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Title: 'Online Omnivores' or 'Willing but Struggling'? Identifying online grocery shopping behavior segments using attitude theory

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Conflicts of interest
The authors declare that they have no conflicts of interest.

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Title: 'Online Omnivores' or 'Willing but Struggling'? Identifying online grocery shopping behavior segments using attitude theory

Abstract: The landscape of grocery shopping is changing fast. Online retailing via home delivery or 'click and collect', convenience stores and various hybrid shopping channels are gaining popularity with some consumers, but not with others. The central premise of this paper is that focusing on the 'average grocery shopper' is not very helpful if the objective is to understand recent and future changes in grocery shopping. There are few recent studies that have identified groups of individuals using online and multi-channel shopping by considering both observable behavior and associated attitudes – feelings, beliefs, opinions and behavioral dispositions – and by drawing explicitly on attitude theories from social psychology. The current paper thus aims to identify and describe groups of grocery shoppers using a psychographic segmentation approach that is explicitly grounded in the Theory of Planned Behavior (TPB) (Ajzen, 1991) and its close cousin, the Technology Acceptance Model (TAM) (Davis et al., 1989). Primary data were collected through a self-completion questionnaire that produced a largely representative study sample of 2,032 grocery shoppers across the United Kingdom, Europe's largest market for online grocery shopping. A principal component and two stage cluster analysis methodology was implemented to identify five well-defined and highly interpretable segments according to their attitudes, norms, perceptions and beliefs, then profiled by their socio-economic and grocery shopping characteristics. The segments reveal a range of different grocery shopping preference levels, from those 'super-shoppers' (Flynn and Goldsmith, 2016) who are clearly attracted to the online experience and want more ('Intensive Urbanites', 'Online Omnivores') to those who appear resistant and socially responsible towards the adoption of online shopping services ('Resisting and Responsible'). The key distinguishing features of these segments suggest that shoppers might be attracted to or repelled from online shopping for reasons of convenience, perceived benefits, costs and risks, technology affect, time pressures and fit into daily schedules (perceived behavioral control), as well as social and environmental dimensions of personal norms and beliefs.

Keywords: Consumer segmentation; Psychographic segmentation; Attitude theory; Technology acceptance framework; Grocery shopping

1 INTRODUCTION

The landscape of grocery shopping is changing fast. Having been around for several decades, online grocery shopping is now increasing significantly around the world (Nakano and Kondo, 2018). In the UK, for example, 41% of shoppers bought groceries online in 2017 (IGD, 2017) and this share is expected to grow further by more than 50% between 2017 and 2022, fueled by new developments such as fast deliveries (within hours, not days), more unattended delivery options and the emergence of voice ordering (IGD, 2018). Nonetheless, online shoppers tend to engage in multi-channel shopping, typically combining online and larger stores, and online and convenience[1] stores (Ganesh et al., 2010; Lee et al., 2017). Half of UK shoppers use five or more different channels every month and buy from twelve different store brands on average (IGD, 2018). One reason for the popularity of multi-channel grocery shopping is the rise to prominence of hard discount stores. Recent trends show that online shopping and discount stores were responsible for 80% of growth in the UK grocery market between 2012 and 2016 (Gladding, 2016).

The central premise of this paper is that focusing on the 'average grocery shopper' is not very helpful if the objective is to understand recent and future changes in grocery shopping. This claim is supported by a suite of recent studies demonstrating that online retailing via home delivery or click and collect, convenience stores and various hybrid shopping channels are gaining popularity with some consumers, whereas many other consumers are reluctant to accept change and try new services and technologies (Asger Nielsen and Ramus, 2005; Chu et al., 2010; Hand et al., 2009; Harris et al., 2017a; Harris et al., 2017b). Behavioral differences such as these suggest that market segmentation techniques may provide useful insights into how different groups of people make different shopping choices. Market segmentation has been applied productively in past research on shopping behavior (e.g. Chetthamrongchai and Davies, 2000; Konuş et al., 2008; Müller and Hamm, 2014; Nakano and Kondo, 2018; Putrevu and Lord, 2001; Sands et al., 2016). Nonetheless, there are few recent studies that have identified groups of individuals using online and multi-channel shopping by considering both observable behavior and associated attitudes – feelings, beliefs, opinions and behavioral dispositions – and by drawing explicitly on attitude theories from social psychology.

The current paper thus aims to identify and describe groups of grocery shoppers using a psychographic segmentation approach that is explicitly grounded in the Theory of Planned Behavior (TPB) (Ajzen, 1991) and its close cousin, the Technology Acceptance Model (TAM) (Davis et al., 1989). Both theories are extensions of the Theory of Reasoned Action (Fishbein and Ajzen, 1975) and have been used across many research fields to examine why particular behaviors are undertaken and technological innovations adopted. Although criticized on multiple grounds, they remain very popular and highly regarded in numerous research fields, which is why they were selected as theoretical points of departure for the current study. Below they are used to derive a meaningful consumer segmentation (or typology) by using factor and hierarchical cluster analysis on primary survey data from a study sample of 2,032 UK grocery shoppers. The segments are then profiled in terms of observed shopping preferences and demographic, socio-economic and geographical characteristics.

[1] Convenience stores: in the UK these are small to medium size stores with a sales area of less than 3,000 sq.ft, which are open for long hours (incl. Sundays) and sell products from at least seven grocery categories. Typical stores include *Tesco Express, Sainsbury's Local* and *The Co-operative Food.*

This approach, we propose, deepens understanding of consumer heterogeneity in a fast evolving grocery retailing landscape by clarifying how, for different groups of grocery shoppers, attitudes regarding how, when and where to conduct grocery shopping are associated with observable choices regarding channel (online, offline, or combinations of both as with click and collect) and type of outlet and location for offline shopping (e.g. large, out-of-town supermarket or convenience store nearby). Understanding those associations for different groups is useful in at least three respects. Firstly, it can inform the development of marketing strategies, for instance to encourage more online shopping that are tailored to the feelings, beliefs, opinions and behavioral dispositions of specific consumer segments. Secondly, it can advance understanding of which kinds of grocery retailing might be affected when, where and to what extent by further uptake of grocery shopping. Such understanding is pertinent for multiple reasons, including the perspective of including social equity (Badrinarayanan and Becerra, 2018). If, for instance, further growth of online shopping means that physical stores will disappear in certain locations, then individuals and social groups who rely on those stores because they lack access to online shopping or appropriate means of transport may be disproportionally disadvantaged. Finally, knowledge of the associations between grocery shopping behavior and attitudes for different consumer segments can inform research that examines what delivery traffic will be required when and where, with due consequences for road congestion and, depending on vehicle propulsion technology, local air pollution and greenhouse gas emissions (McKinnon et al., 2010).

The paper progresses by first reflecting on the theoretical basis of the study and briefly reviewing the relevant literature. Section 3 outlines the data collection and analysis methods. The results of the segmentation analysis are presented and discussed in Sections 4 and 5. The paper concludes with a number of implications for research and practice.

2 UNDERSTANDING GROCERY SHOPPING

2.1 Theoretical underpinnings

A wide range of theoretical approaches can be, and has been, used to understand variations in grocery shopping between and within individuals. Among the most basic are studies that rely on the *ad hoc* specification of relationships between one or more facets (product, channel, time/frequency, etc.) of grocery shopping and characteristics of the choice alternatives or shoppers in question. In this context *ad hoc* means based on previous research, intuition and/or inductive reasoning. This approach is often implemented under a random utility maximization framework but not necessarily; it can yield pertinent results (e.g., Lee et al., 2017; Suel and Polak, 2017) but choices about which variables to include in model specifications remain arbitrary and the risk of omitted variable bias is significant. Theoretically more advanced are specifications that are grounded explicitly in micro-economic theory (e.g., Bawa and Ghosh, 1999; Doti and Sharir, 1981; Marshall and Pires, 2017). Nonetheless, studies adopting this kind of approach treat the decision making processes that result in certain behavior outcomes as a black box, and ultimately rely on correlations between input factors (e.g. price levels) and behavioral output variables. Studies of this kind also tend to privilege instrumental considerations linked to efficiency, cost and convenience over other, more-than-rational factors that pertain, for instance, to symbolism, identity formation and value systems.

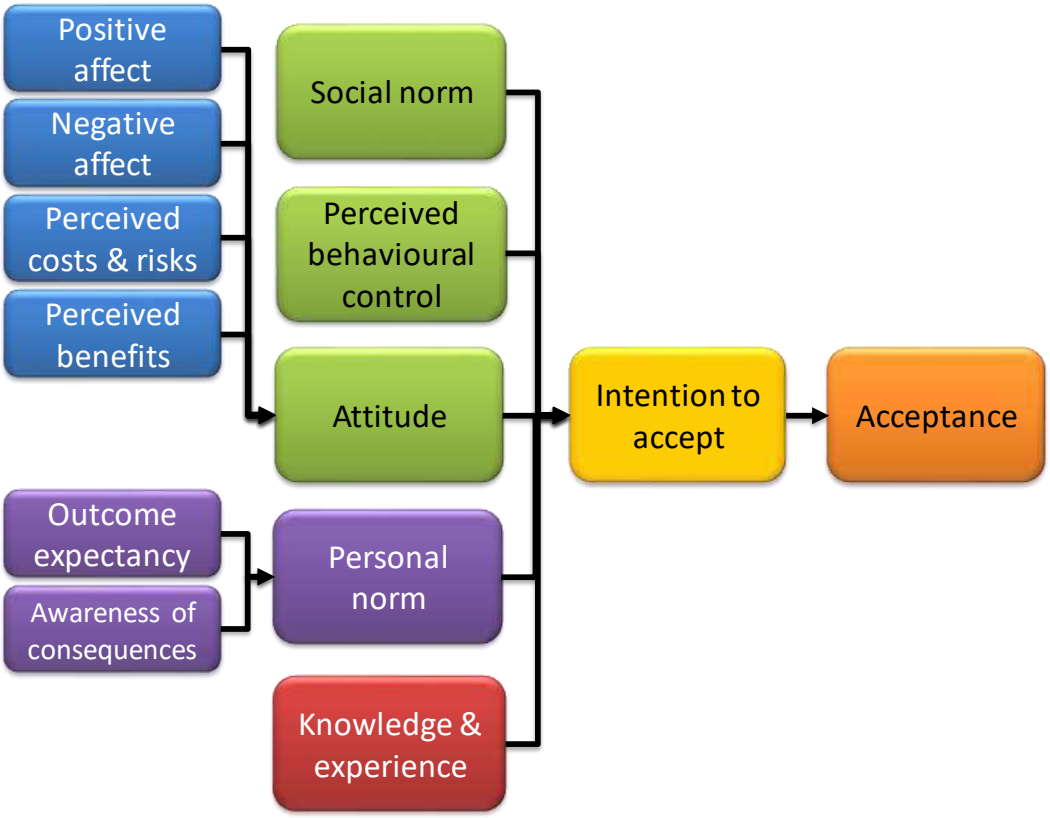
A wide body of research on grocery shopping has sought to open up the decision making processes that produce certain behavioral outcomes. Some of this work is informed by thinking in sociology and social theory (e.g. Elms et al., 2016; Everts and Jackson, 2009; Jackson et al., 2006) but most relies in one way or another on developments in the psychological sciences. Some researchers have drawn on insights on decision rules and heuristics (e.g. Timmermans, 1983) whereas others have built on developments in behavioral economics (e.g. Mortimer and Weeks, 2019). A common approach is to turn to generic theoretical models that seek to represent the often unobservable factors and processes that trigger specific behavior outcomes. Many such models are available, including the Theory of Interpersonal Behavior (Triandis, 1977), the Norm Activation Model (NAM) (Schwartz, 1977) and the Theory of Planned Behavior (TPB) (Ajzen, 1991), and outside the study of grocery shopping these have been brought together and integrated in a variety of ways (Klöckner, 2014).

It appears that the TPB, which is an extension of the Theory of Research Action (TRA) (Fishbein and Ajzen, 1975), is the most widely used of those models. It has been criticized extensively, for instance for disregarding habituation and learning (but see Klöckner, 2014), but remains popular, not least because of its effectiveness and parsimony. Time and again empirical research confirms its hypotheses that a) behavior is preceded by behavioral intention; b) the latter is dependent on attitude, social norm and perceived behavioral control; and c) each of these is dependent on behavioral, normative and control beliefs.[2]

One of the most significant developments of the TRA/TPB is the Technology Acceptance Model (TAM) (Davis et al., 1989). This posits, in its original formulation, that behavioral intention is a function of attitude towards the behavior in question, which in turn is dependent on perceived usefulness and perceived ease of use, a concept that is closely aligned with the TPB's perceived behavioral control. The original TAM model has been extended in multiple ways over time, including by Huijts et al. (2012) who have added the TRA/TPB element of social norm and TAM element of personal norm (Figure 1).

[2] It should be noted that c) is confirmed much more infrequently than b) and a).

Figure 1: Graphic representation of the conceptual framework



Source: Adapted from Huijts et al. (2012: Fig. 6).

This model has played a decisive role in the development of the survey on which the current study is based (see Section 3.1) for two main reasons. One is that it builds on the TPB, which combines confirmation in many empirical studies with parsimony in structure and design. The other is that it extends the TPB by adding the elements of personal norm, which is influenced by awareness of adverse consequences (e.g. effect on the local economy) and outcome expectancy. It also adds relevant antecedents of attitudes in the elements of perceived costs, risks and benefits, positive and negative feelings in response to the service offering, as well as trust (i.e. trust in actors who are responsible for the service such as retailers or market regulators) and procedural fairness (i.e. the perceived fairness of the decision process that led to implementation of a service). Due to its robust characteristics, TAM has been one of the most commonly employed model to explain an individual's acceptance of a particular information system (Lee et al., 2003). At the same time, we are cautious not to (over)interpret elements such as attitude or perceived behavioral control as determinants of behavior (indirectly via behavioral intention). The model as shown in Figure 1 remains static and does not take account of the fact that grocery shopping is a repetitive behavior in which people learn form, and adapt to, previous experiences and often do so in complex ways. Old and recent studies in transportation research (Golob, 2001; Golob et al., 1977; Kroesen et al., 2017; van Wee et al., 2019) confirm that attitudinal variables may be just as strongly, if not more so, be shaped by observed behavior as the reverse, so it is best to understand attitudes as correlates of behavior that both reinforce and are reinforced by behavioral choices. This still implies that measuring attitudes is capable of advancing our understanding of interpersonal

behavioral differentiations, which is why attitudes feature prominently in the measurement and analytical approach outlined below.

2.2 Review of the relevant literature

We briefly describe and assess previous consumer segmentation studies that addressed attitudinal (and other individual) characteristics as well as segmentation of consumers. These were identified by searching review articles and research papers for various combinations of the terms 'psychographic segmentation', 'online grocery shopping' and 'grocery shopper typology' (via *Scopus* and *ScienceDirect*, augmented by a selection of journals that are known to publish in this area, e.g. *Environment and Planning A*). The criteria for inclusion/exclusion were: direct relevance to the aims of the study; use of attitudes to derive consumer segments or typologies; investigation of online grocery shopping (with and without competition with physical store shopping); and use of primary, empirical data to test theoretical concepts. Table 1 lists the relevant studies and highlights their main methods, data sources and conclusions.

Table 1: Summary of the consumer segmentation literature, ordered by date of publication

Study	Methods and data	Conclusion
Chetthamrongchai and Davies (2000)	Time allocation theory Cluster analysis of attitudinal statements Food shopping	4 segments Factors: 5 time attitudes and 5 shopping attitudes
Rohm and Swaminathan (2004)	Typology based upon online shopping motivations Exploratory factor analysis, cluster analysis Online grocery shopping	4 shopping types 4 factors: overall convenience, physical store orientation, information use in planning & shopping task, variety seeking
Konuş et al. (2008)	Multiple channels and products (not groceries) Psychographic, sociodemographic factors Latent-Class Analysis	3 consumer segments Main factors: shopping enjoyment, loyalty, innovativeness
Hansen (2008)	Hierarchical value-attitude-behavior approach, Theory of Planned Behavior Scale development Exploratory and confirmatory factor analysis	Consumers may link personal values to attitude towards online grocery buying, moderated by previous use (any online purchase or online grocery purchase)
Mokhtarian et al. (2009)	General shopping and travel-related attitudes Books/CDs/DVDs ('search' goods) and clothing/shoes ('experience' goods) only Factor and cluster analysis, psychographic segmentation	7 consumer segments Main factors: shopping enjoyment, store enjoyment, price consciousness, time consciousness, impulse buying, materialism, trust, caution, pro-credit card, trendsetting, pro-technology, pro-exercise, pro-environment
Ganesh et al. (2010)	Online shopper typologies based on (a) online shopping	5 segments: Interactive, Destination, Apathetic, E-window shopper, Basic,

	motivation and (b) importance of e-store attributes, Big Middle Theory Factor and cluster analysis	Bargain seekers, Shopping enthusiasts Factors: role enactment, convenience, avant-gardism, affiliation, personalized services, stimulation, offline presence, product variety, online attractiveness, price orientation, e-store essentials
Wang et al. (2014)	Perceived channel values at different shopping stages, online versus offline *No groceries* Latent-Class Analysis	2 consumer segments Main factors: shopping channel attributes and consumers' intrinsic channel preferences, innovativeness
Williams et al. (2015)	Market research: service suppliers and major purchases Factor and cluster analysis	5 segments Factors: income, age, self-efficacy, lack of interest, confidence, decisiveness, willingness to invest time, negotiate best deal
Atkins et al. (2016)	'Smart' grocery shoppers Factor and cluster analysis	3 segments Factors: information search, planning for purchase, saving effort, getting the right product, saving money, saving time
Harris et al. (2017a)	Cluster analysis Perceived advantages and disadvantages of online and in-store grocery shopping	Various shopper typologies Factors: individual characteristics, perceptions and channel patronage preferences
This study	*Factor and cluster analysis on attitudinal statements* *Technology acceptance framework* *Grocery shopping*	*5 segments* *Main factors underlying the segmentation: perceived online benefits, perceived online costs/risks, innovativeness (personal norm), social norm, time pressures (perceived behavioral control), environmental, social & efficiency dimensions of personal norm*

2.2.1 Choice of analytical frameworks and methods

The studies included in this review either lacked any specific theoretical underpinning or used a range of theories including motivation theory, time allocation theory and the TPB. Most of the studies deployed some combination of factor and/or cluster analysis to segment the market for grocery shoppers. For instance, in an early segmentation of the market for food shoppers, Chetthamrongchai and Davies (2000) explored the potential for time allocation theory to provide the necessary theoretical underpinning and used cluster analysis (without prior factor analysis) of attitudes to shopping and to time to define four segments. In contrast, Hansen (2008) used exploratory and confirmatory factor analysis (without clustering) within a TPB framework to show that consumers may link personal values to attitude towards online grocery buying. Rohm and Swaminathan (2004) developed a typology based upon motivations for shopping online (loosely based on motivation theory) and used a combination of factor and cluster analysis to generate a four cluster solution of grocery shopping types:

'convenience shoppers'; 'variety seekers'; 'balanced buyers'; and 'store-oriented shoppers'. Focusing more generally on online shopping motivation and the importance of e-store attributes, Ganesh et al. (2010) used (exploratory and confirmatory) factor and cluster analysis to identify seven online shopper typologies; five of which were consistent with traditional shoppers: *apathetic shoppers, shopping enthusiasts, destination shoppers, basic shoppers,* and *bargain seekers* – and two additional online segments: *interactive shoppers* and *e-window shoppers*. Furthermore, Mokhtarian et al. (2009) used factor and cluster analysis on 42 attitudinal statements to reveal seven market segments with different attitudinal profiles: *store shopaholics*, *bichannel shopaholics*, *time-starved worriers*, *nonmaterialistic greens*, *unwired antishoppers*, *practical and leisure-oriented*, and *technoconservatives*. The study created segments based on psychological factors then profiled the segments using shopping behavior and sociodemographic variables – similar to the approach used in our study but for general shopping activities. Furthermore, Williams et al. (2015) used factor and cluster analysis to segment consumers of services and general purchases into five groups based on consumer attitudes, motivations and purchasing behaviors in two consumer markets: *constrained strugglers*, *consciously unengaged*, *worried indecisives*, *traditional valueseekers* and *leading edgers*. Based on 'smart' shopping activities Atkins et al. (2016) used factor and cluster analysis to identify three grocery shopper segments labelled *spontaneous*, *apathetic* and *involved smart shoppers*. Harris et al. (2017a) used cluster analysis (without prior factor analysis) to develop shopper typologies based on perceived advantages and disadvantages of online and in-store grocery shopping.

In contrast to the above cluster analyses, Konuş et al. (2008) used latent class analysis of psychographic and sociodemographic factors to segment consumers on the basis of their attitudes toward multiple channels as search and purchase alternatives and identified three segments: *multichannel enthusiasts, uninvolved shoppers*, and *store-focused consumers*. Similarly, Wang et al. (2014) used latent class multinomial logit modelling to identify two consumer segments comprising innovative consumers and conventional consumers in terms of their online versus offline channel usage.

2.2.2 Choice of discriminating factors

The most frequently and strongly observed discriminating factors were: shopping convenience (Atkins et al., 2016; Ganesh et al., 2010; Rohm and Swaminathan, 2004) (Harris et al., 2017a); time consciousness and pressures (Atkins et al., 2016; Harris et al., 2017a; Mokhtarian et al., 2009; Williams et al., 2015); price consciousness (Atkins et al., 2016; Ganesh et al., 2010; Mokhtarian et al., 2009); innovativeness (Konuş et al., 2008; Wang et al., 2014); shopping enjoyment (Konuş et al., 2008; Mokhtarian et al., 2009; Williams et al., 2015); use of information (Atkins et al., 2016; Rohm and Swaminathan, 2004; Williams et al., 2015); and variety seeking (Atkins et al., 2016; Ganesh et al., 2010; Rohm and Swaminathan, 2004).

Other factors that were less frequently observed were physical store orientation (Rohm and Swaminathan, 2004), store enjoyment (Mokhtarian et al., 2009), store loyalty (Konuş et al., 2008), impulse buying (Mokhtarian et al., 2009), self-efficacy and confidence (Williams et al., 2015). While salient to the online context some motives and psychological variables such as those relating to personal traits, trust and social norms emerged as moderately important factors in those studies that included them in their framework. For instance, Mokhtarian et al. (2009) showed the importance of materialism, trust, caution, pro-credit card,

trendsetting, pro-technology, pro-exercise and pro-environment attitudes in discriminating between shopping segments. Similarly, Ganesh et al. (2010) showed that motivations such as role enactment and avant-gardism can play a role.

In sum, the studies included in this review produced between two and seven shopper segments or typologies, mainly due to differences in analytical frameworks, methods and discriminating factors. Most lacked any specific theoretical underpinning. While the literature on the growing online grocery market is expanding year-on-year, the literature on psychographic segmentation of the online market is somewhat limited. Our work extends and deepens understanding of consumer heterogeneity in a fast evolving grocery retailing landscape by clarifying how, for different groups of grocery shoppers, attitudes and perceptions regarding how, when and where to conduct grocery shopping are associated with observable choices regarding channel and type of outlet and location for offline shopping.

3 METHODS AND DATA

3.1 Data collection

3.1.1 Survey design

The primary data collection instrument was a newly developed self-completion survey questionnaire employed online across the United Kingdom of Great Britain and Northern Ireland (UK). The survey consisted of multiple parts, including sections on people's current grocery shopping behavior (who, what product types, which shopping channel, when, how often and by which mode of transport); their attitudes, norms and perceptions about shopping as well as broader social and environmental values; and their demographic, socio-economic and geographical profile. The five product types were: (1) Bread, milk and dairy products; (2) Fresh food (fruit, veg, fish and meat); (3) Heavy and bulky groceries (e.g. tinned fruit and veg, soft drinks, beer and wine, household cleaning and washing powder, toilet paper); (4) Frozen food and ready meals; and (5) Toiletries, health and beauty products. The four shopping channels were: (1) Online (home delivery or 'click and collect' at a store or a locker); (2) Convenience store; (3) Supermarket, hypermarket or discount supermarket; (4) and 'Other retailer', e.g. bakery, butcher, greengrocer.

The demographic variables included gender, age, ethnicity, number of family members, presence of children in the household, highest educational qualification, household income and car accessibility. The geographical variables included household location and urban/rural classification based on the postcode of the household's residential location.

In operationalizing the constructs from the theoretical model in Figure 1 we faced two challenges. First, there are no standard measurement items available to operationalize the various constructs and capture what can reasonably be expected to be the most important aspects of concepts such as personal norm or perceived benefits in the context of grocery shopping using different retail channels. We therefore relied on a wider field of research to select a set of relevant measurement items (Anable, 2005; Çelik, 2011; Chi, 2018; Ha and Stoel, 2009; Higham et al., 2013; Huijts et al., 2012; Morton et al., 2016). Second, measurement of multiple constructs for different shopping channels (e.g. home delivery, supermarket, convenience store) risks overburdening survey respondents, especially when a survey seeks to capture more than people's attitudes, norms and perceptions about shopping. Measurement items were instead focused on online grocery shopping and grocery shopping in general. To reduce respondent burden further we limited the total number of items to 30. This

number is somewhat arbitrary but prior experience with similar surveys (Morton et al., 2017) suggests that respondents are not so overburdened that measurement reliability becomes a concern. We decided not to operationalize the attitude and personal norms constructs explicitly, instead concentrating on the measurement of constructs that, according to Figure 1, determine them (see Table 2). The consequence of our focus on minimizing respondent burden is that we end up with unequal numbers of items per construct (see Table 2). This is not ideal but the effect can to a considerable extent be mitigated by subjecting the responses to the selected items to principal component analysis (PCA). An additional advantage of using PCA is that it allows for validation of the latent theoretical constructs in Figure 1 and Table 2.

Table 2: Assignment of survey items to theoretical constructs

Theoretical constructs		*Survey items*
Primary	***Secondary***	
Behavioral intention		I would like to buy more of my groceries online
Social norm (perceived social pressure to perform or not perform the behavior)		Most of my friends do their grocery shopping online Most of my family members do their grocery shopping online Many people I know think I should do more of my grocery shopping online
Perceived behavioral control (perceived ease or difficulty of performing a behavior)		Online grocery shopping is easy Finding a suitable delivery time for when I am home is difficult for me Finding the time to shop online in advance is difficult for me
Attitude (favorable or unfavorable evaluation of the behavior)	**Positive affect** (pride, happiness, satisfaction, etc.)	Online grocery shopping is fun I regard grocery shopping as a recreational/sociable activity I like to use new and different services and technologies
	Negative affect (fear, anger, worries)	Online grocery shopping is stressful Online grocery shopping is frustrating
	Perceived benefits (cognitions of personal and collective benefits)	Online grocery shopping is informative Online grocery shopping is efficient Online grocery shopping is environmentally friendly Online grocery shopping is useful Online grocery shopping is convenient Online grocery shopping is cheap Online grocery shopping is trustworthy
	Perceived costs & risks (monetary cost, effort, uncertainty, safety risk)	Online grocery shopping is complicated Online grocery shopping is time consuming Online grocery shopping is risky
Personal norm (internalized moral obligations to perform or refrain from certain actions)	**Outcome expectancy** (perception or feeling that people can mitigate a problem)	I like to support my local retailers whenever I can Being environmentally responsible is important to me I would pay more for the convenience of home delivery of groceries
	Awareness of consequences (awareness of consequences of not acting in a socially desirable way)	I worry that online grocery business is destroying 'high street' stores and reducing choice in stores Doing things in the most efficient way possible is important to me
Knowledge and experience (Knowledge about, and past experience with, technology and behavior)		I generally know more than other people about new technology I find myself pressed for time, when I do my grocery shopping I am in a hurry when I do my grocery shopping I generally like to see (and touch) groceries before I buy them

3.1.2 Survey administration, piloting and sampling

The survey was administered by Accent, a market research company based in London that specializes in consumer insights and stated choice experiments. The survey was implemented online in two phases. First, a small-scale pilot (N=58) was conducted in early Spring of 2017 to provide the necessary insights into survey feasibility (e.g. survey length and participant burden) and the quality of participants' responses. The pilot provided strong evidence that the questionnaire worked well, collecting sensible data for each section and taking less than 20 minutes to complete, on average. Second, the main stage survey was conducted in late spring 2017.

The sampling frame included people registered on the online consumer panel provided by Accent. The panel included UK adults (>17 years of age) who had access to online services and was representative of the UK population in terms of age, gender and residential location. A proportionate stratified sampling approach (Henry, 1990; Kish, 1965) was applied with strata based on personal characteristics: age (six groups), gender, and residential location (eleven Government Office Regions). People who were not involved in grocery shopping were screened out by asking a screening question[3] at the start of the survey interview. This provided a study sample of 2,032 UK shoppers who were broadly representative of the general population who were aged 18 and over, computer savvy and had access to the internet.

3.1.3 Characteristics of study participants

Comparisons with national data for England, Wales and Scotland (DfWP, 2017; NRS, 2018; ONS, 2017) suggested that participants were somewhat better-educated, less likely to be in full-time employment and more likely to be on 'home duties' (Table 3). They also included a lower share of people on middle incomes (between £20k and £40k per household per year), a higher share of people amongst the higher earners (>£40k per household per year), fewer non-white adults and had lower car accessibility than the general population. Otherwise the study sample was largely representative in its demographic, socio-economic and geographical characteristics. Therefore, no post-stratification weighting was applied.

[3] Screening question Q1: Do you have sole or part responsibility for any of the following activities? Please tick all that apply. - Paying gas or electricity bills, - Grocery shopping, - Booking holidays, - Buying computer equipment or technology for personal use, - Getting a car serviced, - Buying takeaway food, - None of these.

Table 3: Comparison between sample and population characteristics

Conceptual domain	Variable	Category	Sample *N=2032*	Sample %	National %
Demographic	Gender	Female	1040	51.2	51.4
		Male	992	48.8	48.6
	Age (years)	18 to 24	259	12.8	11.9
		25 to 34	308	15.2	17.3
		35 to 44	314	15.5	17.3
		45 to 54	344	17.0	16.5
		55 to 64	417	20.6	16.0
		65 and over	387	19.1	20.9
		mean (years)	48	-	48
	Ethnicity	White	1878	92.4	89.2
		Non-White	154	7.6	10.8
	Any dependent child in HH	Yes	565	27.8	29.1
	Avg. HH size	persons per HH	2.4	-	2.4
Socio-economic	Highest educational qualification ^	Degree	677	33.3	27.2
		A-level, BTEC, etc.	656	32.2	15.9
		GCSE, O-level	507	25.0	28.5
		None or other	192	9.5	28.3
	Employment status	Full-time	721	35.5	41.5
		Part-time	309	15.2	17.2
		Student	114	5.6	5.3
		Retired	480	23.6	21.4
		Home duties	158	7.8	3.9
		Sick/unemployed/other	250	12.3	10.8
	Annual household income (before housing costs)	>£40,000	503	28.0	19.0
		£20,001-40,000	688	38.0	47.9
		≤£20,000	633	35.0	33.1
		mean (GBP)	31,200	-	30,960
	Access to car + driving license	No	593	29.2	25.7
		Yes	1439	70.8	74.3
Geographical	Region	East Midlands	156	7.7	7.4
		East of England	168	8.3	9.5
		Greater London	242	11.9	13.2
		North East	93	4.6	4.3
		North West	271	13.3	11.5
		Scotland	191	9.4	8.6
		South East	263	12.9	14.0
		South West	144	7.1	8.8
		Wales	88	4.3	5.0
		West Midlands	185	9.1	9.0
		Yorkshire and Humber	231	11.4	8.6
	Urban/rural Status $	Urban	1416	83	82
		Rural	300	17	18

Sources: National statistics for residents aged 18 and above; Census 2011 population data for England & Wales (ONS, 2017) and Scotland (NRS, 2018); data on household income is after tax but excludes housing costs (DfWP, 2017).
[$] Urban/rural status for N=1716 (84%) as not everyone provided their household location.
[^] Highest educational qualification: there are 9 qualification levels in the UK: degree=level 4 qualification and above; A-level, BTEC, etc.=level 3 qualification; GCSE, O-level=level 2 qualification; None or other=level 1 and entry level qualifications (UK Government, 2019).

3.2 Data analysis

First, principal component analysis (PCA) was used to reduce the 30 attitudinal statements into eight overarching, psychologically meaningful constructs. Using SPSS v25 we explored alternative extraction methods (exploratory factor analysis (EFA) using PCA as well as principal axis factoring), rotation methods (varimax, oblique) and cut off points (Eigenvalue>1, scree plot examination) to identify eight constructs. While EFA using PAF has the advantages of being able to identify latent constructs and factor correlations (Fabrigar et al., 1999; Floyd and Widaman, 1995; Widaman, 1993), PCA was used in the current application due to the more common use of PCA in the literature, the relative ease with which the results can be interpreted, PCA being determinate, and the orthogonality of the extracted constructs (no correlation) (Fabrigar et al., 1999). To test for internal consistency and reliability of the results, additional EFA with principal axis factoring was performed (not reported but available on request). Both methods gave slightly different factor loadings (as expected) but the substantive results (rotated factor vs. component matrices, Table 4) remained.

Second, a two-stage cluster analysis common in market research (Sarstedt and Mooi, 2014) was performed to identify segments of grocery shoppers. In the first stage, hierarchical cluster analysis (HCA) on the set of attitudinal factors identified above was employed using Ward's distance measurement that uses the *F* statistic to maximize the significance of differences between clusters. This gave an indication of how the study sample was partitioning and the 'correct' number of clusters to be used in the second stage. Following visual inspection of the HCA Dendrogram (Figure A.1 in Appendix A), the HCA Agglomeration Schedule (Figure A.2 in Appendix A) and application of the Variance Ratio Criterion (VRC) based on relative *F* values of the ANOVA for each clustering (Caliński and Harabasz, 1974; Kryszczuk and Hurley, 2010; Milligan and Cooper, 1985), cluster solutions were derived that proved effective at producing inter-cluster heterogeneity and intra-cluster homogeneity. Following an assessment of the suitability and composition of the two 'best' cluster solutions for developing meaningful segmentation strategies, a five-cluster solution was chosen as the most appropriate one for this study. Further details on this process are given in Appendix A, including a description of how the VRC was derived and used.

In the second stage, the initial cluster centers calculated in the hierarchical solution were used as seed points for a K-means cluster analysis (Hartigan and Wong, 1979; Punj and Stewart, 1983), which was used to identify the final clusters utilized in the market segmentation. The analysis implied a reordering and resizing of clusters when compared to the unseeded K-means. Tests of difference (Pearson Chi-Square or Kruskal-Wallis, depending on the type of variable) were employed to determine if the segments were significantly different on the key descriptive variables (e.g. age, gender, education, car access, psychological factors). Finally, the segments were profiled by combining the psychological

detail that underpinned the segmentation with demographic and geographical characteristics and observed grocery shopping behaviors.

4 RESULTS

4.1 From attitudinal statements to meaningful constructs

The PCA of the attitudinal statements produced eight independent constructs, which in line with the framework (Figure 1) were labelled: *Positive Attitudes, Negative Attitudes, Social Norm, Perceived Behavioral Control (Time Pressure), Innovativeness (Affect and Knowledge), Grocery Shopping Attitude and Outcome Awareness*, *Outcome Expectancy* and *Outcome Awareness (Efficiency)* (see Table 4). As demonstrated in Table 5, many of the created latent constructs map onto the theoretical ones in Figure 1, although perceived benefits and positive affect and perceived costs/risks and negative affect have been combined into *Positive Attitudes* and *Negative Attitudes*, respectively. This is plausible as attitudes have both positive cognitive and affective components (e.g. Huijts et al., 2012). The personal norm related constructs are not as well replicated in the PCA, possibly because the measurement items were not as tightly focused on online grocery shopping than those for affects, benefits, costs/risks and social norms.

Table 4: Results of the Principal Component Analysis (rotated component matrix with component loadings)

	Components							
	Positive Attitudes	Negative Attitudes	Social Norm	Perceived Behavioral Control (Time Pressure)	Innovativeness (Affect and Knowledge)	Grocery Shopping Attitude and Outcome awareness	Outcome Expectancy	Outcome Awareness (Efficiency)
Informative*	**.744**							
Efficient*	**.737**							
Trustworthy*	**.712**							
Environmentally friendly*	**.708**							
Useful*	**.702**							
Convenient*	**.672**							.418
Cheap*	**.650**							
Easy*	**.647**	-.422						
Fun*	**.643**							
I would like to buy more of my groceries online	.497		.472					
Stressful*		**.826**						
Frustrating*		**.823**						
Complicated*		**.803**						
Time consuming*		**.766**						
Risky*		**.624**						
Most of my friends do their grocery shopping online			**.809**					
Most of my family members do their grocery			**.784**					

shopping online								
Many people I know think I should do more of my grocery shopping online			**.707**					
I would pay more for the convenience of home delivery of groceries	**.456**		.472					
I find myself pressed for time, when I do my grocery shopping				**.750**				
I am in a hurry when I do my grocery shopping				**.750**				
Finding a suitable delivery time for when I am home is difficult for me				**.713**				
Finding the time to shop online in advance is difficult for me				**.702**				
I generally know more than other people about new technology					**.820**			
I like to use new and different services and technologies					**.796**			
I worry that online grocery business is destroying 'high street' stores and reducing choice in stores						**.658**		
I generally like to see (and touch) groceries before I buy them						**.649**		
I regard grocery shopping as a recreational/sociable activity						**.559**		-.434
Being environmentally responsible is important to me							**.783**	
I like to support my local retailers whenever I can							**.683**	
Doing things in the most efficient way possible is important to me							.405	**.484**
Explained variance (%): 66.2 in total	17.0	11.9	8.9	7.8	5.9	5.8	4.8	4.0
Eigenvalue (after rotation)	5.3	3.7	2.8	2.4	1.8	1.8	1.5	1.3

Notes: Only loadings >0.4 are shown. * Item anchor phrase: "Compared to buying groceries in store, online shopping for groceries is…"

Table 5: Mapping the created latent constructs onto the theoretical constructs

Component Labels and attitudinal statements	Constructs of the conceptual framework
*Positive Attitudes**	
Informative	Perceived benefits
Efficient	Perceived benefits
Trustworthy	Perceived benefits
Environmentally friendly	Perceived benefits
Useful	Perceived benefits
Convenient	Perceived benefits
Cheap	Perceived benefits
Easy	Perceived behavioral control
Fun	Positive affect
I would pay more for the convenience of home delivery of groceries	Outcome expectancy
*Negative Attitudes**	
Stressful	Negative affect

Frustrating	Negative affect
Complicated	Perceived costs/risks
Time consuming	Perceived costs/risks
Risky	Perceived costs/risks
Social Norm	
Most of my friends do their grocery shopping online	Social norm
Most of my family members do their grocery shopping online	Social norm
Many people I know think I should do more of my grocery shopping online	Social norm
Perceived Behavioral Control (Time Pressure)	
I find myself pressed for time, when I do my grocery shopping	Knowledge and experience
I am in a hurry when I do my grocery shopping	Knowledge and experience
Finding a suitable delivery time for when I am home is difficult for me	Perceived behavioral control
Finding the time to shop online in advance is difficult for me	Perceived behavioral control
Innovativeness (Affect and Knowledge)	
I generally know more than other people about new technology	Knowledge and experience
I like to use new and different services and technologies	Positive affect
Grocery Shopping Attitude and Outcome Awareness	
I worry that online grocery business is destroying 'high street' stores and reducing choice in stores	Awareness of consequences
I generally like to see (and touch) groceries before I buy them	Knowledge and experience
I regard grocery shopping as a recreational/sociable activity	Positive affect
Outcome Expectancy	
Being environmentally responsible is important to me	Outcome expectancy
I like to support my local retailers whenever I can	Outcome expectancy
Outcome Awareness (Efficiency)	
Doing things in most efficient way possible is important to me	Awareness of consequences
Intention	
I would like to buy more of my groceries online	Behavioral intention

Notes: *Scale anchor phrase: "Compared to buying groceries in store, online shopping for groceries is…".

Positive Attitudes expresses a strong belief in the general benefits and positive affect of online grocery shopping. In contrast, *Negative Attitudes* concerns the perceived costs, risks and impractical aspects of online grocery shopping when compared to buying groceries in store. People who score highly on this factor tend to find online shopping emotionally and cognitively challenging. *Social Norm* conveys the extent to which shoppers may be influenced by their social network ('significant others') to perform a certain action (Ajzen, 1991; Çelik, 2011). *Perceived Behavioral Control (Time Pressure)* relates to concerns about time pressures and difficulties in planning to shop online. It expresses the scarcity and inflexibility of the consumer's time resources (Suri and Monroe, 2003), as people who lack time tend to shop in a planned way (Kleijnen et al., 2007). The next three factors relate to personal norms, that is, the set of expectations that people hold for themselves (Huijts et al., 2012). First, *Innovativeness (affect and knowledge)* expresses the propensity to try new and different technologies or services and to seek new experiences (Midgley and Dowling, 1978). Second, *Grocery Shopping Attitude and Outcome Awareness* is a personal norm dimension that relates to trust in and procedural fairness of online grocery shopping. It also expresses a strong belief in traditional values and the recreational/sociable benefit of going to a physical store or market instead of shopping 'anonymously' online, therefore articulating the hedonic value of shopping and the extent to which entertainment and emotional benefit is strived for (Babin et al., 1994). Third, *Outcome Expectancy* expresses personal beliefs about the social

and environmental impacts of shopping. *Outcome Awareness (Efficiency)* was included as a single item in the subsequent cluster analysis; it concerns the personal belief in doing things efficiently while not being overly concerned about the recreational/sociable benefits of grocery shopping. While the intention to buy more groceries online did not load strongly, this item featured implicitly in *Positive Attitudes* and *Social Norm* constructs (Table 4).

The reliability analysis (Table A.1 in Appendix A) showed that the Cronbach's alpha values for the multi-item constructs were all greater than 0.7 except for *Grocery Shopping Attitude and Outcome Awareness* (α=.641) and *Outcome Expectancy* (α=.623). Nevertheless, both components were included in the clustering as the study sample was relatively large (Fabrigar et al., 1999) and the two components added 8.8% to the explained variance.

4.2 From attitudinal constructs to shopper segments

Using the two-stage cluster analysis of the independent factors identified above, we identified five distinct segments that have different attitudinal profiles. Performing the analysis with the initial cluster centers based on HCA/Ward outcomes followed by K-means clustering gave the final cluster centers shown in Table 6. Each of the five identified segments has been assigned a short name, which will be described further in the next Section.

Table 6: Final cluster centers, sizes and shares

	Clusters[$]					ANOVA
Components/factors	**IU**	**OO**	**UM**	**WS**	**RR**	***F*** [(*)]
Positive Attitudes	0.770	0.624	-0.062	-0.092	-0.998	*267.3*
Negative Attitudes	0.590	-0.711	0.112	-0.053	0.483	*129.6*
Social Norm	1.123	-0.047	0.236	-0.504	-0.297	*136.4*
Perceived Behavioral Control (Time Pressure)	0.947	-0.780	0.049	0.812	-0.488	*366.9*
Innovativeness (affect and knowledge)	0.782	0.209	-0.421	-0.200	0.121	*75.2*
Grocery Shopping Attitude and Outcome Awareness	0.584	-0.175	0.066	-0.279	0.129	*33.7*
Outcome Expectancy	0.467	0.295	-0.952	0.120	0.551	*260.4*
Outcome Awareness (efficiency)	-0.053	0.089	-0.448	0.886	-0.451	*176.9*
Cluster size (*N*)	204	484	528	428	388	2032
Cluster share	10%	24%	26%	21%	19%	100%

[$]Short names: IU=Intensive Urbanites, OO=Online Omnivores, UM=Uncaring Multitude, WS=Willing but Struggling, RR=Resisting and Responsible. [(*)] The F-statistics are reported only for descriptive purposes and cannot be interpreted as tests of the hypothesis that the cluster means are equal. PBC=perceived behavioral control.

4.3 Market segment profiles

The five segments were profiled first against a series of psychological factors (Table 6) and then described in terms of shopping behavior (Table 7 and Appendix B) and socio-economic characteristics (Table 8). The tests of difference revealed that from a total of 75 categorical

and scale variables[4] included in the dataset, the vast majority (70) demonstrated statistically significant differences between segments.[5]

4.3.1 Intensive Urbanites (IU)

We begin the profiling with the *Intensive Urbanites* ('IU') who tend to be the most positive about online shopping overall. Representing the smallest segment (10%), shoppers in this cluster tend to interact with and be influenced by their social network a lot more than the other groups (strongly positive score on *Social Norm*). They are also overly concerned about time pressures and perceived difficulties in planning to shop online (strongly positive score on *Perceived Behavioral Control (Time Pressure)*), and tend to like new technology and know more than others about it (strongly positive score on *Innovativeness (affect and knowledge)*). They have embraced online shopping already and 41% shop online for grocery at least once per week (against 11% overall), although they also shop often in convenience stores (57% against 23% overall) and 'other retailers' such as bakeries, butchers and specialist stores (53% against 18% overall). This 'hyper-shopping' behavior is evident across *all* product types, particularly for buying frozen food and ready meals (especially physical stores) as well as toiletries, health and beauty products, which 34% buy online at least once per week (against 7% overall). Convenience stores are popular choices for daily shopping of fresh produce (17% every day against 2% overall) and frozen food and ready meals (12% against 2% overall). Their tendency to 'hyper-shop' is less evident for visiting larger stores but patronage is still more frequent than for any of the other segments. For physical store shopping *Intensive Urbanites* tend to prefer the more upmarket UK retailers such as Waitrose, Marks & Spencer as well as convenience forecourts at train or petrol stations (Table B.1 in Appendix B). When shopping online, they tend to prefer retailers who have a distinct online presence and reputation such as Ocado, Waitrose and Amazon over the more established, larger 'physical-store' brands such as Tesco, Asda or Sainsbury's.

This group tends to buy groceries more impulsively than planned in advance. They also have a desire to see and touch groceries before they buy them (87% against 73% overall) while stating very high intentions to buy more online (70% against 25% overall). They would also pay more for the convenience of home delivery. In terms of demographics (Table 8), *Intensive Urbanites* tend to include more men (56% against 49% overall) and much younger shoppers (avg. age 37 against 48 years overall, with only 4% aged 65 years or older). They are highly educated, economically active (85% against 56% in employment or education overall) and earn significantly more than the average (£41k against £31k overall). More than double the average (57% against 28% overall) tend to have dependent children living at home, and car accessibility is lowest of all the clusters (20% against 28% overall), which is reflected in preference for walking or cycling to/from physical stores or collection points rather than travel by car. Geographically, this group includes a much higher share of people living in

[4] This included demographic and socio-economic variables (e.g. gender, age, highest level of education, employment status, ethnicity, long-term illness, presence of children, net household income), car access and driving licence, household location (full UK postcode), psychological factors (8 in total), intention to shop more online, shopping frequency by product type (5 in total), shopping frequency by channel and product type (4x5=20 in total), transport mode to/from physical stores or collection point, shopping volume (number of bags, crates) by channel and product type, shopping frequency by channel and retailer, time and location of ordering online, preference for impulsive vs. planned online shopping by product type, and reasons for choosing retailer x for online shopping (e.g. brand loyalty, price, quality, on subscription plan, etc.).

[5] For instance, shopping frequency by channel, product type and travel mode to/from store or collection point was significantly different between segments only when considering all product types.

Greater London (34% against 12% overall), an observation that was also reflected in the higher urban share of 90% (against 83% overall).

In sum, this group tends to include the 'super-shopping' (Flynn and Goldsmith, 2016), already converted, highly connected, affluent, busy and convenience-loving shoppers who engage in frequent multi-channel shopping in more upmarket retailers and across all product types.

Table 7: Selection of observed shopping and travel indicators for the five consumer segments

	Clusters (with number and short name[$])					
Shopping behaviors[#]	**IU**	**OO**	**UM**	**WS**	**RR**	**All**
Shopping once a week or more:*						*(N=2032)*
Online (home delivery, C&C)	41%	16%	7%	5%	2%	**11%**
Convenience store	57%	23%	21%	19%	13%	**23%**
Supermarket/discounter	77%	57%	63%	65%	67%	**64%**
Another retailer (bakery etc.)	53%	14%	16%	10%	13%	**18%**
Online – once a week or more:						*(N=2032)*
Bread, milk and dairy	33%	15%	7%	7%	1%	**10%**
Fresh food (fruit/veg/meat/fish)	43%	16%	7%	9%	3%	**12%**
Heavy and bulky groceries	49%	20%	8%	5%	1%	**14%**
Frozen food and ready meals	47%	21%	9%	2%	2%	**14%**
Toiletries, health and beauty	34%	9%	6%	2%	1%	**7%**
Convenience store – once a week or more:						*(N=2032)*
Bread, milk and dairy	58%	37%	26%	19%	21%	**30%**
Fresh food (fruit/veg/meat/fish)	60%	23%	20%	26%	15%	**24%**
Heavy and bulky groceries	53%	25%	26%	18%	14%	**25%**
Frozen food and ready meals	67%	12%	15%	18%	6%	**20%**
Toiletries, health and beauty	43%	15%	14%	13%	7%	**15%**
Supermarket/discounter – once a week or more:						*(N=2032)*
Bread, milk and dairy	90%	71%	82%	81%	86%	**81%**
Fresh food (fruit/veg/meat/fish)	83%	79%	82%	88%	91%	**84%**
Heavy and bulky groceries	74%	49%	57%	66%	71%	**61%**
Frozen food and ready meals	74%	54%	54%	58%	62%	**59%**
Toiletries, health and beauty	63%	29%	32%	34%	29%	**34%**
Travel mode to/from supermarket						*(N=2028)*
Walk or Cycle	28%	27%	24%	20%	21%	**24%**
Car (as driver or passenger)	61%	62%	68%	71%	71%	**67%**
Bus (or other public transport)	11%	11%	8%	9%	9%	**9%**
Travel mode to/from collection point (*if online and C&C*)						*(N=506)*
Walk or Cycle	29%	17%	13%	17%	16%	**19%**
Car (as driver or passenger)	60%	73%	73%	75%	68%	**69%**
Bus (or other public transport)	11%	10%	14%	8%	16%	**11%**
Shopping volume (average number of carrier bags per shop)						
Online	7.3	7.9	6.7	6.5	5.7	**7.1**
Convenience store	2.2	1.4	1.4	1.3	1.3	**1.5**
Supermarket/discounter	5.5	3.8	4.2	4.1	3.7	**4.1**

[$]IU=Intensive Urbanites, OO=Online Omnivores, UM=Uncaring Multitude, WS=Willing but Struggling, RR=Resisting and Responsible. [#]All were found to demonstrate statistically significant differences between segments (determined by using either Chi-Square or Kruskal–Wallis tests of difference). *For any product type. C&C=Click & Collect.

4.3.2 Online Omnivores (OO)

Similar to the *Intensive Urbanites*, *Online Omnivores* ('OO', 24% of the sample) tend to embrace the instrumental benefits of online shopping (strongly positive score on *Positive Attitudes*). What distinguishes them most from the *Intensive Urbanites* is that they tend not to be overly pressed for time or in a hurry, and find it (much) easier to identify a suitable delivery time or plan to shop online in advance (strongly negative score on *Perceived Behavioral Control (Time Pressure)*). They are also the least concerned about the potential emotional and cognitive challenges of online shopping (strongly negative score on *Negative Attitudes*). This generally positive attitude towards online shopping is reflected in the observation that 16% of this segment already shop online for groceries at least once per week (against 11% overall), whereas they shop less frequently in supermarkets and discounters (57% against 64% overall), with 20% visiting a physical store less than once a month against 12% overall (Table 7). They also tend to buy more than any of the other segments each time they shop online (averaging 7.9 carrier bags per shop against 7.1 overall). This preference for shopping online over physical stores is evident across all product types. For example, while 20% of this segment buy heavy and bulky groceries online at least once per week (against 14% overall), 'only' 49% choose to buy these in supermarkets/discounters (against 61% overall). Convenience stores are relative popular choices for bread, milk and dairy (37% at least once a week against 30% overall) but less so for frozen food and ready meals (12% against 20% overall). In terms of retailers, this group tends to shop online from the larger and more mainstream retailers such as Tesco and Sainsbury's – in contrast to the *Intensive Urbanites* who prefer more upmarket retailers (Table B.1 in Appendix B). They also tend to shop less frequently in physical stores that do not offer online (e.g. Aldi, Lidl) or target the price conscious (e.g. Morrisons).

Online Omnivores tend to be marginally older (avg. age 49.0 years against 47.5 years overall) and include fewer people who are in employment or education (48% against 56% overall) (Table 8). They tend to have average household incomes (£31.3k per year) and slightly lower car accessibility (67% against 71% overall), which is reflected in the preference for walking, cycling or public transport to/from physical stores or collection points rather than travel by car. Geographically, this group is spread fairly equally across the country.

Interestingly, this group includes those who are the *least* concerned out of all the segments about being able to 'see and touch' groceries before they buy them (54% against 73% overall). This group also tends to buy groceries more planned in advance than impulsive, particularly for fresh food – another important distinction from the other online adopter cluster, the *Intensive Urbanites*. They are also more likely than all other segments (16% vs 10% overall) to be on a subscription plan (for example, Tesco 'Delivery Saver' or Amazon 'Prime'), intend to shop more for groceries online (36% against 25% overall) and would pay more for convenience of home delivery.

In sum, this group includes the 'online-loving', economically inactive, not particularly time pressured (or bothered about seeing products first) shoppers on a subscription plan who engage in multi-channel shopping (with a distinct preference for online) from more traditional retailers across all product types.

Table 8: Individual characteristics of the identified consumer segments

	Clusters (with number and short name[$])					
Individual characteristics[#]	**IU**	**OO**	**UM**	**WS**	**RR**	**All**
Female	44%	53%	49%	58%	48%	**51%**
Average age (years)	37	49	47.5	43.3	55.8	**47.5**
Degree	44%	31%	28%	40%	31%	33%
In employment or education	85%	48%	58%	69%	36%	**56%**
Household income (GBP, '000)	41.2	31.3	28.1	32.7	27.9	**31.2**
Living in Greater London	34%	11%	11%	11%	5%	**12%**
Car access and driving licence	80%	67%	68%	69%	77%	**71%**
Dependent children @ home	57%	25%	28%	29%	14%	**28%**

[$]IU=Intensive Urbanites, OO=Online Omnivores, UM=Uncaring Multitude, WS=Willing but Struggling, RR=Resisting and Responsible. [#]All were found to demonstrate statistically significant differences between segments (determined by using either Chi-Square or Kruskal–Wallis tests of difference).

4.3.3 Uncaring Multitude (UM)

Forming the largest segment at 26%, the *Uncaring Multitude* ('UM') tend to be the least socially and environmentally responsible out of all the clusters (strongly negative score on *Outcome Expectancy*). They dislike new technology and services more than the other segments (moderately negative score on *Innovativeness (affect and knowledge)*), and efficiency is not important to them (moderately negative score on *Outcome Awareness (efficiency)*). They also expressed a much lower intention to buy more online (15% against 25% overall) and were less likely than others (4% against 10% overall) on a subscription plan. These somewhat indifferent attitudes and beliefs manifest themselves in lower shopping rates overall, particularly using online (only 7% shop online at least once a week against 11% overall). This group also tends to buy groceries more impulsively than planned in advance, particularly for bread, milk and dairy. In terms of retailer preferences (Table B.1 in Appendix B), this group tends to shop more from retailers geared towards the more price conscious (e.g. Lidl, Iceland, Asda, Aldi), and less from upmarket retailers such as M&S, Ocado and Waitrose.

In many other respects, shoppers in the *Uncaring Multitude* tend to be close to average, including most socio-demographic characteristics (e.g. gender, age, employment status, car access) and residential location. They tend, however, to be less educated (28% have a degree against 33% overall), earn less than the average (£28.1k per year against £31.2k overall) and use the car more (and consequently walk or cycle less) than others for collecting online orders.

In sum, this 'middle-ground' group includes the less socially and environmentally responsible, less engaged, price conscious and less educated shoppers on lower incomes who are still skeptical about online shopping (and new technology in general) and prefer more traditional shopping channels across all product types.

4.3.4 Willing but Struggling (WS)

The *Willing but Struggling* ('WS', 21% of the sample) tend to be very conscious of and pressed for time (strongly positive score on *Perceived Behavioral Control (Time Pressure)*) and doing things efficiently is important to them (strongly positive score on *Outcome*

Awareness (efficiency)). While people in this group do not perceive grocery shopping to be a social or recreational activity, they quite like the convenience of online shopping. Few of their friends and family do their grocery shopping online or think they should do more of their shopping that way (moderately negative score on *Social Norm*). They somewhat dislike new technology and services (marginally negative score on *Innovativeness (affect and knowledge)*) and do not score strongly on either *Positive Attitudes* or *Negative Attitudes*, suggesting that exposure to and experience of online shopping had so far been low. This is reflected in the observation that only 5% of this segment already shop online for groceries at least once per week (against 11% overall), 19% in convenience stores (against 23% overall) and 10% at other retailers (against 18% overall). The indifference to shopping online is evident across all product types (but particularly for fresh produce, bread and dairy) and may be reflected in the slight preference (77% against 73% overall) to 'see and touch' groceries before buying them. When they do shop online, they tend to buy fewer groceries per shop (6.5 carrier bags on average against 7.1 bags overall) and prefer the more traditional, price conscious retailers such as Tesco and Asda over the more upmarket Ocado and Waitrose (Table B.1 in Appendix B).

The *Willing but Struggling* tend to buy groceries more planned in advance than impulsively, particularly for frozen food and ready meals. They are marginally more likely than other segments (12% against 10% overall) to be on a subscription plan, but hold slightly below average intention to shop *more* for groceries online (23% against 25% overall) and are less likely to pay more for the convenience of home delivery (20% against 24% overall).

This group further includes a higher share of female (58% against 51% overall) and younger shoppers (avg. age 43.3 years against 47.5 years overall) who are more educated (40% with degree against 33% overall), more economically active (69% in employment or education against 56% overall) and earning slightly more than average (£32.7k per year against £31.2k overall). This is the only segment that was slightly overrepresented in rural locations (20% against 17% overall), including South East England and Yorkshire and The Humber. This might explain why cars were used more often to travel to supermarkets and discounters (71% against 67% overall) or collection points (75% against 69% overall).

In sum, this group includes time pressured, efficient, educated, economically active, younger and predominantly female shoppers who buy groceries from more traditional retailers across all product types – but not (yet) online.

4.3.5 Resisting and Responsible (RR)

As the name suggests, the *Resisting and Responsible* shoppers ('RR', 19% of the sample) tend to be highly skeptical about the instrumental benefits of online shopping (strongly negative score on *Positive Attitudes*), which they find somewhat emotionally and cognitively challenging (moderately positive score on *Negative Attitudes*). They are likely to be environmentally responsible and support their local retailers (moderately positive score on *Outcome Expectancy*). They tend not to be overly pressed for time or in a hurry, and finding a suitable delivery time or planning to shop online in advance is easy (moderately negative score on *Perceived Behavioral Control (Time Pressure)*). The largely negative attitudes towards and perceptions of online shopping are echoed in that this group tends not to shop online very much at all (only 2% do so at least once per week against 11% overall) and express very little intention to do more of it (only 3% against 25% overall). This resistance to

shopping groceries online is evident across all product types and may at least partially be explained by the strong preference (the highest of all segments at 90% against 73% overall) to 'see and touch' groceries before buying them. They are also less likely than others (4% against 10% overall) to be on a subscription plan. While they also shop significantly less often in convenience stores (13% against 23% overall), they generally shop more than average in supermarkets/discounters, especially for heavy and bulky groceries (71% against 61% overall). They tend to buy fewer groceries per shop across all channels (e.g. supermarkets, 3.7 carrier bags on average against 4.1 bags overall) and prefer price-conscious supermarket retailers such as Morrisons, Tesco and Aldi. Shoppers in this segment also tend to normally go to stores or supermarkets of the same company (46% against 39% overall), in particular at retailer Morrisons, suggesting brand loyalty is important to them.

Demographically, this segment tends to include significantly higher shares of older (avg. age 55.8 years against 47.5 years overall, with 35% over 65 years of age against 19% overall) and male shoppers (52% against 49% overall) who are less economically active (36% in employment or education against 56% overall) and have the lowest average household income out of all the clusters (£27.9k against £31.2k overall). Only 14% (against 28% overall) have dependent children living at home, and car accessibility is also lower than the sample average (23% against 29% overall). They tend to include higher shares of people living in the East of England, the North West, Yorkshire and The Humber and rural Scotland – but not in Greater London.

In sum, this segment includes the 'online resisting', socially responsible, brand loyal, older and retired shoppers who prefer more traditional shopping channels across all product types.

5 DISCUSSION

5.1 Summary of findings

This paper identifies and describes groups of grocery shoppers using a psychographic segmentation approach that is explicitly grounded in the TPB and the TAM. It provides an investigation of the attitudes and behaviors related to grocery shopping for a largely representative and stratified sample of 2,032 grocery shoppers across the UK. The principal component analysis with varimax rotation and Kaiser normalization of 30 attitudinal statements yielded eight overarching, psychologically meaningful and independent constructs with regard to shopping behavior: *Positive Attitudes, Negative Attitudes, Social Norm, Perceived Behavioral Control (Time Pressure), Innovativeness (affect and knowledge), Grocery Shopping Attitude and Outcome Awareness, Outcome Expectancy,* and *Outcome Awareness (efficiency)*. Overall, while these constructs aligned well with the constructs found in the TPB and TAM, not all items mapped onto the TPB and TAM constructs and the number of items per construct was uneven. This confirmed the motivation to use exploratory factor analysis and reduce items using PCA. Nonetheless, the findings suggest that grounding grocery shopping segmentation research in theoretical models such as the TBP and TAM generates meaningful results.

Two-stage cluster analysis of the eight factor scores led to five well-defined and highly interpretable segments of the sample. The consumer segments vary in size (from 10% for *Intensive Urbanites* to 26% for *Uncaring Multitude*) and reveal a range of different grocery shopping preferences, from those who appear to resist online grocery shopping for

social, environmental and instrumental reasons to those who are clearly attracted to the online experience and want more. Our findings suggest that UK shoppers might be attracted to or repelled from online shopping for reasons of convenience, positive/negative experience (and avoidance of experience of the alternative), affinity to innovation, responding to time pressures and fit into daily schedules, as well as identification with social and environmental values. Discovery of these characteristics complements and extends previous research (see Section 2) that considered shopping-related attitudes and preferences (e.g. Harris et al., 2017a; Konuş et al., 2008; Lee et al., 2017; Mokhtarian et al., 2009; Williams et al., 2015).

The presence of preference heterogeneity supports the paper's starting premise that there is no 'average online grocery shopper' – a claim that was derived from other research segmenting consumers shopping for food (Chetthamrongchai and Davies, 2000; Müller and Hamm, 2014), shopping for low-involvement, more frequently purchased categories (Nakano and Kondo, 2018), shopping for 'search' and 'experience' goods (Mokhtarian et al., 2009) and multi-channel shopping for non-grocery items (Konuş et al., 2008; Sands et al., 2016).

In terms of relative importance of the underlying factors in discriminating between clusters, this research suggests that factors relating to perceived behavioral control (time pressure), positive attitudes towards online (positive affect, perceived online benefits), and social & environmental dimensions of personal norm are more 'influential' (in terms of comparing *F-statistics* between factors) than factors relating to the shopping dimension of personal norm, innovativeness (technology affect) and any negative attitudes towards online grocery shopping (costs and risks, negative affect).

5.2 Implications for retail practice and outcomes

The rapidly changing landscape of the online grocery market has introduced a range of uncertainties around the environmental and social outcomes. A psychometric segmentation can inform and raise the effectiveness of attempts to minimize the negative collective effects of changes in grocery shopping behavior such as possibly greater contribution to local air pollution and greenhouse gas emissions (Edwards et al., 2010) and other negative consequences including social distributional effects (Badrinarayanan and Becerra, 2018; OECD, 1999). Maximizing uptake in certain locations could potentially reduce externalities by optimizing delivery schedules in those areas; for example, British retailer Ocado puts its 'green van' on the time slots when other people in a postcode area are being delivered to in that timeslot to encourage shoppers to choose it. However, maximizing uptake could also have a possible downside in some locations, namely contributing to the disappearance of larger physical stores. This presents a dilemma for public policy whether online grocery shopping should be encouraged or not. By segmenting grocery shoppers the paper provides a better understanding of the behavioral responses to these uncertainties for each segment. Nevertheless, public policy faces a challenge here, as it would seem prudent for whatever position they take to be a well-considered one, and possibly one that attempts to "thread the needle" by both supporting physical stores while incentivizing optimal delivery scheduling.

To explore these uncertainties, it is helpful to look more closely at the key distinguishing features of the consumer segments and explore what makes various groups tick (or not). The *Willing but Struggling* are perhaps the most interesting of the segments, as they state they want to shop online but cannot find the time and space to do so. Existing time pressures, limited social influence and relative inexperience of online grocery shopping suggest that the *Willing but Struggling* may need to try out and experience existing online

services or be offered a tailored shopping experience that fits well into their tight daily schedules and is efficient from search to delivery to increase take-up. Overall, therefore, this group is more likely to substitute online for physical store shopping than adding to it (Cao et al., 2012; Farag et al., 2007). Assuming online grocery shopping is less polluting than in-store shopping (Edwards et al., 2010), the environmental consequences are thus likely to be positive.

As this group tends to include the more educated, economically active, younger and female shoppers who buy groceries from more traditional retailers across all product types, there seems to be a case for optimizing the experience (both ordering and delivery, whether click and collect or home delivery), tailoring around situational factors that may currently prevent take-up (Hand et al., 2009) and appeal to the utilitarian (rather than hedonic) outcomes of grocery shopping (Babin et al., 1994). In practice, this may mean improving and simplifying navigation on devices and computers (e.g. following the '3 click' rule from search to purchase); avoiding a lengthy or complicated checkout processes; offering payment methods (such as PayPal) that reduce friction at checkout; and offering a local (within 5 miles) click and collect service. In addition, situational factors could be used as a basis for marketing communications content and target advertising, for instance, by using magazines directed at new parents (Hand et al., 2009).

While both the *Intensive Urbanites* and *Online Omnivores* score high on convenience, efficiency, trust and other perceived benefits, *Intensive Urbanites* also state some degree of dissatisfaction with online grocery services, which suggests they could potentially shop online even more if perceptions and/or reality of the negative aspects of online (e.g. perception of online being complicated, stressful, frustrating) were improved. As they include the highly connected, affluent, busy and convenience-loving shoppers who are prepared to pay more for the convenience and ease of use, there is the potential for a separate, super-convenient service to be paid at a premium (e.g. an 'Amazon Prime' for groceries). Another distinguishing factor between these two segments is that while *Intensive Urbanites* combine frequent online with frequent shopping in physical stores (i.e. 'super-shopping' or 'multichannel enthusiasts', comparable to Konuş et al. (2008)), *Online Omnivores* have a distinct preference for online over other channels. This distinction adds to the more general finding that online shopping may be associated for some segments with higher in-store shopping rates (Lee et al., 2017) and tends to have a complementary rather than substitutional effect on in-store shopping (Cao et al., 2012; Farag et al., 2007). Thus, the environmental consequences of this additionality *may* be negative, particularly at the system level (travel for shopping, logistics, stores, production) (Durand and Gonzalez-Feliu, 2012; Wiese et al., 2015). In addition, as the *Online Omnivores* are different from the *Intensive Urbanites* in being less economically active, not particularly time pressured and not bothered about seeing or touching groceries first, they may be the easier of the two early adopter groups to be kept happy (as not to abandon online shopping) by a more flexible but high-quality service.

Whilst the *Intensive Urbanites* display the highest levels of innovativeness (positive affect), the *Uncaring Multitude* exhibit the lowest level of innovativeness, suggesting that the latter group's motivation to buy more online is unlikely to originate from their degree of adoptive innovativeness (Midgley and Dowling, 1978) alone. Indeed, we found few clues about what makes the *Uncaring Multitude* tick (e.g. low prices), only what should *not* be done to convince these shoppers (e.g. one should *not* appeal to the social, environmental or efficiency dimensions of their personal norm). As they tend to include the less engaged, price

conscious and less educated shoppers on lower incomes who prefer more traditional shopping channels, any interest in online may be increased by broadening the shopping choices in terms of products (non-grocery), lower prices or experiences (e.g. storytelling, gamification). As a consequence, however, this group may shop online *in addition* to shopping and bargain hunting locally, with possible negative environmental consequences.

At the other end of the scale, the *Resisting and Responsible* shoppers' skepticism of and difficulties with online shopping combined with the desire to 'see and touch' and shop locally suggests retailers may want to appeal more to their social or environmental identity – perhaps through collaboration with local shops to counter any negative social distributional effects (Durand and Gonzalez-Feliu, 2012), or highlighting the environmental benefits of shopping online (Edwards et al., 2010). Overall, shoppers in this segment will be the most difficult to convince that online is something for them. As they include the brand loyal, older and retired shopper who prefers more traditional shopping channels, retailers may have to pay them or lure them into trials as to make them experience the service first hand. Strategically, this may be the last group into which online retailers may want to invest a lot of effort.

In sum, the profiling of the attitudinal clusters in terms of shopping behavior (frequency, volume), main shopping travel mode and socio-demographics revealed a number of important differences between clusters than could be used to provide a more stratified understanding of the behavioral responses to the rapidly changing online grocery market. The results compare with findings from previous segmentation research that highlights the importance of a number of sociodemographic and other characteristics, including shopping channel choices, attitudes, perceptions and beliefs (Chetthamrongchai and Davies, 2000; Ganesh et al., 2010; Konuş et al., 2008; Mokhtarian et al., 2009; Williams et al., 2015).

5.3 Limitations and further research

This study has created and populated a comprehensive technology acceptance framework with a largely representative sample of more than 2,000 UK grocery shoppers. Together with the channel-specific stated choices in another part of the survey, which remain to be analyzed, and the situational, psychological, socio-demographic and other variables captured by the extensive questionnaire, these data offer the most comprehensive set of grocery shopping-related variables that we have seen empirically measured by a single study. Accordingly, we believe that they will continue to provide useful insights for some time to come, especially with respect to the role the growing online channel is playing in the grocery shopping behavior of ordinary UK residents. Also, as the UK is playing a leading role in adopting online grocery shopping (CRR, 2018; IGD, 2017) other markets in countries with low adoption may benefit from the research and its findings.

The study has, however, a number of limitations. First, it is cross-sectional; hence we cannot infer causality on any of the associations between, for instance, psychological factors and cluster membership. Second, the data were collected during a six-week period of time in May/June 2017; therefore, the dynamic stability over time with regard to number, size and properties of the segments could not be determined (Müller and Hamm, 2014). Further research could develop discrete-choice models using a variety of dependent-variable formulations (actual and intended choices for a planned vs. immediate need purchase) and, beyond that, applications of more sophisticated methodologies such as latent class and hybrid choice models, which have been shown to be slightly better from the statistical perspective (e.g. model fit), but not necessarily superior from the conceptual perspective (Tang and

Mokhtarian, 2009). Further analysis is required to verify any claims on the possible impacts of the growing online grocery shopping market segments on environmental (air pollution) and social (distribution, access) outcomes. Finally, some of the theoretical constructs could have been operationalized more precisely, and that this is an important area for future research.

6 CONCLUSIONS

Starting on the premise that there is no such thing as an 'average grocery shopper', this study identified and described groups of grocery shoppers using a psychographic segmentation approach that is explicitly grounded in the TPB and TAM. Attitudinal segmentation and profiling of British shoppers produced five meaningful consumer groups. Each of the five segments represents a unique combination of self-reported likelihood to shop groceries online and differs in terms of average perceptions, beliefs and concerns and the importance attached to symbolic, affective and instrumental factors (Dittmar, 1992) in relation to grocery shopping. The research shows that non-cost attitudinal, situational and demographic factors influence shopping channel choice. It further highlights the importance of combining theory with topic-specific issues and concerns, thus supporting the notion that consumer segmentation must be theoretically informed and take account of specific characteristics and circumstances of the object of interest.

The results demonstrate that combining psychographic segmentation with traditional demographic and socioeconomic characteristics, shopping behavior and shopping travel mode choice can provide a detailed description of the distinct features of the identified segments; identify what makes various groups tick (or not tick); provide evidence of the relative importance of the various factors underlying the technology acceptance framework; and provide a more stratified understanding of the behavioral responses to the rapidly changing online grocery market. The research thus has the potential to offer a series of insights for policy and practice regarding the structure of demand in the growing market for online grocery shopping.

DECLARATIONS OF INTEREST

None.

APPENDIX A: Supplementary details of the factor and cluster analyses

A.1 Details on the psychological constructs

Table A.1: Attitudinal statement configurations of the psychological constructs (N=2032)

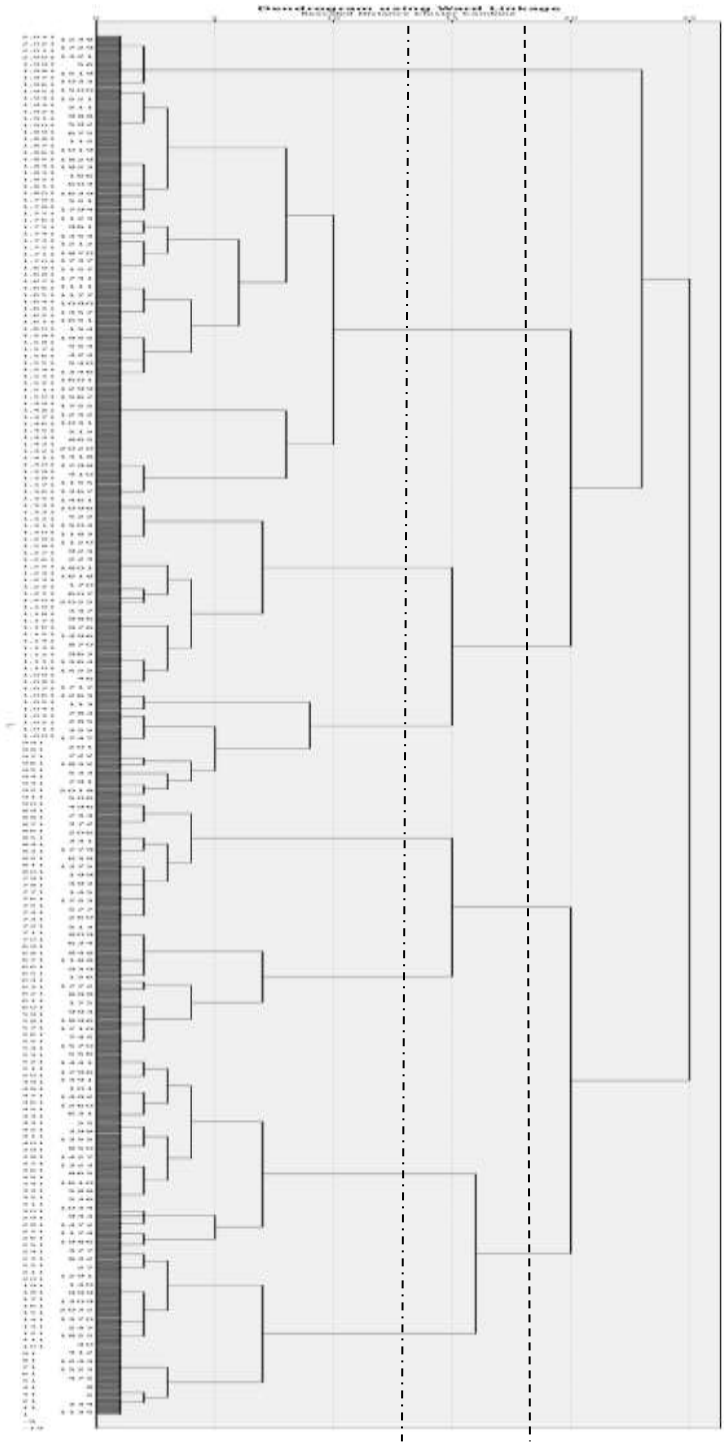
Attitudinal Statements ***and labels for the constructs***	**Factor Loading**	**Mean scale 1-5**	**Standard Deviation**
Positive Attitudes: α = .902*			
Informative	.744	3.11	.951
Efficient	.737	3.40	.980
Trustworthy	.712	3.16	.961
Environmentally friendly	.708	3.07	.930
Useful	.702	3.58	.990
Convenient	.672	3.66	1.032
Cheap	.650	2.73	.947
Easy	.647	3.52	.991
Fun	.643	2.62	1.041
I would pay more for the convenience of home delivery of groceries	.456	2.52	1.208
Negative Attitudes: α = .866*			
Stressful	.826	2.62	1.035
Frustrating	.823	2.84	1.070
Complicated	.803	2.65	1.063
Time consuming	.766	2.98	1.069
Risky	.624	2.91	1.098
Social Norm: α = .805			
Most of my friends do their grocery shopping online	.809	2.54	1.069
Most of my family members do their grocery shopping online	.784	2.28	1.123
Many people I know think I should do more of my grocery shopping online	.707	2.39	1.105
Perceived Behavioral Control (Time Pressure): α = .785			
I find myself pressed for time, when I do my grocery shopping	.750	2.51	1.106
I am in a hurry when I do my grocery shopping	.750	2.62	1.107
Finding a suitable delivery time for when I am home is difficult for me	.713	2.58	1.195
Finding the time to shop online in advance is difficult for me	.702	2.46	1.103
Innovativeness (affect and knowledge): α = .717			
I generally know more than other people about new technology	.820	2.91	1.090
I like to use new and different services and technologies	.796	3.18	1.000
Grocery Shopping Attitude and Outcome Awareness: α = .641			
I worry that online grocery business is destroying 'high street' stores and reducing choice in stores	.658	3.34	1.091
I generally like to see (and touch) groceries before I buy them	.649	3.97	.978
I regard grocery shopping as a recreational/sociable activity	.559	2.90	1.177
Personal Outcome Expectancy: α = .623			
Being environmentally responsible is important to me	.783	3.66	.936
I like to support my local retailers whenever I can	.683	3.60	.880
Outcome Awareness (efficiency)			
Doing things in most efficient way possible is important to me	.484	3.78	.844

Notes: *Scale anchor phrase: "Compared to buying groceries in store, online shopping for groceries is…".
α: Cronbach's alpha. PBC=perceived behavioral control.

A.2 Dendrogram

The hierarchical stage of the cluster analysis using Ward's distance produced the Dendrogram shown in Figure A.1, illustrating an increased degree of stability of the cluster solution after distance 10. This included solutions covering three, five and eight clusters.

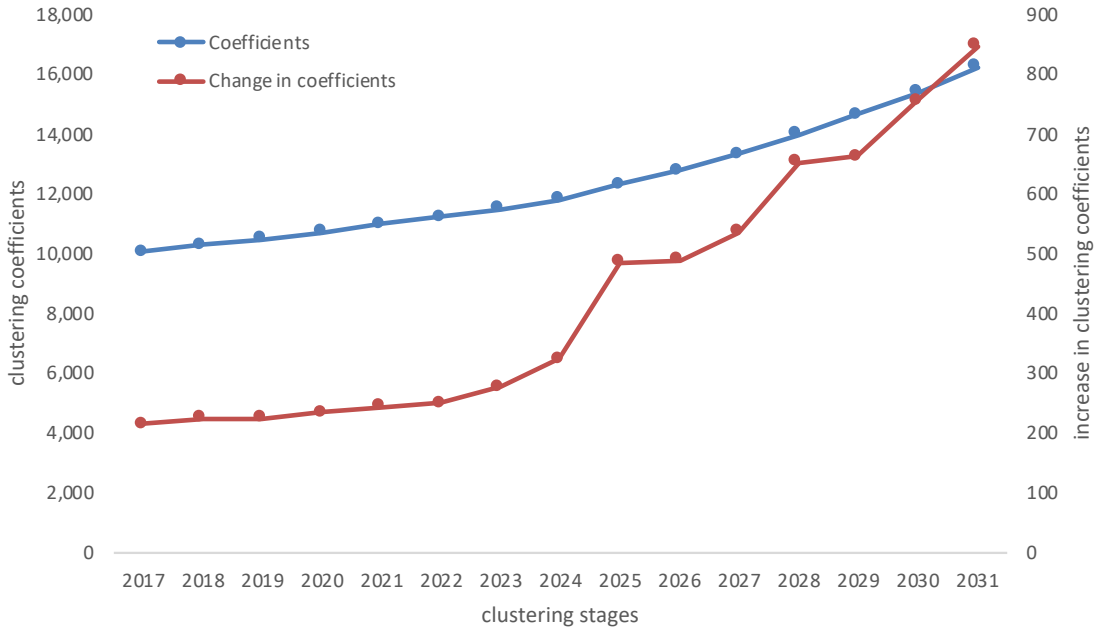
Figure A.1: Dendrogram, suggesting either a five or eight cluster solution



A.3 Agglomeration Schedule of the Hierarchical Cluster Analysis

The clustering coefficients (and increases at each stage) of the last 15 stages of the HCA Agglomeration Schedule of the 8-factor clustering are shown in Figure A.2.

Figure A.2: Agglomeration Schedule, showing the last 15 HCA stages



A.4 Application of Variance Ratio Criterion by Caliński and Harabasz (1974)

The Variance Ratio Criterion (VRC) for 5 to 10 cluster solutions was performed using K-means clustering of unseeded cluster centers. To compute the VRC statistic for each case of number of segments, we followed Caliński and Harabasz (1974) and simply summed up the *F* values of the ANOVA for each clustering (k=5,…,10). The results are shown in Table A.2.

Table A.2: VRC statistic for cluster solutions k=5 to k=10

Number of clusters (k)	*VRC(k)*	*W(k)*
5	**1463.7**	**-42.3**
6	1317.6	81.9
7	1253.5	103.8
8	**1293.2**	**-102.2**
9	1230.6	32.6
10	1200.7	-18.9

To determine the 'correct' number of segments, we computed:

$$W(k) = [VRC(k+1) - VRC(k)] - [VRC(k) - VRC(k-1)]$$

for each segment solution. In the final step we chose a value for k, which minimized the value of $W(k)$. Comparing the values for $W(k)$, we establish that the minimum is achieved for $k = 8$, with $k = 5$ being the 'second best' solution. Further taking into account the scree plot and

Dendrogram (Figure A.1), we established that either an eight- or a five-segment solution was effective at producing inter-cluster heterogeneity and intra-cluster homogeneity.

The eight cluster solution gave a higher resolution of consumer heterogeneity, illustrated by the observation that the cluster centers tend to be slightly further apart in the eight cluster solution (not shown). However, given that one of the goals of this work was to provide insights into developing effective segmentation strategies, user comprehension and utilisation of eight segments of different sizes and profiles may in practice be cognitively challenging and impractical. In other words, a five cluster solution allowed the description of the analysis to be manageable. Therefore, the five segment solution was selected as the first choice for further analysis, with the eight segment solution as a second choice for sensitivity analysis.

APPENDIX B: Supplementary Results of the Segmentation Analysis

B.1 Shopping frequency by retailer in physical stores or online

Table B.1: Shopping frequency by retailer for online and physical store grocery shopping, by segment

	Clusters (with number and short name[$])					
Shopping frequency[#]	**IU**	**OO**	**UM**	**WS**	**RR**	**All**
Online retailers: once a month or more*						*(N=2032)*
Amazon	46%	9%	6%	6%	3%	10%
Asda	52%	22%	20%	16%	10%	21%
Iceland	43%	15%	18%	7%	6%	15%
Morrisons	48%	15%	13%	7%	10%	15%
Ocado	33%	5%	2%	2%	1%	6%
Sainsbury's	53%	23%	16%	14%	10%	20%
Tesco	64%	39%	26%	26%	12%	30%
Waitrose	40%	7%	5%	4%	3%	8%
Supermarket/discounter retailers: once a month or more*						*(N=2032)*
Aldi	54%	30%	36%	36%	41%	37%
Asda	64%	36%	38%	40%	35%	40%
Iceland	48%	24%	28%	20%	23%	26%
Lidl	51%	21%	29%	25%	27%	28%
M&S	53%	21%	18%	19%	21%	23%
Morrisons	54%	29%	34%	26%	42%	35%
Sainsbury's	67%	40%	41%	39%	44%	44%
Tesco	78%	57%	56%	61%	52%	59%
Waitrose	40%	14%	10%	14%	13%	15%
Convenience store retailers: once a month or more*						*(N=2032)*
SPAR, Londis, Budgens, etc.	52%	14%	16%	14%	11%	18%
Tesco Express, SB's Local, etc.	74%	42%	36%	43%	32%	42%
Co-op Food	61%	32%	28%	32%	26%	33%
Convenience forecourts	56%	14%	12%	15%	9%	17%
Independents, corner shops	59%	24%	23%	26%	19%	27%

[$]IU=Intensive Urbanites, OO=Online Omnivores, UM=Uncaring Multitude, WS=Willing but Struggling, RR=Resisting and Responsible. [#]All were found to demonstrate statistically significant differences *between* segments (determined by using either Chi-Square or Kruskal–Wallis tests of difference). *For any product type. SB's=Sainsbury's.

REFERENCES

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50 (2), 179-211.

Anable, J., 2005. 'Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behavior segments using attitude theory. Transport Policy 12 (1), 65-78.

Asger Nielsen, N., Ramus, K., 2005. Online grocery retailing: what do consumers think? Internet Research 15 (3), 335-352.
Atkins, K.G., Kumar, A., Kim, Y.-K., 2016. Smart grocery shopper segments. Journal of International Consumer Marketing 28 (1), 42-53.
Babin, B.J., Darden, W.R., Griffin, M., 1994. Work and/or Fun: Measuring Hedonic and Utilitarian Shopping Value. J. Cons. Res. 20 (4), 644-656.
Badrinarayanan, V., Becerra, E.P., 2018. Shoppers' attachment with retail stores: Antecedents and impact on patronage intentions. Journal of Retailing and Consumer Services.
Bawa, K., Ghosh, A., 1999. A Model of Household Grocery Shopping Behavior. Marketing Letters 10 (2), 149-160.
Caliński, T., Harabasz, J., 1974. A dendrite method for cluster analysis. Communications in Statistics 3 (1), 1-27.
Cao, X., Xu, Z., Douma, F., 2012. The interactions between e-shopping and traditional in-store shopping: an application of structural equations model. Transportation 39 (5), 957-974.
Çelik, H., 2011. Influence of social norms, perceived playfulness and online shopping anxiety on customers' adoption of online retail shopping. International Journal of Retail & Distribution Management 39 (6), 390-413.
Chetthamrongchai, P., Davies, G., 2000. Segmenting the market for food shoppers using attitudes to shopping and to time. British Food Journal 102 (2), 81-101.
Chi, T., 2018. Understanding Chinese consumer adoption of apparel mobile commerce: An extended TAM approach. Journal of Retailing and Consumer Services 44, 274-284.
Chu, J., Arce-Urriza, M., Cebollada-Calvo, J.-J., Chintagunta, P.K., 2010. An Empirical Analysis of Shopping Behavior Across Online and Offline Channels for Grocery Products: The Moderating Effects of Household and Product Characteristics. Journal of Interactive Marketing 24 (4), 251-268.
CRR, 2018. Online Retailing: Britain, Europe, US and Canada 2017, last accessed at http://www.retailresearch.org/onlineretailing.php on 22/06/2018. Centre for Retail Research.
Davis, F.D., Bagozzi, R.P., Warshaw, P.R., 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science 35 (8), 982-1003.
DfWP, 2017. Households Below Average Income: An analysis of the UK income distribution: 1994/95-2015/16. Department for Work and Pensions, London, UK.
Dittmar, H., 1992. The social psychology of material possessions: to have is to be. Harvester Wheatsheaf and St. Martin's Press, Hemel Hempstead. ISBN 9780312085384. Harvester Wheatsheaf and St. Martin's Press, Hemel Hempstead.
Doti, J.L., Sharir, S., 1981. Households' Grocery Shopping Behavior in the Short-Run: Theory and Evidence. Econ. Inq. 19 (2), 196-208.
Durand, B., Gonzalez-Feliu, J., 2012. Urban Logistics and E-Grocery: Have Proximity Delivery Services a Positive Impact on Shopping Trips? Procedia - Social and Behavioral Sciences 39, 510-520.
Edwards, J.B., McKinnon, A.C., Cullinane, S.L., 2010. Comparative analysis of the carbon footprints of conventional and online retailing: A "last mile" perspective. International Journal of Physical Distribution and Logistics Management 40 (1-2), 103-123.
Elms, J., de Kervenoael, R., Hallsworth, A., 2016. Internet or store? An ethnographic study of consumers' internet and store-based grocery shopping practices. Journal of Retailing and Consumer Services 32, 234-243.

Everts, J., Jackson, P., 2009. Modernisation and the Practices of Contemporary Food Shopping. Environment and Planning D: Society and Space 27 (5), 917-935.
Fabrigar, L.R., Wegener, D.T., MacCallum, R.C., Strahan, E.J., 1999. Evaluating the use of exploratory factor analysis in psychological research. Psychol. Methods 4 (3), 272-299.
Farag, S., Schwanen, T., Dijst, M., Faber, J., 2007. Shopping online and/or in-store? A structural equation model of the relationships between e-shopping and in-store shopping. Transp. Res.: Part A: Pol. Practice 41 (2), 125-141.
Fishbein, M., Ajzen, I., 1975. Belief, attitude, intention and behavior: An introduction to theory and research.
Floyd, F.J., Widaman, K.F., 1995. Factor analysis in the development and refinement of clinical assessment instruments. Psychol. Assess. 7 (3), 286-299.
Flynn, L.R., Goldsmith, R.E., 2016. Introducing the super consumer. Journal of Consumer Behavior 15 (3), 201-207.
Ganesh, J., Reynolds, K.E., Luckett, M., Pomirleanu, N., 2010. Online Shopper Motivations, and e-Store Attributes: An Examination of Online Patronage Behavior and Shopper Typologies. Journal of Retailing 86 (1), 106-115.
Gladding, N., 2016. Grocery Retail Forecast 2016 - 2021. The Institute of Grocery Distribution, Watford, UK.
Golob, T.F., 2001. Joint models of attitudes and behavior in evaluation of the San Diego I-15 congestion pricing project. Transportation Research Part A: Policy and Practice 35 (6), 495-514.
Golob, T.F., Horowitz, A.D., Wachs, M., 1977. ATTITUDE-BEHAVIOR RELATIONSHIPS IN TRAVEL DEMAND MODELLING, GMR-2398, Presented at the Third International Conference on Behavioral Travel Modelling, April 3-7, 1977, Tanunda, South Australia, p. 20.
Ha, S., Stoel, L., 2009. Consumer e-shopping acceptance: Antecedents in a technology acceptance model. J. Bus. Res. 62 (5), 565-571.
Hand, C., Riley, F.D.O., Harris, P., Singh, J., Rettie, R., 2009. Online grocery shopping: the influence of situational factors. European Journal of Marketing 43 (9/10), 1205-1219.
Hansen, T., 2008. Consumer values, the theory of planned behavior and online grocery shopping. International Journal of Consumer Studies 32 (2), 128-137.
Harris, P., Riley, F.D.O., Riley, D., Hand, C., 2017a. Online and store patronage: a typology of grocery shoppers. International Journal of Retail & Distribution Management 45 (4), 419-445.
Harris, P., Robinson, H., Riley, F.D.O., Hand, C., 2017b. Consumers' Multi-Channel Shopping Experiences in the UK Grocery Sector: Purchase Behavior, Motivations and Perceptions: An Extended Abstract, in: Rossi, P. (Ed.), Marketing at the Confluence between Entertainment and Analytics. Springer International Publishing, Cham, pp. 103-107.
Hartigan, J.A., Wong, M.A., 1979. Algorithm AS 136: A K-Means Clustering Algorithm. Journal of the Royal Statistical Society. Series C (Applied Statistics) 28 (1), 100-108.
Henry, G.T., 1990. Practical sampling. Sage, Newbury Park, CA.
Higham, J., Cohen, S.A., Peeters, P., Gössling, S., 2013. Psychological and behavioral approaches to understanding and governing sustainable mobility. Journal of Sustainable Tourism 21 (7), 949-967.

Huijts, N.M.A., Molin, E.J.E., Steg, L., 2012. Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. Renewable and Sustainable Energy Reviews 16 (1), 525-531.
IGD, 2017. UK Grocery Market Update: BFFF. Insight from IGD: Retail Analysis and ShopperVista. The Institute of Grocery Distribution, Watford, UK.
IGD, 2018. The online grocery path-to-purchase. The Institute of Grocery Distribution, Watford, UK.
Jackson, P., del Aguila, R.P., Clarke, I., Hallsworth, A., de Kervenoael, R., Kirkup, M., 2006. Retail Restructuring and Consumer Choice 2. Understanding Consumer Choice at the Household Level. Environment and Planning A: Economy and Space 38 (1), 47-67.
Kish, L., 1965. Survey sampling. Wiley, New York.
Kleijnen, M., de Ruyter, K., Wetzels, M., 2007. An assessment of value creation in mobile service delivery and the moderating role of time consciousness. Journal of Retailing 83 (1), 33-46.
Klöckner, C.A., 2014. The dynamics of purchasing an electric vehicle – A prospective longitudinal study of the decision-making process. Transportation Research Part F: Traffic Psychology and Behavior 24, 103-116.
Konuş, U., Verhoef, P.C., Neslin, S.A., 2008. Multichannel Shopper Segments and Their Covariates. Journal of Retailing 84 (4), 398-413.
Kroesen, M., Handy, S., Chorus, C., 2017. Do attitudes cause behavior or vice versa? An alternative conceptualization of the attitude-behavior relationship in travel behavior modeling. Transportation Research Part A: Policy and Practice 101, 190-202.
Kryszczuk, K., Hurley, P., 2010. Estimation of the Number of Clusters Using Multiple Clustering Validity Indices, in: El Gayar, N., Kittler, J., Roli, F. (Eds.), Multiple Classifier Systems. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 114-123.
Lee, R.J., Sener, I.N., Mokhtarian, P.L., Handy, S.L., 2017. Relationships between the online and in-store shopping frequency of Davis, California residents. Transp. Res.: Part A: Pol. Practice 100, 40-52.
Lee, Y., Kozar, K., Larsen, K., 2003. The Technology Acceptance Model: Past, Present, and Future. Communications of the Association for Information Systems 12.
Marshall, G., Pires, T., 2017. Measuring the Impact of Travel Costs on Grocery Shopping. The Economic Journal 128 (614), 2538-2557.
McKinnon, A.C., Cullinane, S.L., Edwards, J.B., 2010. Comparative analysis of the carbon footprints of conventional and online retailing: A “last mile” perspective. International Journal of Physical Distribution & Logistics Management 40 (1/2), 103-123.
Midgley, D.F., Dowling, G.R., 1978. Innovativeness: The Concept and Its Measurement. J. Cons. Res. 4 (4), 229-242.
Milligan, G.W., Cooper, M.C., 1985. An examination of procedures for determining the number of clusters in a data set. Psychometrika 50 (2), 159-179.
Mokhtarian, P.L., Ory, D.T., Cao, X., 2009. Shopping-Related Attitudes: A Factor and Cluster Analysis of Northern California Shoppers. Environment and Planning B: Planning and Design 36 (2), 204-228.
Mortimer, G., Weeks, C.S., 2019. How unit price awareness and usage encourages grocery brand switching and expenditure. Journal of Retailing and Consumer Services 49, 346-356.
Morton, C., Anable, J., Nelson, J.D., 2016. Assessing the importance of car meanings and attitudes in consumer evaluations of electric vehicles. Energy Efficiency 9 (2), 495-509.

Morton, C., Anable, J., Nelson, J.D., 2017. Consumer structure in the emerging market for electric vehicles: Identifying market segments using cluster analysis. International Journal of Sustainable Transportation 11 (6), 443-459.
Müller, H., Hamm, U., 2014. Stability of market segmentation with cluster analysis – A methodological approach. Food Quality and Preference 34, 70-78.
Nakano, S., Kondo, F.N., 2018. Customer segmentation with purchase channels and media touchpoints using single source panel data. Journal of Retailing and Consumer Services 41, 142-152.
NRS, 2018. Scotland's Census 2011, last accessed at http://www.scotlandscensus.gov.uk/ on 23/02/2018. National Records of Scotland, Edinburgh.
OECD, 1999. Economic and Social Impact of E-commerce: Preliminary Findings and Research Agenda. OECD, Paris.
ONS, 2017. Census 2011, Data last accessed 27/02/2018 at https://www.nomisweb.co.uk. Office of National Statistics, London.
Punj, G., Stewart, D.W., 1983. Cluster Analysis in Marketing Research: Review and Suggestions for Application. J. Marketing Res. 20 (2), 134-148.
Putrevu, S., Lord, K.R., 2001. Search dimensions, patterns and segment profiles of grocery shoppers. Journal of Retailing and Consumer Services 8 (3), 127-137.
Rohm, A.J., Swaminathan, V., 2004. A typology of online shoppers based on shopping motivations. J. Bus. Res. 57 (7), 748-757.
Sands, S., Ferraro, C., Campbell, C., Pallant, J., 2016. Segmenting multichannel consumers across search, purchase and after-sales. Journal of Retailing and Consumer Services 33, 62-71.
Sarstedt, M., Mooi, E., 2014. Cluster Analysis, A Concise Guide to Market Research. Springer, Berlin, Heidelberg.
Schwartz, S.H., 1977. Normative Influences on Altruism11This work was supported by NSF Grant SOC 72-05417. I am indebted to L. Berkowitz, R. Dienstbier, H. Schuman, R. Simmons, and R. Tessler for their thoughtful comments on an early draft of this chapter, in: Berkowitz, L. (Ed.), Advances in Experimental Social Psychology. Academic Press, pp. 221-279.
Suel, E., Polak, J.W., 2017. Development of joint models for channel, store, and travel mode choice: Grocery shopping in London. Transp. Res.: Part A: Pol. Practice 99, 147-162.
Suri, R., Monroe, K.B., 2003. The Effects of Time Constraints on Consumers' Judgments of Prices and Products. J. Cons. Res. 30 (1), 92-104.
Tang, W., Mokhtarian, P.L., 2009. Accounting for Taste Heterogeneity in Purchase Channel Intention Modeling: An Example from Northern California for Book Purchases. Journal of Choice Modelling 2 (2), 148-172.
Timmermans, H., 1983. NON-COMPENSATORY DECISION RULES AND CONSUMER SPATIAL CHOICE BEHAVIOR: A TEST OF PREDICTIVE ABILITY*. The Professional Geographer 35 (4), 449-455.
Triandis, H.C., 1977. Interpersonal Behavior. Brooks/Cole, Monterey, CA.
UK Government, 2019. What qualification levels mean, accessed at https://www.gov.uk/what-different-qualification-levels-mean on 05/07/2019. UK Government, London.

van Wee, B., De Vos, J., Maat, K., 2019. Impacts of the built environment and travel behavior on attitudes: Theories underpinning the reverse causality hypothesis. Journal of Transport Geography 80, 102540.
Wang, Q., Yang, X., Song, P., Sia, C.L., 2014. Consumer segmentation analysis of multichannel and multistage consumption: A latent class MNL approach. Journal of Electronic Commerce Research 15 (4), 339-358.
Widaman, K.F., 1993. Common Factor Analysis Versus Principal Component Analysis: Differential Bias in Representing Model Parameters? AU - Widaman, Keith F. Multivariate Behavioral Research 28 (3), 263-311.
Wiese, A., Zielke, S., Toporowski, W., 2015. Shopping travel behavior. International Journal of Retail & Distribution Management 43 (4/5), 469-484.
Williams, B., Bhaumik, C., Silk, A., 2015. Consumer Empowerment survey report, Report on a segmentation of the general public. GfK NOP Social Research for the then Department for Business, Innovation and Skills, London.