2021

A Bibliometric Review of Digital Nudging within Digital Food Choice Environments

Jessica Piper
University of Newcastle, jessica.piper@uon.edu.au

Marc T.P. Adam
University of Newcastle, marc.adam@newcaslte.edu.au

Nienke De Vlieger
University of Newcastle, nienke.devlieger@newcastle.edu.au

Clare Collins
University of Newcastle, clare.collins@newcastle.edu.au

Tamara Bucher
University of Newcastle, tamara.bucher@newcastle.edu.au

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Full Research Paper

Jessica Piper
School of Environmental and Life Sciences
The University of Newcastle
Australia
Email: jessica.piper@uon.edu.au

Marc T. P. Adam
School of Information and Physical Sciences
The University of Newcastle
Australia
Email: marc.adam@newcaslte.edu.au

Nienke De Vlieger
School of Environmental and Life Science
The University of Newcastle
Australia
Email: nienke.devlieger@newcastle.edu.au

Clare Collins
School of Health Sciences
The University of Newcastle
Australia
Email: clare.collins@newcastle.edu.au

Tamara Bucher
School of Environmental and Life Sciences
The University of Newcastle
Australia
Email: tamara.bucher@newcastle.edu.au

Abstract

People increasingly make choices about their food intake in digital environments (e.g., online food delivery, online grocery shopping, online school canteens). Given the critical role of diet quality as a key driver for non-communicable disease, it is vital to understand how to design such systems to facilitate healthy food choice through digital nudging. To better understand the impact of digital technologies on food choice, we need to understand the knowledge structure of previous literature. A systematic review of literature identified 83 relevant publications which have been included in this study. Bibliometric analyses were used to map out the knowledge structure, historical roots, and evolution. Reference year spectroscopy, co-word analysis and co-citation analysis were used. Findings show digital nudging is a rapid growing field with strong historical roots in psychology. Additionally, current literature is utilizing psychological theories during the development of digital technologies aimed at nudging consumers towards healthier food options.

Keywords: digital nudging, persuasive technology, user interface design, digital food environment

1 Introduction

Over the past decade there has been an increase in consumers using digital platforms to access food (Li et al. 2020). Digital food environments can be defined as user interfaces (UI) through which individuals interact with the wider food system (Granheim et al. 2020). Websites (e.g., online grocery stores), technology-facilitated delivery services (e.g., UberEats), pre-ordering systems, (e.g., school canteen ordering systems), and ordering services (e.g., ordering screens in major fast-food outlets) allow consumers to order and purchase food (Bates et al. 2020). This shift in food choice environment sees individuals exposed to an increasing number of visual cues through UI during the decision-making process. Design elements of UI's impact upon consumer's choice, thus making UI design a key modifiable factor in how consumers assess each food product and how they select between food items.

Within the digital food choice environment there is no neutral way to present choices, therefore nudging consumers towards certain options. The method of deliberately designing UIs to influence choice in digital environments in a predictable way has been termed 'digital nudging' by Weinmann et al. (2016). Whilst existing literature explores the impact of digital nudging on food choice, there is potential for future studies to investigate the link between food-choice related literatures and information systems (IS) literature on digital nudging. To the best of our knowledge, currently there is no review that provides a bibliometric assessment of digital nudging and food choice literature. Bibliometric analyses allow us to better understand the composition, concepts, influential authors, and interconnections within a research field. This paper sets out to address the following research question:

RQ: How has research into the impact of digital nudging in food choice environments evolved?

Specifically, we use reference publication year spectroscopy (RPYS) to examine the historical roots of digital nudging research (Marx et al. 2014), co-word analysis to outline the evolution of key words (Callon et al. 1983), and co-citation analysis to identify central digital nudging publications (Zupic and Čater 2015). We use the Scopus database to keep in alignment with other bibliometric reviews, (e.g., (Pham et al. 2021). After assessing 83 publications until the end of 2020, we found strong historical roots within the field of psychology, providing frameworks for current quantitative studies based in laboratory and field settings. Findings also show that research on digital nudging for food choice has experienced strong growth in just 5 years, starting with 2 clusters of 7 keywords in 2015 and growing to a complex interconnected network of 7 clusters with 243 keywords in 2020. By using bibliometric analysis to map out the historical roots, evolution and knowledge structure of the digital nudging field, our study enriches previous literature reviews while providing insight into the importance and potential impact of current research.

2 Background

On average, people make over 200 food choices per day with great variance existing between individuals (Wansink and Sobal 2007). Innate bodily processes, such as hunger and satiety have been shown to influence the decisions we make, however external factors, such as the environment in which we make these decisions, often overrules (Stöckli et al. 2016). We live in an obesogenic environment which is detrimental to our overall health status (Lake and Townshend 2006). Increased access to energy dense, nutrient poor foods has contributed to the global obesity crisis, with individuals choosing to consume these foods over health promoting fruits, vegetables, legumes and wholegrains (AIHW 2019). The impact our environment has upon food choices is further highlighted by the current pandemic. During the early stages of the pandemic there was a 300 percent increase in online grocery sales with predicted growth in the future (Redman 2020). As our food environment and choices evolve rapidly into the digital world, there is now a pressing need to evaluate how these technologies are affecting food choice. In the interest of public health, we can evaluate whether modifying key elements in UI design have the potential to 'nudge' consumers towards choosing the healthier options.

The concept of nudging, as defined by Thaler (2009) refers to "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives". Therefore, by making changes to the food choice environment we could potentially nudge individuals into choosing the healthier option by minimizing perceived effort in the decision-making process, making the desired option appear as the easiest option. In the physical food environment, nudging has been found effective. For example, if one choice of food is placed further away, people tended to eat less from that choice (Bucher et al. 2016). Furthermore, it has been found that vegetable intake can be increased by offering more vegetable variety at a buffet (Bucher et al. 2014).

The concept of nudging has also been applied to digital food choice environments. Wienmann et al. (2016), defines digital nudging as the *"use of user-interface design elements to guide people's behavior*

in digital choice environments" (p. 433), with the aim of gently steering individuals towards the more favorable option, the option which is thought to be in the best interest of individuals as well as society. For example, one study in the UK found that customers of an online grocery store can be nudged towards healthier options by manipulating factors such as the order the products appear on the page, the calorie information or the cost (Bunten et al. 2021).

UI design has been shown to influence individuals' decision, either deliberately or accidently. Therefore, it is important to understand the impact digital nudges may have upon consumers food choices within the digital food choice environment. Collating and analyzing related publications from a variety of fields of research allows for the identification of publications existing outside of the most common research field. Further, any historical and emerging trends may be unearthed which can assist in the guidance of future research.

3 Methods

3.1 Index Database

Web of Science (WoS) and Scopus are the main databases used to conduct bibliometric analyses, with Scopus providing greater coverage and identification of citable publications than WoS. For these reasons, the bibliometric analyses used in this review were carried out using Scopus (Baas et al. 2020). To find literature on the topic digital nudging, a general search of "digital nudging" and "food choice" was undertaken. From this initial search 10 publications were read in-depth to assist in identifying keywords for this review. The following terms were identified: *(digital OR online OR on-line OR on-screen OR web-based OR computer-based OR "user interface" OR "UI" OR "user interface design" OR image* OR colour* OR color*)* AND *("persuasive system*" OR "choice architecture" OR nudg* OR "behavioral econom*" OR "behavioural econom*" OR "persuasive technolog*" OR gamification)* AND *(food OR diet OR "food choice" OR fruit* OR vegetable* OR "energy intake")*. To identify relevant publications within the IS field, *"user interface", "UI", "user interface design"* and *gamification* were included.

Our research represents literature published until the end of 2020 to consider full years of research, with searches conducted in WoS and Scopus. Initial searches yielded 408 publications, with 247 and 161 from WoS and Scopus respectively. Ninety-one duplicates were excluded, resulting in 317 publications for title and abstract screening. During title and abstract screening, two authors independently reviewed the records with a consensus approach used to resolve any disagreements, establishing reliability throughout the selection process. Publications were only retained if they were related to digital nudging in food choice, with a focus on digital nudging, theoretical frameworks, food choice environments, food choice behaviors and outcomes. After removing 234 publications, we agreed on 83 publications to be included in the sample. Publications found in WoS were manually searched for in Scopus, with all articles collated in Scopus.

3.2 Bibliometric Analyses

To gain insight into the historical origins of digital nudging research, RPYS analysis as described by Hou (2017) was used. A relationship exists between current research and past research outputs where more frequently cited publications have evolved from the utilization of prior highly cited publications. To perform RYPS analysis we used CRExplorer (http://crexplorer.net), see (Grummeck-Braamt et al., 2021) for a similar approach.

To explore knowledge structure and its development within the digital nudging field co-word analysis was used. Co-word analysis can be used to identify interrelated concepts by examining patterns of co-occurrence of pairs of words or phrases, which may reveal any emerging trends. To identify the most central publications relating to digital nudging, co-citation analysis was used. Co-citation analysis explores similarities between publications, authors, or journals, consequently identifying the most central publications within a research field. To perform co-word and co-citation analysis, we used VOSviewer (http://vosviewer.com), see (Grummeck-Braamt et al., 2021) for a similar approach.

4 Results

4.1 Results of RPYS

A 5-year deviation median curve is shown in Figure 1, representing the evolution of knowledge structure (Hou 2017) within the research field of digital nudging within digital food choice environments.

Eighteen citation peaks can be seen from 1950 to 2020, with the 4 most prominent peaks in 2004, 2009, 2012, and 2015.

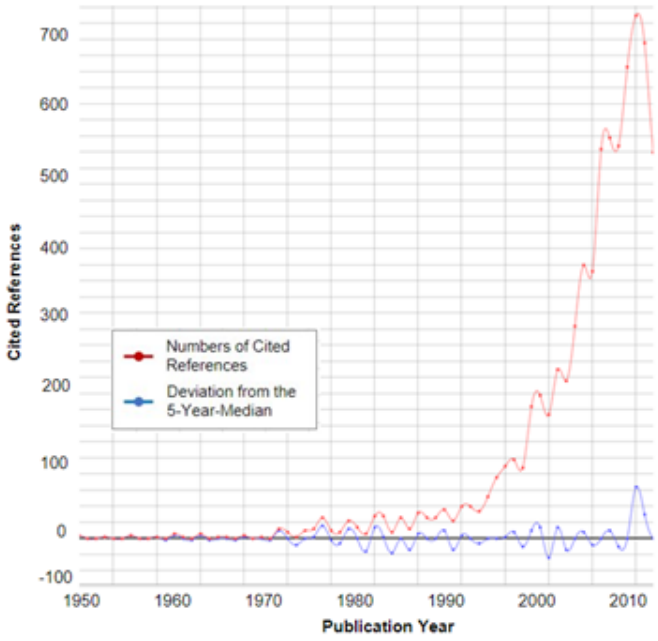

Figure 1. Evolution of Digital Nudging in Digital Food Environments Research

An overview of the top 20 citations unearthed from the 18 citation peaks is outlined in Table 1.

#	(Authors, Year)	Outlet (Area)
1	(Ferster and Skinner 1957)	Appleton-Century-Crofts [PSY]
2	(Stern 1962)	J. of Marketing [MKT]
3	(Waugh and Norman 1965)	Psych. Rev. [PSY]
4	(Restle 1970)	J. of Experimental Psych. [PSY]
5	(Jacobs and Hustmyer 1974)	Perceptual and Motor Skills [HMS]
6	(Kahneman and Tversky 1979)	Econometrica [ECON]
7	(Block 1982)	American J. of Epidemiology [MAT]
8	(Blasko 1985)	Proceed. of the Conf. of the Amer. Acad. of Advert. 1985 [MKT]
9	(Bandura 1986)	Prentice-Hall, Inc
10	(Watson et al. 1988)	J. of Pers. and Soc. Psych. [PSY]
11	(Cialdini et al. 1990)	J. of Pers. and Soc. Psych. [PSY]
12	(Serdula et al. 1993)	Preventive Med. [MHS]
13	(Steptoe et al. 1995)	Appetite [FS]
14	(Bartle 1996)	J. of MUD Research [IS]
15	(Wansink et al. 2001)	Cornell Hotel & Restaurant Admin. Quarterly
16	(Bandura 2004)	Health Edu. Beh. [MHS]
17	(Lin et al. 2006)	Ubi. Comp. 2006 [IS]
18	(Thaler and Sunstein 2009)	Penguin US

19	(Liu et al. 2012)	Appetite [FS]
20	(Demarque et al. 2015)	J. of Enviro. Psych. [PSY]

Table 1. Top 20 Citations from 18 Citation Peaks

Note: Outlets are categorised by subject areas, based on 2018 ABS Journal Guide. PSY psychology, MKT marketing, HMS human movement and sport science, COG cognitive science, ECON economics MAT, mathematical science, MHS medical and health science, IS information systems, FS food science.

Table 1 shows that the field of digital nudging has strong historical roots in the field of psychology with contributions from the fields of marketing, human movement and sport science, economics, mathematics, food science and IS.

4.2 Results of Co-word Analysis

The evolution of knowledge structure over 5 years is shown Figure 2. Three snapshots were created with the first representing a citation peak established during RPYS analysis (2015) and the last portraying the end of the review period (2020). As this is a relatively young area of research the second snapshot was taken 2 years after the first to show the rapid growth within this research field (2017). Each snapshot represents the cumulative digital nudging literature up until that point in time.

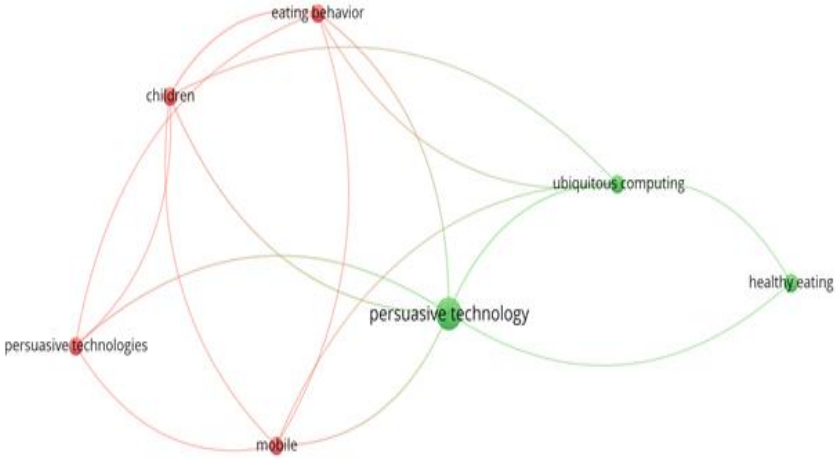

Figure 2. Results of Co-word Analysis: Snapshot 1 (2015)

The keywords shown in Figure 2 are related to dietary behaviors (eating behavior and healthy eating), technologies aimed at behavior change (persuasive technology/technologies and ubiquitous computing) as well as targeted populations (children).

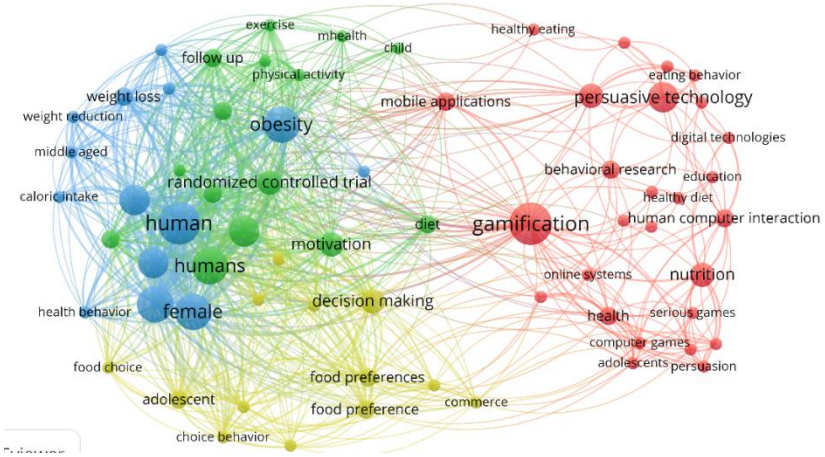

Figure 3. Results of Co-word Analysis: Snapshot 2 (2017)

In 2 years, the field of digital nudging experienced rapid growth. Figure 3 shows an advancements from early research with an increase in dietary behaviors assessed (food preference/s, food choice, weight loss, weight reduction, caloric intake and snacking), technologies utilized to promote behaviour change (gamification, computer games, serious games, personalization, mobile applications, human computer interaction, mHhealth, social networking and online systems) as well as an expansion in targeted populations (adults, middle aged, adolescents, females and males). Further, we start to see emerging research from the field of medical research (eHealth and mHealth).

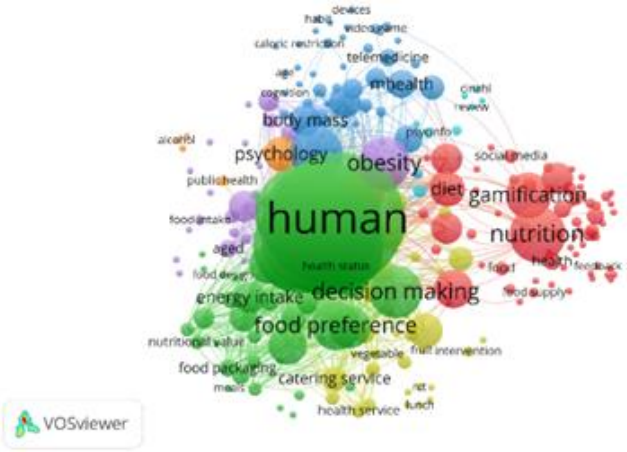

Figure 4. Results of Co-word Analysis: Snapshot 3 (2020)

Compared with 2015, substantial rapid growth can be seen in the number of keywords (7 to 243) and clusters (2 to 7). An increase in keywords outside of the nutrition and psychology fields can be seen, with further contributions from the health and medical fields (public health and telemedicine). We can also see an increase in settings (school, online, menu, restaurants, catering service and internet-based intervention).

Figures 2, 3 and 4 show rapid exponential growth within the digital nudging research field. In 5 years, this field has evolved from 2 connected clusters with 7 keywords (2015), to a network of 4 clusters with 69 keywords (2017) and finally a complex network of 7 clusters with 243 keywords (2020).

Investigations into the most frequently used keywords are shown in Table 2. Significant differences can be seen between 2015 and 2020 including the change from children to adult, the inclusion of controlled study, and the disappearance of persuasive technology, eating behavior and healthy eating in 2020. The shift towards food preference, decision making, and choice behavior is also of interest.

#	**Keywords**		**KTLS**		**Occurrences**	
	2015 (Total 7)	2020 (Total 243)	2015	2020	2015	2020
1	Persuasive Technology	Human	11	912	4	38
2	Children	Article	7	686	2	27
3	Eating Behavior	Controlled Study	7	605	2	22
4	Mobile	Major Clinical Study	6	453	2	17
5	Ubiquitous Computing	Food Preference	6	366	2	14
6	Persuasive Technologies	Decision Making	5	365	2	15
7	Healthy Eating	Adolescents	2	338	2	13
8		Obesity		313		15
9		Choice Behavior		310		11
10		Caloric Intake		274		11

Table 2. Top 7 keywords until 2015 and top 10 keywords until 2020

4.3 Results of Co-citation Analysis

Co-citation analysis, set with a citation threshold of 3 citations, initially yielded a small, interconnected network containing 5 publications. Reducing the citation threshold from 3 citations to 2 citations led to a large increase in publications identified, yielding 42 publications (shown in Figure 5). To quantify the strength of the links between publications, each publication within the network is given a total link strength, enabling identification of the publications with the highest weight within the network. Publications with a high total link strength may have few strong links with few publications or weak links with a larger number of publications.

Figure 5. Results of Co-citation Analysis 2 Citation Threshold

Until the end of 2020, co-citation analysis identified 4 clusters of co-citations with cluster 1 the largest consisting of 16 references. The publication with the highest weight in this cluster is a systematic review and meta-analysis conducted by Long et al., (2015) investigating the impact labelling calories on restaurant menus has on calories ordered (Long et al. 2015). Similarly, other publications within this cluster investigated potential effects of changes to the choice architecture. Interestingly, 3 publications within this cluster are from the field of psychology, highlighting the interdisciplinary nature of digital nudging within the digital food environment.

The 10 most central publications which influenced research into digital nudging within digital food choice environments are shown in Table 3. Publication total link strength (PTLS) was used to determine the most influential publications within this field.

Authors (Year)	PTLS	Outlet (Area)	Methods
(Brunstrom & Shakeshaft, 2009)	28	Appetite [FS]	Computer-based tasks and survey
(Dayan and Bar-Hillel 2011)	22	Judge. & Dec. Mak. [PSY]	Lab and field study, food selection tasks
(Branen et al., 2002)	19	J. of Nutr. Edu. & Beh. [FS]	Lab, food selection task
(Kahn and Wansink 2004)	19	J. of Cons. Research [PSY]	Lab and field study
(Kerameas et al., 2015)	19	Health Psy. [MHS]	Lab, food selection task
(Labbe et al., 2017)	19	Appetite [FS]	Lab
(Marchiori et al., 2012)	19	J. of Nutr. Edu. & Beh. [FS]	Lab, food selection task
(Oldham-Cooper et al., 2017)	19	Appetite [FS]	Computer-based
(Wada et al., 2007)	19	Appetite [FS]	Computer-based
(Wansink and van Ittersum 2003)	19	J. of Cons. Research [PSY]	Lab, drink pouring task

Table 3. Top 10 most central publications that influence digital nudging in the digital food environment research

The PTLS was low as this is a relatively young area of research. The field of food science is heavily represented within these central publications with contributions stemming from the field of psychology and medical and health science. Nine of the 10 most influential publications within the digital nudging field examine the impact of a variety of external factors on food choice, intake, and mass estimation and 1 publication investigates the impact of glass size on volume of drink poured. All publications collected quantitative data, with 6 conducting food/drink selection tasks in-person and 4 using computer-based methods. This confirms digital nudging research is interdisciplinary in nature and built upon intervention studies, in both the digital and in-person food choice environments.

5 Discussion

The digital food environment encompasses a range of UIs for consumers to access the wider food systems. These UI's include online food delivery services (e.g., UberEats), websites (e.g., online grocery stores), pre-ordering systems, (e.g., school canteen ordering systems), and ordering services (e.g., ordering screens in major fast-food outlets). Our bibliometric review shows that research into digital nudging within the digital food environment is a relatively new and rapidly expanding field of study. Contributions from psychology, health, information systems, medical, and food sciences have highlighted the interdisciplinary nature of this research. Central influences from quantitative laboratory, field, and computer-based studies have assisted in the exponential growth of knowledge within this field in recent years. Historically, the field of psychology has had the greatest impact in laying the foundation for current research to build upon.

RYPS analysis revealed strong historical connections between the research field of psychology and digital nudging within the digital food environment. Links to digital nudging can be made as far back as 1957 with Ferster and Skinner, (1957) exploring the evolutionary concept of reinforcement, the idea that a certain behavior can be expected in response to a certain stimulus. Prior to its definition in 2009, publications have been utilizing aspects of nudging based upon psychological theories, such as the Social Cognitive Theory (Bandura 1986), the Primary Model (Waugh and Norman 1965) and the Positive and Negative Affect Schedule (Watson et al. 1988).

Bandura (2004) utilised the Social Cognitive Theory to examine health promotion and disease prevention. The theory postulates that human motivation, wellbeing, and behavior is regulated by self-efficacy beliefs, goals, knowledge, outcome expectations and perceived environmental impediments and facilitators. This theory has provided the foundation for research into nudging in the digital food environment. Prior studies have applied this theory, for example, (Hendy and Raudenbush 2000) carried out a series of experiments testing the effectiveness of teachers' modelling healthy food choice, a construct described by the Social Cognitive Theory, to encourage acceptance of healthy food in children.

The first publication to provide contributions from a field other than psychology was a 1982 review of validations of dietary assessment methods (Block 1982). Further connections from the Food Science field included the development of the food choice questionnaire, which utilised multidisciplinary methods guided by psychologists and nutritionists, and previous literature from multiple fields during the development phase (Steptoe et al. 1995). The earliest link to the field of IS occurred in 1996 with a study investigating the type of individuals who are likely to engage in multi-user dungeons (Bartle 1996).

Research focused on nudging in food choice environments links back to 2001 (Wansink et al. 2001), however, 'nudging' was not formally defined until 2009 (Thaler and Sunstein 2009). Instead of using the term 'nudging' to describe their study, Wansink et al., (2001) used 'influence' and 'halo effect' when examining the effects descriptive labelling has on restaurant sales, consumers taste perception and attitudes towards the restaurant. The term 'nudging' builds upon decades of research into behavioral economics and cognitive biases and describes the process of promoting the preferred option through considered changes to choice, or 'architecture'.

Emerging research shows an increase in the number of nudging interventions used within the digital food choice environment. Recent highly cited research investigated the impact of different nudges on food choice and perception (Demarque et al. 2015; Liu et al. 2012). Changes to labelling (Bollinger et al. 2011; Kiszko et al. 2014; Long et al. 2015; Tandon et al. 2010; Thorndike et al. 2014) and positional changes (Bucher et al. 2016; Dayan and Bar-Hillel 2011; Keller et al. 2015) are the most prominent nudges.

The frequency of co-word occurrences highlights the exponential growth of knowledge the field of digital nudging in digital food choice environments is experiencing. Early research, from 2012 to the end of 2015, emerged from the fields of IS and Health and was focused on improving the eating habits of adults and children through digital technologies. Augmented reality and mobile health interventions delivered by digital public display boards and mobile applications were aimed at improving snack and food choices. One publication from this early research utilised the Behaviour Change Wheel framework to guide the development of a mobile application targeted at parents to encourage healthy eating and childhood weight management (Curtis et al. 2015).

Recent studies have incorporated theories of psychological and behavioral science to aid in the development of digital technologies. Podina et al. (2017) utilized principles of the Cognitive Behaviour Theory to develop a protocol for an intervention with a gamified mobile application component (Podina

et al. 2017). Wen (2107) also developed a gamified application using theories of psychological and behavioral sciences. By using theories within the fields of Psychology and Behavioral Sciences to guide the development of interventions utilizing aspects from the IS field, researchers have been able to create highly targeted interventions aimed at improving eating behaviors.

The present bibliometric review highlights that the knowledge of digital nudging in digital food environments is scattered across different fields of study. Researchers may be unaware and could potentially miss important contributions from other fields. The current knowledge builds upon theoretical foundations in the field of psychology, with historical roots linking the Social Cognitive Theory (Bandura 1986), the Primary Model (Waugh and Norman 1965) and the Positive and Negative Affect Schedule (Watson et al. 1988) to the field of digital nudging in digital food choice environments. The findings of this study provide a useful overview of the most central publications within this research field. Influential publications have mainly stemmed from the food science field with the research field of psychology, and medical and health science also contributing. All central publications collected quantitative data, comprising of experiments to determine the effects of external factors and nudges on food choice, intake, and mass estimation. These findings highlight the interdisciplinary nature of digital nudging in digital food choice environments and how the field is built upon intervention studies, in both the digital and in-person food choice environments.

6 Conclusion

In conclusion, our bibliometric review contributes to the expanding literature on digital nudging by synthesizing literature from a wide range of research fields, allowing identification of publication from other research fields. However, our study is also subject to limitations. First, bibliometric reviews are constrained to an index database, limiting the scope of our review. A further limitation is that content analysis was not conducted on the publications, creating further avenues for future research. Future research should aim to broaden our knowledge of the psychological theories and frameworks underpinning the research field of digital nudging in digital food environments. To achieve this, future studies should explore other databases to capture publications not captured by this review. Further review methods should also be conducted to assess the quality of the existing literature and reveal potential existing contradictions.

7 References

AIHW, A. G. 2019. "Poor Diet." from https://www.aihw.gov.au/reports/food-nutrition/poor-diet/contents/poor-diet-in-adults

Baas, J., Schotten, M., Plume, A., Côté, G., and Karimi, R. 2020. "Scopus as a Curated, High-Quality Bibliometric Data Source for Academic Research in Quantitative Science Studies," *Quantitative Science Studies* (1:1), pp. 377-386.

Bandura. 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

Bandura. 2004. "Health Promotion by Social Cognitive Means," *Health Educ Behav* (31:2), pp. 143-164.

Bartle, R. 1996. "Hearts, Clubs, Diamonds, Spades: Players Who Suit Muds,").

Bates, S., Reeve, B., and Trevena, H. 2020. "A Narrative Review of Online Food Delivery in Australia: Challenges and Opportunities for Public Health Nutrition Policy," *Public Health Nutrition*), pp. 1-11.

Blasko, V. J. 1985. "A Content Analysis of the Creative Characteristics of Outdoor Advertising: National Vs. Regional Differences," *Proceedings of the 1985 Conference of the American Academy of Advertising*: Tempe, AZ, pp. 17-21.

Block, G. 1982. "A Review of Validations of Dietary Assessment Methods," *American Journal of Epidemiology* (115:4), pp. 492-505.

Bollinger, B., Leslie, P., and Sorensen, A. 2011. "Calorie Posting in Chain Restaurants," *American Economic Journal: Economic Policy* (3:1), pp. 91-128.

Bucher, T., Collins, C., Rollo, M. E., McCaffrey, T. A., De Vlieger, N., Van der Bend, D., Truby, H., and Perez-Cueto, F. J. 2016. "Nudging Consumers Towards Healthier Choices: A Systematic Review of Positional Influences on Food Choice," *Br J Nutr* (115:12), pp. 2252-2263.

Bucher, T., Siegrist, M., and Van Der Horst, K. 2014. "Vegetable Variety: An Effective Strategy to Increase Vegetable Choice in Children," *Public Health Nutrition* (17:6), pp. 1232-1236.

Bunten, A., Porter, L., Sanders, J. G., Sallis, A., Payne Riches, S., Van Schaik, P., González-Iraizoz, M., Chadborn, T., and Forwood, S. 2021. "A Randomised Experiment of Health, Cost and Social

Norm Message Frames to Encourage Acceptance of Swaps in a Simulation Online Supermarket," *PLOS ONE* (16:2), p. e0246455.
Callon, M., Courtial, J.-P., Turner, W. A., and Bauin, S. 1983. "From Translations to Problematic Networks: An Introduction to Co-Word Analysis," *Social Science Information* (22:2), pp. 191-235.
Cialdini, R., Reno, R., and Kallgren, C. 1990. "A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places," *Journal of Personality and Social Psychology* (58), pp. 1015-1026.
Curtis, K. E., Lahiri, S., and Brown, K. E. 2015. "Targeting Parents for Childhood Weight Management: Development of a Theory-Driven and User-Centered Healthy Eating App," *JMIR mHealth and uHealth* (3:2).
Dayan, E., and Bar-Hillel, M. 2011. "Nudge to Nobesity Ii: Menu Positions Influence Food Orders," *Judgment and Decision Making* (6), pp. 333-342.
Demarque, C., Charalambides, L., Hilton, D. J., and Waroquier, L. 2015. "Nudging Sustainable Consumption: The Use of Descriptive Norms to Promote a Minority Behavior in a Realistic Online Shopping Environment," *Journal of Environmental Psychology* (43), pp. 166-174.
Ferster, C. B., and Skinner, B. F. 1957. *Schedules of Reinforcement*. East Norwalk, CT, US: Appleton-Century-Crofts.
Granheim, S. I., Opheim, E., Terragni, L., Torheim, L. E., and Thurston, M. 2020. "Mapping the Digital Food Environment: A Scoping Review Protocol," *BMJ Open* (10:4), p. e036241.
Hendy, H. M., and Raudenbush, B. 2000. "Effectiveness of Teacher Modeling to Encourage Food Acceptance in Preschool Children," *Appetite* (34:1), pp. 61-76.
Hou, J. 2017. "Exploration into the Evolution and Historical Roots of Citation Analysis by Referenced Publication Year Spectroscopy," *Scientometrics* (110:3), pp. 1437-1452.
Jacobs, K. W., and Hustmyer, F. E., Jr. 1974. "Effects of Four Psychological Primary Colors on Gsr, Heart Rate and Respiration Rate," *Percept Mot Skills* (38:3), pp. 763-766.
Kahn, B. E., and Wansink, B. 2004. "The Influence of Assortment Structure on Perceived Variety and Consumption Quantities," *Journal of Consumer Research* (30:4), pp. 519-533.
Kahneman, D., and Tversky, A. 1979. "Prospect Theory: An Analysis of Decision under Risk," *Econometrica* (47:2), pp. 263-291.
Keller, C., Markert, F., and Bucher, T. 2015. "Nudging Product Choices: The Effect of Position Change on Snack Bar Choice," *Food Quality and Preference* (41), pp. 41-43.
Kiszko, K. M., Martinez, O. D., Abrams, C., and Elbel, B. 2014. "The Influence of Calorie Labeling on Food Orders and Consumption: A Review of the Literature," *Journal of Community Health* (39:6), pp. 1248-1269.
Lake, A., and Townshend, T. 2006. "Obesogenic Environments: Exploring the Built and Food Environments," *Journal of the Royal Society for the Promotion of Health* (126:6), pp. 262-267.
Li, C., Mirosa, M., and Bremer, P. 2020. "Review of Online Food Delivery Platforms and Their Impacts on Sustainability," *Sustainability* (12:14), p. 5528.
Lin, J. J., Mamykina, L., Lindtner, S., Delajoux, G., and Strub, H. B. 2006. "Fish'n'steps: Encouraging Physical Activity with an Interactive Computer Game," Berlin, Heidelberg: Springer Berlin Heidelberg, pp. 261-278.
Liu, P. J., Roberto, C. A., Liu, L. J., and Brownell, K. D. 2012. "A Test of Different Menu Labeling Presentations," *Appetite* (59:3), pp. 770-777.
Long, M. W., Tobias, D. K., Cradock, A. L., Batchelder, H., and Gortmaker, S. L. 2015. "Systematic Review and Meta-Analysis of the Impact of Restaurant Menu Calorie Labeling," *Am J Public Health* (105:5), pp. e11-24.
Marx, W., Bornmann, L., Barth, A., and Leydesdorff, L. 2014. "Detecting the Historical Roots of Research Fields by Reference Publication Year Spectroscopy (Rpys)," *Journal of the Association for Information Science and Technology* (65:4), pp. 751-764.
Pham, H.-H., Dong, T.-K.-T., Vuong, Q.-H., Luong, D.-H., Nguyen, T.-T., Dinh, V.-H., and Ho, M.-T. 2021. "A Bibliometric Review of Research on International Student Mobilities in Asia with Scopus Dataset between 1984 and 2019," *Scientometrics* (126:6), pp. 5201-5224.
Podina, I. R., Fodor, L. A., Cosmoiu, A., and Boian, R. 2017. "An Evidence-Based Gamified Mhealth Intervention for Overweight Young Adults with Maladaptive Eating Habits: Study Protocol for a Randomized Controlled Trial," *Trials* (18:1).
Redman, R. 2020. "Online Grocery Sales Jumped 300% Early in Pandemic." from https://www.supermarketnews.com/issues-trends/fmi-online-grocery-sales-jumped-300-early-pandemic

Restle, F. 1970. "Speed of Adding and Comparing Numbers," *Journal of Experimental Psychology* (83:2, Pt.1), pp. 274-278.
Serdula, M. K., Ivery, D., Coates, R. J., Freedman, D. S., Williamson, D. F., and Byers, T. 1993. "Do Obese Children Become Obese Adults? A Review of the Literature," *Preventive Medicine* (22:2), pp. 167-177.
Steptoe, A., Pollard, T. M., and Wardle, J. 1995. "Development of a Measure of the Motives Underlying the Selection of Food: The Food Choice Questionnaire," *Appetite* (25:3), pp. 267-284.
Stern, H. 1962. "The Significance of Impulse Buying Today," *Journal of Marketing* (26:2), pp. 59-62.
Stöckli, S., Stämpfli, A. E., Messner, C., and Brunner, T. A. 2016. "An (Un)Healthy Poster: When Environmental Cues Affect Consumers' Food Choices at Vending Machines," *Appetite* (96), pp. 368-374.
Tandon, P. S., Wright, J., Zhou, C., Rogers, C. B., and Christakis, D. A. 2010. "Nutrition Menu Labeling May Lead to Lower-Calorie Restaurant Meal Choices for Children," *Pediatrics* (125:2), pp. 244-248.
Thaler, R., and Sunstein, C. 2009. *Nudge: Improving Decisions About Health, Wealth, and Happiness*.
Thorndike, A. N., Riis, J., Sonnenberg, L. M., and Levy, D. E. 2014. "Traffic-Light Labels and Choice Architecture: Promoting Healthy Food Choices," *American Journal of Preventive Medicine* (46:2), pp. 143-149.
Wansink, B., Painter, J., and van Ittersum, K. 2001. "Descriptive Menu Labels' Effect on Sales," *The Cornell Hotel and Restaurant Administration Quarterly* (42:6), pp. 68-72.
Wansink, B., and Sobal, J. 2007. "Mindless Eating," *Environment and Behavior* (39:1), pp. 106-123.
Wansink, B., and van Ittersum, K. 2003. "Bottoms Up! The Influence of Elongation on Pouring and Consumption Volume," *Journal of Consumer Research* (30:3), pp. 455-463.
Watson, D., Clark, L. A., and Tellegen, A. 1988. "Development and Validation of Brief Measures of Positive and Negative Affect: The Panas Scales," *J Pers Soc Psychol* (54:6), pp. 1063-1070.
Waugh, N. C., and Norman, D. A. 1965. "Primary Memory," *Psychological Review* (72:2), pp. 89-104.
Zupic, I., and Čater, T. 2015. "Bibliometric Methods in Management and Organization," *Organizational Research Methods* (18:3), pp. 429-472.

Acknowledgements

This research was supported by an Australian Research Council Discovery Project grant (DP210100285).