Why was this the case? d. What, if any, changes could be made to the app to improve your experience? e. Will you continue to use the mobile app? Why? Would you tell your friends to use it? Why?
5. Can you tell me about your experience of taking part in this study?	
Probes	a. How did being part of a study make you feel? Did it make any difference to your behaviour, do you think? What was the difference? Why? b. Why did you get involved in the study at the beginning? What were you expecting? Do you think it met these expectations? Why?
7. Is there anything else that you would like to tell me?	

Appendix 7.16 Study Completion Questionnaire

Name: _____

Date: _____

Please answer the following questions as best as you can. If you don't want to answer a question, just leave it blank. If you don't understand a question, just let me know.

Section A

1. Thinking of your time at the supermarket today, please rate your hunger on the scale below (1 not hungry at all to 10 extremely hungry)

1 2 3 4 5 6 7 8 9 10

Not Extremely

Hungry Hungry

At All

2. Please indicate for each of the five statements which is closest to how you have been feeling over the *last two weeks*. Notice that higher numbers mean better well-being. Example: If you have felt cheerful and in good spirits more than half of the time during the last two weeks, circle number 3.

Over the last two weeks:	**All of the time**	**Most of the time**	**More than half of the time**	**Less than half of the time**	**Some of the time**	**At no time**
I have felt cheerful and in good spirits.	5	4	3	2	1	0
I have felt calm and relaxed.	5	4	3	2	1	0
I have felt active and vigorous.	5	4	3	2	1	0
I woke up feeling fresh and rested.	5	4	3	2	1	0
My daily life has been filled with things that interest me.	5	4	3	2	1	0

3. Please indicate for each of the three statements which is closest to how you were feeling while in the supermarket today. Notice that higher numbers mean better well-being. Example: If you felt cheerful and in good spirits more than half of the time today, circle number 3.

		All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	Not at all
In the supermarket:	I felt cheerful and in good spirits.	5	4	3	2	1	0
In the supermarket:	I felt calm and relaxed.	5	4	3	2	1	0
In the supermarket:	I felt active and vigorous.	5	4	3	2	1	0
Please indicate for each of the two statements which is closest to how you are feeling today							
Today:	I woke up feeling fresh and rested.	5	4	3	2	1	0
Today:	My daily life is filled with things that interest me.	5	4	3	2	1	0

4. Obesity represents a very serious problem for Irish people.

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
☐	☐	☐	☐	☐

5. How important do you think healthy eating is compared to other lifestyle behaviours, such as physical activity and not smoking?

Very Important	Important	Neither important nor unimportant	Unimportant	Not at all Important
☐	☐	☐	☐	☐

6. Thinking about your own health, please rate how serious a risk you consider each of the following to be for your health on a scale of 1 to 5, where 1 is not at all serious, and 5 is very serious.

	Not at all serious		Neither		Very Serious
Your weight	1	2	3	4	5
Your eating habits	1	2	3	4	5
Your stress level	1	2	3	4	5

7. How easy or difficult would it be to make improvement to the way you eat?

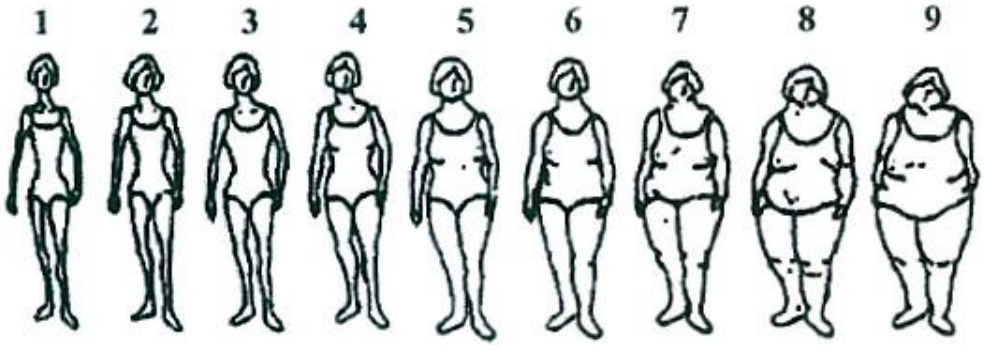
Very easy	Quite easy	Quite difficult	Very difficult	No changes necessary
☐	☐	☐	☐	☐

8. How is your health in general?

Very bad	Bad	Fair	Good	Very good
☐	☐	☐	☐	☐

9. Do you know your height & weight? Will you share this information with us?
   Weight:
   Height:
   I don't know this information/I don't want to share this information

10. From the following contour drawings, please select which body type you feel is closest to your own



11. What is your highest level of education? (Please tick ONE answer only).

Some primary (not complete)		Primary Degree/ Nursing Qualification	
Primary or equivalent		Postgraduate/ Higher Degree	
Intermediate / Junior/ Group Certificate or equivalent		Other _____	
Leaving Certificate or equivalent			
Leaving Certificate Applied			
Apprenticeship/ Trade Certificate/ FAS Training			

12. Which of the descriptions comes closest to how you feel about your household's income nowadays? Please select one answer.

Living very comfortably on present income	☐
Living comfortably in present income	☐
Coping on present income	☐
Finding it difficult on present income	☐
Finding it very difficult on present income	☐
Don't know	☐

13. What is your nationality?

_____

Section B. Please read the text below and answer the questions that follow.

Eating well and staying fit are important to health. Good nutrition allows healthy growth and development for children and teens. A healthy diet may prevent long-term diseases such as heart disease, high blood pressure, type 2 diabetes, some cancers, malnutrition, osteoporosis, and others. It may also increase your chances for a longer life. Good nutrition can also help maintain a healthy weight. When we eat food and drink beverages, we consume calories along with other nutrients. Calories are a vital source of energy for the body, but it is important to take in the right amount. Taking in too few can lead to weight loss, while taking in too many may lead to weight gain.

Some foods are high in calories and low in other nutrients. These foods are considered *energy-dense*. You could eat a few energy dense foods and meet your calorie needs, but not get enough vitamins, minerals, and other important nutrients. A better idea would be to eat a variety of foods that are *nutrient-dense,* or foods that provide many vitamins, minerals, and other needed nutrients, but are low in calories, such as fruits and vegetables. According to the *2016 Irish Department of Health Guidelines,* a healthy diet emphasizes vegetables, salad, fruit, wholemeal and wholegrain cereals, reduced/ low fat dairy products, lean meats, poultry (without skin), fish, beans, eggs, and nuts. A healthy diet is also low in some nutrients, such as saturated fat, *trans* fat, cholesterol, sodium, and added sugars, and low in foods and drinks high in sugar and salt.

1. To lose _____, a person may need to eat fewer calories.
   a. weight
   b. cancer
   c. fruits
   d. fitness

2. Good _____ may prevent chronic diseases like high blood pressure.
   a. eggs
   b. diabetes
   c. nutrition
   d. chicken

3. A person who eats too few nutrients may develop _____.
   a. fat
   b. malnutrition
   c. deafness
   d. vitamins

4. Some nutrients, like _____ should be limited in a healthy diet.
   a. fruits
   b. vegetables
   c. niacin
   d. cholesterol

5. An example of an energy-dense food is _____.
   a. Milk chocolate (260 calories per 50g)
   b. Grilled turkey breast (132 calories per 85g)
   c. Seedless grapes (50 calories per 80g)
   d. Raw carrot (19 calories per 80g)

6. Nutrient-dense foods such as _____ should be consumed more often.
   a. Milk chocolate (260 calories per 50g)
   b. French fries (224 calories per 80g)
   c. Blueberries (52 calories per 80g)
   d. Bagel (227 calories per 86g)

7. The starch in a slice of bread is a type of _____.
   a. fat
   b. vitamin
   c. carbohydrate
   d. protein

8. Foods like oil and butter are often a source of _____.
   a. vitamin C
   b. carbohydrate
   c. iron
   d. fat

9. The _____ found in orange juice is a type of carbohydrate.
   a. sugar
   b. calcium
   c. protein
   d. folate

10. A good source of _____ is found in foods like eggs, chicken and fish.

a. starch

b. protein

c. fibre

d. sugar

11. Butter, lard, and cheddar cheese all provide high amounts of _____ fat.

a. polyunsaturated

b. saturated

c. monounsaturated

d. trans saturated

12. Because they are a good source of _____, vegetarians might eat kidney beans.

a. vitamin D

b. vitamin B-12

c. fat

d. protein

Household Food Measures

Sometimes we eat food in the right amounts and sometimes we choose smaller or larger portions. For each food pictured, choose what you think is the right portion size.



1. Pictured is one pint of milk. Is this:
   a. More than one portion?
   b. Less than one portion?
   c. About right for one portion?



2. Pictured is a 100g beef burger. Is this:
   a. More than one portion
   b. Less than one portion?
   c. About right for one portion?



3. Pictured is approximately one cup of cooked rice on this plate. Is this:
   a. More than one portion?
   b. Less than one portion?
   c. About right for one portion?



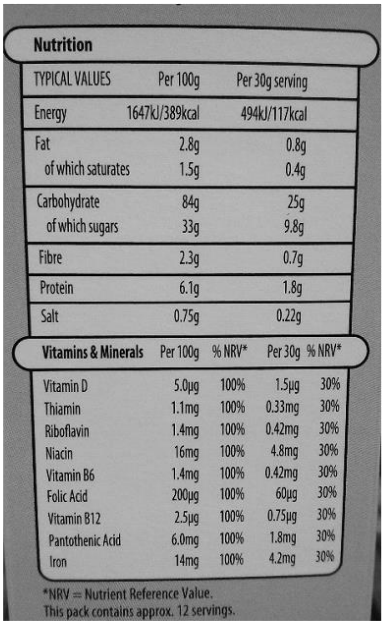
4. Pictured is half a grapefruit. Is this:
    a. More than one portion?
    b. Less than one portion?
    c. About right for one portion?



5. Pictured is 95g spaghetti on the plate at left. Is this:
    a. More than one portion?
    b. Less than one portion?
    c. About right for one portion?



5. Pictured is a 262g sirloin steak. Is this:
    a. More than one portion?
    b. Less than one portion?
    c. About right for one portion?



Nutrition

TYPICAL VALUES	Per 100g	Per 30g serving
Energy	1647kJ/389kcal	494kJ/117kcal
Fat	2.8g	0.8g
of which saturates	1.5g	0.4g
Carbohydrate	84g	25g
of which sugars	33g	9.8g
Fibre	2.3g	0.7g
Protein	6.1g	1.8g
Salt	0.75g	0.22g

Vitamins & Minerals	Per 100g	% NRV*	Per 30g	% NRV*
Vitamin D	5.0µg	100%	1.5µg	30%
Thiamin	1.1mg	100%	0.33mg	30%
Riboflavin	1.4mg	100%	0.42mg	30%
Niacin	16mg	100%	4.8mg	30%
Vitamin B6	1.4mg	100%	0.42mg	30%
Folic Acid	200µg	100%	60µg	30%
Vitamin B12	2.5µg	100%	0.75µg	30%
Pantothenic Acid	6.0mg	100%	1.8mg	30%
Iron	14mg	100%	4.2mg	30%

*NRV = Nutrient Reference Value.
This pack contains approx. 12 servings.

The food label at left is taken from the back of a container of a box of chocolate cereal.

1. How many calories will you consume if you ate 3 servings of this cereal?
    a. 351 calories
    b. 562 calories
    c. 700 calories
    d. 1167 calories

2. One teaspoon of sugar is approximately 4g. If you ate a 60g serving of this cereal, rounded to the nearest teaspoon, how many teaspoons of sugar would you be consuming?
    a. 1 teaspoon of sugar
    b. 5 teaspoons of sugar
    c. 9 teaspoons of sugar
    d. 18 teaspoons of sugar

3. 5 micrograms (µg) of vitamin D every day is recommended for everyone aged 5 to 50 years. How many grams of this cereal would you need to eat to reach the recommended level of vitamin D intake?
    a. 30g
    b. 60g
    c. 80g
    d. 100g

4. How many grams of saturated fat would you consume in one serving of this cereal?
    a. 9.8 grams
    b. 0.8 grams
    c. 2.8 grams
    d. 0.4 grams

5. Which of the following nutrients is not found on this food label?
    a. Vitamin C
    b. Iron
    c. Niacin
    d. Folic Acid

6. The recommended fibre intake per day for an adult is 25g or more. If you are advised to increase your fibre intake, is this food a good choice?
    a. Yes
    b. No

This is a list of foods. Using the chart below, write the name or number of each food in the food group in which it belongs.

1. Apple	2. Cheese	3. Chickpeas	4. Tomato
5. Milk	6. Potato	7. Sweetcorn	8. Banana
9. Noodles	10. Bread	11. Natural yoghurt	12. Rice
13. Orange juice	14. Chicken	15. Beef burger	16. Salad dressing

Grains	Vegetables	Fruits	Meat, Poultry, Fish and Beans	Dairy	Fats & Oils