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RESEARCH ARTICLE

Everywhere and at All Times: Mobility, Consumer Decision-Making, and Choice

Nicholas H. Lurie[1] · Jonah Berger[2] · Zoey Chen[3] · Beibei Li[4] · Hongju Liu[1] · Charlotte H. Mason[5] · David M. Muir[6] · Grant Packard[7] · Joseph Pancras[1] · Ann E. Schlosser[8] · Baohong Sun[9] · Rajkumar Venkatesan[10]

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Abstract Advancements in mobile technologies mean that consumers can engage the digital world wherever they are and whenever they want. This intersection between the digital and the physical has important implications for consumer decision-making. We propose that mobile ecosystems vary in their capabilities and pervasivity (i.e., the degree to which a mobile ecosystem is accessible everywhere and at all times). Further, we propose that accounting for distinguishing aspects of mobile ecosystems, the context in which mobile ecosystems are used, and interactions between mobile ecosystems and mobile contexts are critical in advancing theoretical and substantive understanding of the role of mobile technologies in the marketplace. Based on this perspective, we identify important research topics as well as opportunities and challenges for modeling mobile consumer decision-making.

Keywords Decision-making · Choice behavior · Digital marketing · Mobile marketing · Electronic commerce

Dramatic improvements in mobile technologies allow consumers to search for information, make choices, and consume

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✉ Nicholas H. Lurie
lurie@uconn.edu

Jonah Berger
jberger@wharton.upenn.edu

Zoey Chen
zchen@bus.miami.edu

Beibei Li
beibeili@andrew.cmu.edu

Hongju Liu
hongju.liu@uconn.edu

Charlotte H. Mason
cmason@uga.edu

David M. Muir
muir@udel.edu

Grant Packard
gpackard@wlu.ca

Joseph Pancras
joseph.pancras@uconn.edu

Ann E. Schlosser
aschloss@u.washington.edu

Baohong Sun
bhsun@ckgsb.edu.cn

Rajkumar Venkatesan
venkatesanr@darden.virginia.edu

[1] University of Connecticut, Storrs, CT, USA
[2] University of Pennsylvania, Philadelphia, PA, USA
[3] University of Miami, Coral Gables, FL, USA
[4] Carnegie Mellon University, Pittsburgh, PA, USA
[5] University of Georgia, Athens, GA, USA
[6] University of Delaware, Newark, DE, USA
[7] Wilfrid Laurier University, Waterloo, ON, Canada
[8] University of Washington, Seattle, WA, USA
[9] Cheung Kong Graduate School of Business, Beijing, China
[10] University of Virginia, Charlottesville, VA, USA

products and services wherever they are and whenever they want. Increased mobility is not simply untethered computing; it means bringing new information sources, marketing communication, data processing, and recommendation agents into diverse offline contexts where it augments, and sometimes competes with, traditional ways in which consumers gather information and make choices. In other words, mobility facilitates interactions between digital and physical worlds over time, and these interactions raise new research questions and challenges.

Despite calls for mobile consumer research [20], extant research offers limited insights into how mobility changes the psychological underpinnings of consumer cognitions, decision-making, and choice. Mobile has generally been described in binary and static terms, in which today's smartphones are contrasted with fixed desktops rather than accounting for the array of evolving hardware, software, and connectivity options with and through which consumers interact. Recent research on "mobile" or the "mobile internet" uses these terms to refer to marketing and marketplace behavior via smartphones [e.g., [2, 18, 47]]. However, smartphones are merely one way by which mobile ecosystems, by connecting consumers to online resources everywhere and at all times, impact consumer behavior. As Lamberton and Stephen [26] point out, mobile media along with social and other digital media offer new ways for firms and consumers to interact with each other. In a similar vein, Novak and Hoffman [34] utilize assemblage theory to conceptualize mobile apps as only one element of the Internet of Things (IOT), arguing that IOT assemblages of consumers, information, and devices create new and unique emergent capacities. Grewal et al. [19] take a more focused approach, describing several broad research areas in the domain of mobile advertising, organized around environmental context, advertising goals, and metrics. More specifically, Bart et al. [4] demonstrate that category characteristics such as involvement and utilitarian benefits can impact the effectiveness of mobile display advertising. Several related papers [2, 16, 29] utilize field experiments to measure the impact of flexible targeted mobile promotions using contextual dimensions such as crowdedness, competitive locational targeting (geoconquesting), and spatio-temporal attributes.

In contrast to such research, we propose that mobile be thought of as a continuum in which mobile ecosystems vary in terms of informational *capabilities* (i.e., the ability to transmit, process, and receive information) and *pervasivity* (i.e., the degree to which a mobile ecosystem is accessible everywhere and at all times). By focusing on mobile affordances, rather than particular technologies, we seek to develop a perspective that will remain relevant in the face of technological change. We treat mobility as an ecosystem whose combined parts (e.g., hardware, software, network, and cloud-based computing) determine capabilities and pervasivity. Further, we propose that accounting for distinguishing aspects of mobile ecosystems, the contexts in which mobile ecosystems are used, and interactions between mobile ecosystems and mobile contexts are critical in advancing theoretical and substantive understanding of the role of mobility in the marketplace.

We develop a conceptual model that identifies how mobile ecosystems are likely to impact consumer information search, decision-making, and consumption. Our framework is purposely not tied to any particular technology or ecosystem in order to increase its relevance for future, and currently unknown, technologies. In addition to limiting our scope to consumptive activities, we focus on those aspects that are particular to the mobile experience rather than aspects, such as presence and telepresence, that are important to communicative technologies more generally.

Out of the conceptual model stems several broad research topics. We provide illustrative examples of how these can be turned into testable research predictions. Our hope is that this broad, and admittedly non-exhaustive, approach will help researchers gain new insights into mobile consumer behavior.

1 Mobile Decision-Making and Choice

Two factors are likely to directly and interactively affect mobile decision-making and choice. The first involves the capabilities and pervasivity [i.e., affordances; [27]] of the mobile ecosystem. Capabilities refer to the range of ways in which a mobile ecosystem can be used to perform consumer tasks. Pervasivity refers to the extent to which consumers can use a mobile ecosystem to perform these tasks anywhere and at any time. The second is the mobile context, which often involves information-rich settings—including out-of-doors and in-store environments, physical movement by the consumer who may be walking or driving, and potentially limited cognitive resources due to competition from other attentional tasks. Importantly, the mobile context should play an important role of moderating the relationship between the mobile ecosystem and the decision processes. Decision processes, in turn, should mediate the relationship between the mobile ecosystem, the mobile context, and their interaction to affect choice outcomes—including offline purchases—and decision satisfaction. When consumers repeatedly use mobile ecosystems in particular contexts (e.g., walking outside, on the train, near the refrigerator), they may develop associations with concepts that may remain salient even when these contexts are withdrawn. We refer to these associations as a mobile mindset. Figure 1 outlines the proposed conceptual model and associated research topics, which we expand on as follows.

For the sake of brevity, we limit our discussion of other factors, such as differences in consumer capabilities or other individual state and trait differences, which could contribute to

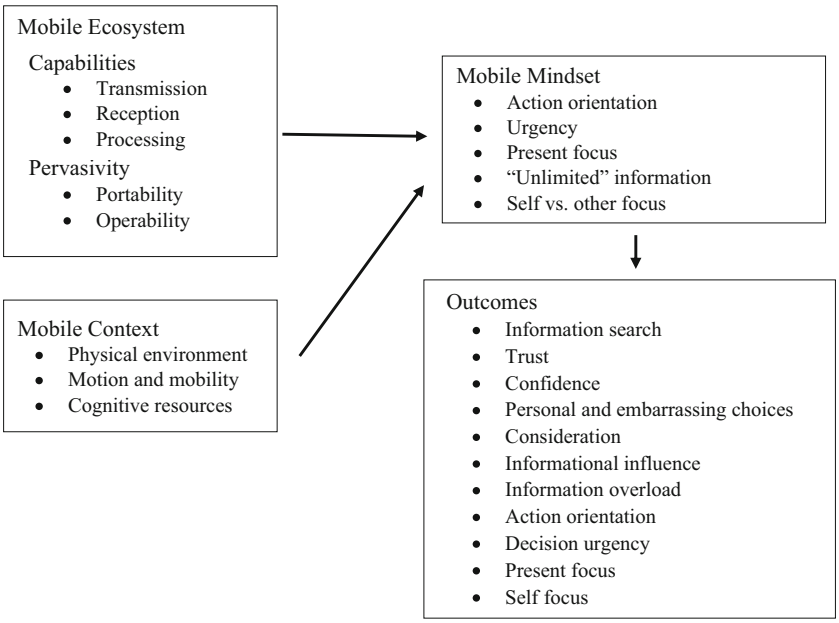

Fig. 1 Conceptual model

the effects of the mobile ecosystem on decision processes and choices outcomes.

2 Mobile Ecosystems

Mobile ecosystems describe a set of Internet-enabled (online) communication and information technologies that aid human cognition and behavior untethered to a specific physical location. These include physical hardware (devices), programmed procedures that provide functional capabilities (software), coupled with cloud-based computing and data resources that enhance their capabilities. Consumer differences in ecosystem components, such as self-contained applications ("apps") and individual hardware and cloud resources, lead to heterogeneity in mobile capabilities. Mobile ecosystems include those for which the hardware is tethered or typically fixed in space but allows a person to use them while walking around (e.g., home automation devices such as Amazon's Echo or the Sonos sound system). Mobile ecosystems depend on the current state of information technologies as well as marketer and intermediary decisions about developing and deploying these technologies.

While smartphones are likely the prototype that comes to mind when talking about mobility, an exploding array of mobile technologies expand the scope of mobile computing. These include activity trackers like the Fitbit, smart watches, wearable technologies such as the Microsoft HoloLens, smart cars, and so on. To sum, our conception of mobile ecosystems includes the diversity of current and future tools that can be used or accessed while the consumer is in a state of motion.

To examine the impact of mobility on consumer decision-making and choice, we propose a framework that highlights two important dimensions of mobile systems: capabilities and pervasivity. While not exhaustive, they help elucidate important research questions about how mobility affects consumer decision-making and choice behavior. We believe the two dimensions are independent in that the information transmission and processing capabilities of mobile ecosystems are independent of their ability to be used anywhere and at all times. Figure 2 offers examples of devices plotted on the two proposed dimensions. For example, smartphones are positioned as the current (2017) prototype given their relatively high performance on both capabilities and pervasivity, while Fitbit is presently high on pervasity but low on capabilities.

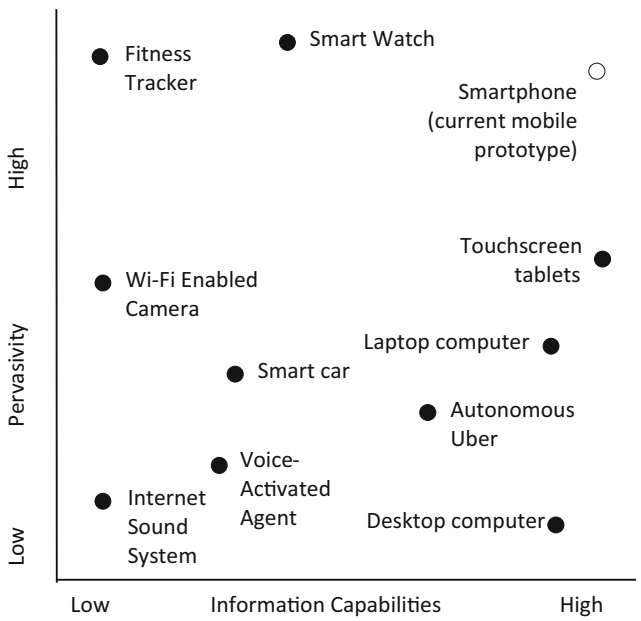

Fig. 2 Mobile ecosystem capabilities and pervasivity

Some devices from the Internet of Things, such as smart refrigerators, would be low in both their information capabilities and pervasivity while others, such as smart cars, have higher levels of each of these dimensions.

2.1 Capabilities

Mobile capability refers to the ability of a device ecosystem to transmit, receive, and process information. Transmission, reception, and processing combine to affect (tele-) presence [i.e., the extent to which the user feels they are virtually in another place, [43]].

2.1.1 Transmission

Most mobile ecosystems can transmit information via touchscreen, keyboard, and/or voice, as well as video and images. While some ecosystem components may be particularly suited for specific transmission tasks (e.g., laptops with their large keyboards facilitate long-form writing), they may lack informational transmission capabilities due to weakness in capturing diverse forms of data, such as spatial locations or movement information. Input and output device constraints such as traditional (non-touch) keyboard and small screens may inhibit information transmission. Information transmission also describes the extent to which the mobile ecosystem facilitates commercial transactions (e.g., sending secure payment information through Apple Pay).

Information transmission also includes the ability to transmit contextual information in real time. For example, most smartphones can capture and transmit the user's spatial/geographic location, direction of movement, and current audial or visual environment. Other mobile technologies, such as Hexoskin's Smart Shirt, capture biometrics (e.g., heart rate, breathing, sleep position). This captured information can be transmitted to another mobile device or cloud-based resources for processing or can be transmitted to other consumers.

2.1.2 Reception

As with information transmission, characteristics of mobile ecosystem components can enhance or inhibit information reception. For example, screen size, bandwidth, and support for different information formats (such as JavaScript) may affect the volume and nature of information received on a given mobile technology. However, mobile ecosystems may offer alternative means through which information can be received, such as voice (e.g., Amazon's Alexa) or haptic feedback (e.g., the Apple Watch).

2.1.3 Processing

Mobile ecosystems vary in their processing capability. More powerful mobile technologies such as smartphones receive, transmit and/or process diverse forms of data (e.g., visual/graphical, audial, textual, movement), making them higher on the informational dimension of capabilities.

2.2 Pervasivity

While examining pervasivity in the context of mobile seems almost tautological, variation on this dimension is a central factor that impacts consumer behavior. Portability and operability are two dimensions of pervasivity that influence the likelihood that a given mobile ecosystem is employed anywhere and all the time.

2.2.1 Portability

Portability refers to the ease with which a particular mobile ecosystem can accompany the consumer wherever she goes. For example, mobile technology that can be easily carried in one's pocket or purse (a typical smartphone) is more freely and easily moved than one that must be carried by hand or in a container (e.g., an iPad or laptop). Even more mobile are wearable technologies (e.g., Fitbit, Google Glass, Hexoskin Smart Shirt) that do not need to be carried.

2.2.2 Operability

Operability refers to the ability to use a mobile ecosystem in all types of circumstances. For example, Google's CarPlay facilitates mobile interactions while driving and mobile ecosystems vary in their ability to recognize speech in loud environments. Ecosystems that connect to cellular as well as Wi-Fi networks can be used in more places. Mobile devices that can be used unobtrusively are more likely to be used in settings in which mobile use is not condoned. Mobile devices that work with limited user input are also higher in operability.

2.3 Mobile Ecosystem Research Topics

As a mobile ecosystem's information capabilities and pervasivity increase, so does the likelihood that it impacts consumer attitudes and behavior. However, significant opportunities are available for theory development and substantive insight regarding how, when, and why mobile ecosystems intervene in consumer decision-making and whether these interventions have a positive or negative impact on consumer behavior. While differences in mobile ecosystem characteristics can lead to a nearly inexhaustible array of research topics and testable predictions, we introduce a few that show the value of considering capability and pervasivity when conducting research on how mobility affects consumer decision-making.

2.3.1 Information Search

Research could examine how mobile ecosystem capabilities and pervasivity impact information search. For example, because many mobile technologies constrain information reception and transmission (i.e., through small screens and keyboards), enhanced access to search resources may be offset by limited search duration [31]. This device constraint may lead to search processes that blur distinctions between deep, systematic, information collection and processing using more shallow, heuristic, methods [22]. Whether and when a mobile ecosystem has a significant impact on search should depend on the ecosystem's information capabilities (e.g., whether and how it receives, processes, and transmits decision-relevant information) and pervasivity (e.g., whether the ecosystem is available at the right place and time). Assuming consumers often have the goal of making a purchase (vs. not making a purchase), research could examine whether consumers are more likely to access positive reviews when using mobile ecosystems that are more pervasive. Examples of testable predications are that greater information capabilities and pervasivity (a) increase the amount of information accessed but not the time spent on search, (b) decrease breadth of search using mobile versus non-mobile ecosystems, (c) decrease time to make decisions, and (d) increase search for more decision confirming information.

2.3.2 Trust

Research could also examine how differences in capabilities and pervasivity affect the extent to which consumers trust mobile ecosystems. Prior research shows that greater investments in website appearance and usability enhance consumer beliefs about marketer abilities, one dimension of consumer trust [38]. Mobile ecosystems with highly specialized information capabilities may be viewed as more credible, because they are highly salient and possibly perceived as more expert in specific decision domains [36]. For example, when driving a smart electric car, a consumer may be more likely to visit a nearby charging station when the station's location pops up as a prompt on the car's screen than a smartphone. When buying running shoes, a specialized device such as a Fitbit may be considered a more reliable source than a smartphone app such as Runkeeper when a consumer wants to estimate their typical running distance. At the same time, variations in the capability of mobile ecosystems to present vivid and compelling information may moderate these effects [36].

Other research could examine perceived differences in source credibility for mobile ecosystems versus people. For example, when evaluating energy saving improvements to a home, a consumer may need to decide how much to weigh information from a (novice) friend, an expert credentialed human energy auditor, or information transmitted to a smartphone or tablet from a Nest thermostat [7]. Testable predictions are that information from mobile ecosystems with more specialized (vs. general) information capabilities will be (a) more trusted, (b) more heavily weighted in judgment and choice, and (c) more heavily weighted relative to information from human novices. Human experts, however, will be more trusted on all these dimensions than such mobile ecosystems.

2.3.3 Confidence

Mobile ecosystems offer nearly limitless opportunities to access online information whenever and wherever wanted. Greater information accessibility offers disparate and interesting predictions for judgment and decision-making. On one hand, the mere access to information via mobile ecosystems may provide a false sense of knowledge [15], and consumers might become overconfident in judgment. On the other hand, mobile ecosystems also provide access to more options (compared to shopping in a physical retail location). As a result, people may feel they have more options, feel less confident, and have more decision-making regret [21]. Testable predictions are that greater pervasivity leads to (a) overconfidence in choice and (b) more decision regret.

2.3.4 Personal Choices

Given the link between the pervasivity and the tendency for the user to have the device with them at all times, technologies high in pervasivity should not only facilitate purchases in general but should also enhance purchases of particular product categories more than others. Heightened pervasivity increases contact between the consumer and her mobile technology from morning rituals, to the gym, workplace, family time at home, evenings out, and even while sleeping through the use of biological or movement trackers. The constant physical presence and physical touch aspects of mobile devices lead to strong emotional and psychological connections between mobile devices and users and greater endowment effects for mobile purchases [8, 44, 45]. Other research suggests that wearables will be perceived as closer, because they serve as symbolic extensions of the self [5].

Greater information capabilities, including storage, increase the amount of personal information associated with a mobile system. That is, mobile devices are interactive diaries of their owners' lives; a place where user thoughts, memories, experiences, and social connections reside. Removing mobile devices from their owners can lead to anxiety, stress, and feelings of abandonment [17, 37]. Together, these aspects of mobile ecosystems should make them more personal and private.

If mobile devices are seen as more private, their use may increase the propensity to make socially undesirable

purchases. While the Internet-enabled personal computer has been described as enabling otherwise embarrassing shopping behavior [25], of potential interest is whether the perceived privacy of mobile shopping environments persists even in highly public settings (e.g., purchasing sex-related products on a smartphone while in a shopping mall). Testable predictions are that greater pervasivity increases (a) the extent to which mobile devices are perceived as part of the extended self, (b) the extent to which mobile devices are used for purchase reflecting one's own (vs. others') preferences, and (c) use of the device for purchases of potentially embarrassing products and services in public settings.

3 Mobile Context

Some of the most interesting research findings on mobile consumer behavior are likely to come from interactions between mobile ecosystems and mobile contexts. Changes in the physical environment, the use of mobile devices while moving, constraints on cognitive resources, and differences in consumer mind-sets and goals are likely to be important moderators of the effects of mobile ecosystems on consumer decision-making and choice.

Mobile ecosystems also differ from Internet-supported decision-making on fixed devices (desktop computers) and physical decision support information in terms of the contexts in which they are used. Usage of mobile ecosystems can be far less limited by time of day or by consumer location. These differences in usage context should have significant impacts on decision-making.

3.1 Physical Environment

Although capabilities and pervasivity determine the extent to which a particular mobile ecosystem facilitates mobile consumer behavior, the benefits and use of these ecosystems depend very much on the context in which they are used. With no time or location restrictions, mobile ecosystems are often used when the consumer is physically and temporally close to a decision-making site (e.g., comparing TVs on a mobile app on the way to a retail store). Further, unlike desktop computers, mobile ecosystems can be used in public spaces such as retail environments, where they can provide online information that supplements and interacts with information available in the physical and social environment. These differences in the mobile usage context should impact consumer information search, consideration, and choice.

3.2 Motion

Mobility entails movement. Mobile devices can be used while traveling to a specific destination, wandering without a purposeful destination, or visiting a place for a limited time before moving on [e.g., standing in front of a product display at a store; [3, 39]]. Each of these involves (a) changes in context during device use and (b) use in novel contexts. These changing contexts may lead to greater variation in purchase behavior by mobile consumers. For example, Andrews et al. [2] find that increased crowding in a subway (in China) increases response to mobile ads. They also imply that mobile technologies are less likely to be associated with particular places and times than tethered technologies.

3.3 Cognitive Resources

Since mobile ecosystems are often used when en route to a decision-making destination, planning and research are likely to be reduced. Further, increased cognitive load from multitasking (e.g., simultaneously texting, navigating, and driving) means that mobile consumers should have fewer cognitive resources available to devote to information search and decision-making tasks. This may lead to an inability to process stimuli systematically even if engagement is high. Limited planning, and limited ability to deeply process information, means that consumers are less likely to form strong attitudes and preferences even when highly motivated to do so [22, 35].

3.4 Mobile Context Research Topics

The interaction between mobile ecosystem characteristics (capabilities and pervasivity) and usage context (physical environment, motion, and cognitive resources) suggests a number of research topics around the product consideration, the relative impact of mobile versus non-mobile information, and the influence of incidental information.

3.4.1 Consideration

Mobile use in physical retail settings, and the combining of digital and real-world information, may lead to consumer behavior that is distinct from that observed in digital or traditional retail environments. For example, research on mobile consumer behavior may challenge dominant information processing paradigms in which consumers retrieve brands from memory and narrow these to form a consideration set [23]. There is potential to explore the possibility of a reverse funnel in search, whereby a consumer who is close to making a product choice expands their consideration set as a result of searching for online information at the point of sale [49]. This suggests the testable prediction that consumers using mobile ecosystems in retail settings will have larger consideration sets than those shopping at home or those shopping in retail settings without using mobile.

3.4.2 Informational Influence

Another question is how mobile systems compete with the physical world for user attention and how this affects behavior. The direction of these effects is not obvious. For example, although greater pervasivity should increase the likelihood that a mobile ecosystem is used as an information source [i.e., it is more accessible, [14]], to the extent that pervasivity is driven by small hardware formats, mobile information may be less immersive and less transportive [13, 33]. This leads to competing predictions. For example, one might argue that the user of a small-screen smartphone is more likely to be influenced by information in the physical environment than the user of a larger-screen tablet. This prediction may be stated as, when mobile consumers are shopping in in-store environments, (a) greater pervasivity increases the relative weight of online versus in-store information in judgment and choice and (b) this effect increases with information capability. Alternatively, one might argue that the tablet's lower pervasivity but higher capabilities enhance its decision-making influence since it tends to be more noticeable and salient than a smartphone that may be forgotten once it is out of sight. This alternative prediction may be stated as (a) greater pervasivity reduces the relative weight of online versus in-store information in judgment and choice and (b) this effect reduces with information capability.

3.4.3 Information Overload

To the extent that consumers who are in motion have fewer cognitive resources to bring to decision-making tasks, they may be more influenced by incidental information—such as an in-store coupon—or may rely more heavily on heuristics (such as picking default options) when making decisions [24]. Relatedly, if mobile technologies are used in environments with competing informational inputs, such as in-store advertising, consumers may experience information overload, resulting in suboptimal decisions and failure to choose [21, 30]. Testable predictions are that greater motion (a) increases the influence of price cues, (b) increases the use of heuristics in choice, and (c) reduces decision quality and the likelihood of making a choice at all.

4 Mobile Mind-set

Beyond mobile ecosystem characteristics and their interaction with usage context, mobile technologies may also affect decision-making via *learned associations*. Learned associations are concepts consumers associate with mobile due to repeated use of mobile ecosystems in particular contexts (e.g., while walking, on the train, near the refrigerator) that may be salient even when consumers are away from these contexts. Using or seeing a mobile device may trigger these associations, leading consumers to reenact mobile behaviors in new contexts.

More generally, mobile device usage may lead to the development of a *mobile mind-set*. One way a mobile mind-set may be engaged is through the presence of a mobile device. For example, research shows that having one's cell phone in the same room, even if it is not being used, reduces working memory and fluid intelligence [48]. In other words, mobile technologies may prime a mind-set that affects decision-making processes and outcomes. Another way a mobile mind-set may work is to change the way consumers act in non-mobile contexts. For example, frequent use of a mobile device to look for information or messages may reduce the ability to pay attention and not get distracted in non-mobile contexts. This implies that greater mobile use will reduce the consumer's ability to process complex media messages. Some suggest that frequent mobile users are less skilled at in-person social interactions [46]. This might mean that greater mobile use leads consumers to eschew help from sales representative in retail settings even in situations where such help may be superior to that available through a mobile device. Similarly, the ability to use mobile technology to satisfy wants and needs all the time may lead consumers to have similar expectations in other contexts.

4.1 Mobile Mind-set Research Topics

4.1.1 Action Orientation

The consumer's physiological state—doing versus thinking—is another contextual variable that accompanies mobile usage. This contextual distinction offers interesting predictions for decision-making. If consumers use mobile ecosystems while physically and/or temporally progressing towards a goal, they may be more contextually focused on doing than planning. Mobile use in such action-oriented contexts could lead to a preference for more accessible, default choices (i.e., more heuristic decision-making) over careful purchase consideration. A state of physical motion may also impact the perception of a time's passage [9], leading to greater temporal discounting [42], or higher willingness to pay for convenience and/or products that are temporally favorable (e.g., a preference for faster but more expensive transportation). Testable predictions are that increased use of mobile devices is associated with (a) greater impulsivity in decision-making, (b) greater tendency to select default choices, (c) greater temporal discounting, (d) stronger preference for feasible versus desirable choice alternatives, and (e) lower price versus time sensitivity.

4.1.2 Decision Urgency

One consequence of frequent use of mobile systems in motion, or en route to an activity or destination, is that people may associate mobile with a feeling of being rushed. If so, consumers

might be motivated or primed to behave with a sense of urgency when completing tasks (e.g., make a purchase) and seek decision-confirming information (e.g., reasons to buy a product) rather than decision-disconfirming information (e.g., reasons not to buy a product) which would slow down completion of the purchase task. Testable predictions are that increased use of mobile devices is associated with (a) faster decision-making and (b) greater search for decision confirming (e.g., positive) information.

4.1.3 Temporal Focus

In addition to associating mobility with urgency, consumers may associate mobile with the present (rather than the future). This is because mobile ecosystems are often used for real-time problem solving (i.e., addressing unplanned issues that require quick decision-making). Thus, mobile decision-makers may be more guided by myopic desires than long-term goals. This suggests that items attractive on hedonic attributes (which appeal to the present, such as a chocolate bar) might be favored over products attractive on more utilitarian attributes [which appeal to the future, such as a granola bar, [40]]. Testable predictions are that increased use of mobile devices is associated with (a) greater focus on short-term versus long-term goals and (b) increased choice of hedonic (vs. utilitarian) products.

4.1.4 Self-Focus

Over time, mobile use may affect the extent to which consumers think about their own needs and wants versus those of others. On one hand, mobile ecosystems are often used in social exchange (for example, two friends might share fishing results using Casio smart watches) and so one might associate mobile with other people. On the other hand, because mobile devices are with their owners constantly and may be seen as extensions of the self [5], mobile might activate thoughts of the self (instead of others). Whether mobile use activates thoughts of the self versus others has implications for decisions that affect others such as the purchase of a family car. If mobile leads to a focus on the self, then consumers may act more selfishly, prioritizing individual preferences over those of others. A focus on the self might also reduce pro-social or helping behaviors. Testable predictions are that increased use of mobile devices is associated with (a) greater influence of others in decision-making, (b) more self- (vs. other) focused decisions, and (c) a reduction in pro-social activities. Table 1 summarizes the research topics and testable predictions.

5 Modeling Mobile Decision-Making

We propose a modeling framework that closely matches our conceptual model (Fig. 1). The dependent variables are the consumers' choice outcomes on mobile ecosystems. These choices may be driven by the interaction of ecosystem characteristics (e.g., hardware, software, cloud-based computing) and mobile use contexts and mediated by consumer decision processes.

Consumers make a wide range of choices when using mobile ecosystems, each of which can be used to address different research topics. For example, a key dependent variable is choice as revealed by purchases using mobile ecosystems with transactional capabilities. Other research topics require modeling pre-purchase search behavior, post-purchase satisfaction, word of mouth, or product return behavior. Channel, platform, and device choice are other dependent variables, as consumers choose between offline and online channels, between mobile and non-mobile ecosystems, and particular platforms (smartphone, tablet, laptop, desktop, etc.) in ways that account for ecosystem characteristics and decision contexts. This list of dependent variables is far from exhaustive. As mobile technologies and applications evolve, researchers may examine an increasing number of consumer choices and use of mobile-based crowdsourcing in physical store environments.

We propose that characteristics of mobile ecosystem capabilities and pervasivity are key independent variables that affect consumer choice. For example, we postulate that devices with low information capabilities may be viewed as more salient and possibly more trusted in specific decisions. We hypothesize that mobile ecosystems with high pervasivity may be perceived as more private, increasing consumer propensity to make socially undesirable purchases. We further propose that consumer choice outcomes depend on the context in which mobile systems are used. Aspects of the informational environment and cognitive constraints can also be examined as explanatory variables.

An essential input to our modeling framework is accounting for consumer decision processes. These are the behavioral mechanisms behind the decisions that consumers make when using mobile ecosystems and suggest how models should be structured to reflect the underlying decision mechanism. For example, the research topic of temporal focus raises questions about whether mobile consumers pursue myopic desires or long-term goals. While a static model is appropriate if consumers are myopic, accounting for long-term goals may require a dynamic structural model [e.g., [1]]. As another example, to account for consumer search behavior and learning from different information sources, a Bayesian learning model can be applied [e.g., [10]]. Other decision processes may be related to social influence, switching costs, search costs, and so on. The rich set of mobile behavior mechanisms poses both challenges and opportunities, rendering it a fruitful area for modeling research.

5.1 Endogeneity

A central theme in our conceptual framework involves understanding how consumer choice behavior is different on mobile

Table 1 Research topics and testable predictions

Research topic	Testable predictions
Capabilities and pervasivity	
Information search	Greater information capabilities and pervasivity:
	(a) increase the amount of information accessed but not the time spent on search;
	(b) lead to narrower search on mobile versus non-mobile ecosystems;
	(c) increase the use of mobile devices in consumer search;
	(d) lead to faster decisions;
	(e) increase search for decision confirming information.
Trust	Information from mobile ecosystems with more specialized information capabilities will be
	(a) more trusted;
	(b) more heavily weighted in judgment and choice;
	(c) more heavily weighted relative to information from human novices but not experts.
Confidence	Greater pervasivity leads to
	(a) overconfidence in choice;
	(b) more decision regret.
Personal choices	Greater pervasivity increases
	(a) the extent to which mobile devices are perceived as part of the extended self;
	(b) use of the device for purchases of potentially embarrassing products and services in public settings.
Mobile context	
Consideration	Consumers using mobile devices as shopping aids in retail settings will have larger consideration sets than consumers shopping at home or those shopping in retail settings without using mobile devices as shopping aids.
Informational influence	When mobile consumers shop in a retail store:
	(a) greater pervasivity increases the relative weight of online versus in-store information in judgment and choice;
	(b) this effect increases with information capability;
	(a) (alt) greater pervasivity reduces the relative weight of online versus in-store information in judgment and choice;
	(b) (alt) this effect reduces with information capability.
Information overload	Greater motion:
	(a) increases the influence of price cues;
	(b) increases the use of heuristics in choice;
	(c) reduces decision quality and the likelihood of making a choice at all.
Mobile mind-set	
Action orientation	Increased use of mobile devices is associated with
	(a) greater impulsivity in decision-making;
	(b) greater tendency to select default choices;
	(c) greater temporal discounting;
	(d) stronger preference for feasible versus desirable choice alternatives;
	(e) lower price versus time sensitivity.
Decision urgency	Increased use of mobile devices is associated with
	(a) faster decision-making;
	(b) greater search for decision confirming (e.g., positive) information.
Temporal focus	Increased use of mobile devices is associated with
	(a) greater focus on short-term versus long-term goals;
	(b) increased choice of hedonic (vs. utilitarian) products.
Self-focus	Increased use of mobile devices is associated with
	(a) greater influence of others in decision-making;
	(b) more self- (vs. other) focused decisions;
	(c) a reduction in pro-social activities.

and non-mobile devices, i.e., the effect of mobile ecosystems. However, as pointed out previously, ecosystem choice is a decision itself. Unobserved factors affecting product choices are likely to affect ecosystem choice as well, introducing correlations between the error term and the mobile platform as an independent variable. This endogeneity, if unaccounted for, may lead to biased estimates of the effect of the mobile platform on consumer choice behavior. Disentangling the impact of the mobile platform on consumer behavior from factors that affect platform choice is a modeling challenge that needs to be addressed through appropriate data collection and econometric techniques. For example, through controlled or natural experiments, the usage of mobile devices may be assigned exogenously, avoiding endogeneity in platform choice. Alternatively, given suitable data, one can model platform choice jointly with choices made on mobile ecosystems. Such a framework can account for correlation between error terms explicitly.

Another endogeneity issue arises from the firms' strategic decisions that affect the mobile context. In addition to setting up physical stores and designing traditional websites, it is increasingly common for firms to develop mobile websites and mobile apps. Firms determine the attributes of these websites, apps, and promotional activities, which in turn affect the mobile ecosystem and mobile context. Therefore, in trying to understand the impact of firm decisions on consumer choice, it is important to realize that these decisions are endogenously determined by firm insights into factors that affect consumer choice. This type of endogeneity is a variant of the non-random marketing mix problem studied by Manchanda et al. [32] and Luan and Sudhir [28], where firm decisions are made using prior knowledge of the response parameters of the targeted customers. Estimated response parameters that do not correct for such non-random firm mobile decision-making will be biased. Again, this endogeneity concern can be alleviated through experimental design or by jointly modeling firm decisions and consumer choices.

5.2 Mobile Data Collection

The framework in Fig. 1 and research topics derived from the framework pose several data challenges. The latest research on mobile decision-making uses a variety of approaches to data collection, including field and natural experiments, as well as employing retrospective scanner or clickstream data that has been the hallmark of quantitative marketing research for decades. In the following sections, we discuss several data challenges to studying mobile consumer behavior.

5.2.1 Accounting for Context

We have suggested that some of the most interesting research questions come from the use of mobile devices out in the real world, including traditional retail environments. Understanding the interactions between the mobile ecosystems and the context of mobile choice involves the merging of mobile and physical world data and raises questions about what data to collect and how and who should collect this data. For example, to obtain comparable online and offline browsing data, should retailers make physical stores more digital by collecting data through beacon technology installed in their stores to track consumer trajectories?

A related data challenge involves attribution of mobile choices to specific media or information sources [e.g., [11]], not all of which may be mobile focused. The classic example of this is consumer response to a television ad with a mobile link, but there can be other subtle cross-channel influences. Should retailers and firms collect offline data to supplement the vast quantities of data generated by consumer activities on mobile ecosystems?

5.2.2 Data Aggregation

Given that that digital data tends to be highly granular and rich, while offline store data tends to be relatively sparse, researchers who wish to combine these data face a number of challenges. What are the optimal techniques to fuse offline and mobile data? Can mobile data be aggregated across space, time, and contexts without losing relevant information, or should firms, retailers and researchers invest in capturing disaggregate and granular non-mobile data? Can "new-age" consumer panels be set up for this purpose, similar to the Nielsen scanner data panels that have been the staple of retail analytics and research for the last few decades?

5.2.3 Experimentation

As discussed previously, models of mobile consumer choices based on secondary data are often subject to potential endogeneity in the consumer's platform choices and in the firms' strategic decisions about the mobile context. In addition to econometric techniques, experimentation—controlled or natural—can address endogeneity through random assignment of participants to different ecosystems or different mobile contexts. Given the ability to target specific mobile consumers, mobile ecosystems provide an appealing environment for field experimentation.

There is a growing body of research on mobile decision-making using controlled field experiments, especially on consumer responses to mobile promotions [e.g., [16]]. A key challenge is that companies must permit researchers unprecedented access to their inner workings to support such research. Researchers who have written on the subject have benefited from working relationships with companies, and hopefully, more companies will partner with researchers in the future.

6 Future Research

Although we have focused on the impact of mobile ecosystems on consumer decision-making, greater mobility is likely to affect many types of consumer behavior. As with decision-making, some of the most interesting of these involve the ways in which mobile technologies facilitate particular consumer behaviors. Some of these include memory capturing [12], identity signaling [6], brand attitudes and loyalty when product quality is easier to access [41], goal pursuit with devices that track goal adherence and progress, word of mouth in an environment where thoughts and experiences can be shared instantly [31], and post-purchase behavior.

Another future research direction is to examine how individual differences moderate mobile consumer decision-making. Modeling approaches to addressing these variables depend on whether consumer heterogeneity is observed or unobserved. In the case of observed heterogeneity, the focus can be on how mobile consumer decision-making differs by observed individual characteristics. For example, although mobile consumers in general may be more influenced by incidental information such as mobile coupons, this influence may vary across consumers with different levels of experience on the retailer's mobile website. Consumers with greater experience may be able to better cope with cognitive constraints and be less influenced by incidental information such as coupons. From a modeling standpoint, this moderating effect can be captured through the interaction between the consumer characteristics and the focal independent variable, e.g., the interaction between a given consumer's prior use of the retailer's mobile website and mobile coupon availability. Access to information through mobile apps may also depend on consumer skills at effectively taking advantage of mobile capabilities.

For brevity, we have focused on how mobile technologies are likely to impact the way in which consumers search for and evaluate information and choose products and services. Future research could build on our conceptual framework to examine how mobile ecosystems affect the creation and sharing of information by consumers. Further, although we have focused on mobile consumer choice behavior, there are many opportunities to leverage our framework to examine mobile from the perspective of the firm. For example, dynamic promotions are an area of growing interest, yet are constrained by mobile ecosystem capabilities. Andrews et al. [2] describe several examples of dynamic mobile promotions, which account for the geographical location of a mobile consumer. One extreme example is the "Hijack" promotion used in Guatemala, where the initial offer is made when the customer is close to a retail store, and the discount reduces with each passing second the customer does not make a purchase. This and other examples of targeting consumers with dynamic promotions demonstrate that, although technology enables marketers to potentially target consumers while they are on the go, the optimal crafting of such promotions demands significant information processing capabilities and pervasivity to gain the consumer's attention while out and about. Does such mobile marketing provide value to the consumer in the short term? Do the information capabilities and pervasivity of mobile ecosystems impact customer lifetime value? These are just a few examples of firm-focused research questions that might draw on the proposed conceptual model.

7 Managerial Implications

Firms make strategic decisions themselves that impact mobile ecosystems, the mobile context, and ultimately facilitate the collection of consumer-level data. They must choose among creating one or more of a mobile website, a mobile app (native app, web app, or hybrid app; branded or third party), and an m-commerce site. The m-commerce site carries with it many unique firm decisions linked to a consumer's decision process, such as whether to include an on-the-go search feature, shopping assistant, payment tool, mobile wallet for rewards, and mobile ratings and reviews. Firms also must decide whether to engage in mobile advertising. Each of these decisions has an impact on the consumers' choices on their mobile devices.

Ultimately, the data best suited to provide researchers with answers about consumer behavior with and through mobile technologies will come from firms that build their own mobile apps. Once a consumer is inside an app, he/she has been captured by the firm since apps compete for customer attention by providing value to the consumer. Loyalty programs are a frequent component of mobile apps, in part because they create a natural segmentation of consumers. These loyalty/reward program members are often willing to provide the granular data needed to understand mobile consumer decision-making. However, use of these individuals' data comes with the caveat that the more loyal customers who use the app are different from the average consumer. In other words, firm-controlled mobile apps are useful to generate testable insights that can subsequently be assessed against a broader (e.g., non-loyal) consumer sample. As new mobile technologies are developed, they will provide marketers with greater insights into consumer decision-making. It will be important for marketers to gain from these insights in ways that do not undermine consumer willingness to share consumption experiences.

8 Conclusions

Mobility is changing consumer decision-making and choice. As marketers observe and respond to these changes, it will be important to isolate and examine mobile ecosystem capabilities, pervasivity, and context effects in terms of their impact on consumer attitudes and behavior. Properly attributing changes

in consumer decision-making to mobile ecosystems, mobile contexts, and marketer actions is important to advancing both theoretical insight and effective marketing strategy in an increasingly mobile world. We hope our conceptual framework offers a first step towards the development of a more robust examination of mobility in the marketplace.

Compliance with Ethical Standards

Contribution Statement We add to empirical research on mobile marketing by developing a conceptual framework that identifies how characteristics of mobile ecosystems and mobile contexts are likely to affect consumer behavior. Drawing on research in psychology, marketing, and information systems, we identify theoretical antecedents and psychological mechanisms that should affect mobile consumer information search, consideration set formation, and choice. Based on this perspective, we identify important research topics as well as opportunities and challenges for modeling mobile consumer decision-making.

References

1. Aguirregabiria V, Mira P (2010) Dynamic discrete choice structural models: a survey. J Econ 156(1):38–67
2. Andrews M, Goehring J, Hui S, Pancras J, Thornswood L (2016) Mobile promotions: a framework and research priorities. J Int Mark 34(May):15–24
3. Barnard L, Yi JS, Jacko JA, Sears A (2007) Capturing the effects of context on human performance in mobile computing systems. Pers Ubiquit Comput 11(2):81–96
4. Bart Y, Stephen AT, Sarvary M (2014) Which products are best suited to mobile advertising? A field study of mobile display advertising effects on consumer attitudes and intentions. J Mark Res 51(3):270–285
5. Belk RW (2013) Extended self in a digital world. J Consum Res 40(3):477–500
6. Berger J, Heath C (2007) Where consumers diverge from others: identity signaling and product domains. J Consum Res 34(2):121–134
7. Biswas D, Biswas A, Das N (2006) The differential effects of celebrity and expert endorsements on consumer risk perceptions. The role of consumer knowledge, perceived congruency, and product technology orientation. J Advert 35(2):17–31
8. Brasel SA, Gips J (2014) Tablets, touchscreens, and touchpads: how varying touch interfaces trigger psychological ownership and endowment. J Consum Psychol 24(2):226–233
9. Casasanto D, Boroditsky L (2008) Time in the mind: using space to think about time. Cognition 106(2):579–593
10. Ching AT, Erdem T, Keane MP (2013) Learning models: an assessment of progress, challenges, and new developments. Mark Sci 32(6):913–938
11. Danaher PJ, Dagger TS (2013) Comparing the relative effectiveness of advertising channels: a case study of a multimedia blitz campaign. J Mark Res 50(4):517–534
12. Diehl K, Zauberman G, Barasch A (2016) How taking photos increases enjoyment of experiences. JPSP 111(2):119–140
13. Escalas JE (2004) Imagine yourself in the product. J Advert 33(2):37–48
14. Feldman JM, Lynch JGJ (1988) Self-generated validity and other effects of measurement on belief, attitude, intention, and behavior. J Appl Psychol 73(3):421–435
15. Fisher M, Goddu MK, Keil FC (2015) Searching for explanations: how the internet inflates estimates of internal knowledge. J Exp Psychol Gen 144(3):674–687
16. Fong NM, Fang Z, Luo X (2015) Geo-conquesting: competitive locational targeting of mobile promotions. J Mark Res 52(5):726–735
17. Friedman SA (2013) Phones, friends, and flu shots: how phone attachment can affect pain perceptions (Honors thesis). Cornell University, Ithaca
18. Ghose A, Goldfarb A, Han SP (2013) How is the mobile internet different? Search costs and local activities. Inf Syst Res 24(3):613–631
19. Grewal D, Bart Y, Spann M, Zubcsek PP (2016) Mobile advertising: a framework and research agenda. J Int Mark 34:3–14
20. Inman JJ (2012) The elephant not in the room: the need for useful, actionable insights in behavioral research. In: Gürhan-Canli Z, Otnes C, Zhu RJ (eds) NA—advances in consumer research, vol 40. Association for Consumer Research, Duluth, pp 1–4
21. Iyengar SS, Lepper MR (2000) When choice is demotivating: can one desire too much of a good thing? JPSP 79(6):995–1006
22. Kahneman D (2011) Thinking, fast and slow. Farrar, Straus, and Giroux, New York
23. Kardes FR, Kalyanaram G, Chandrashekaran M, Dornoff RJ (1993) Brand retrieval, consideration set composition, consumer choice, and the pioneering advantage. J Consum Res 20(1):62–75
24. Kardes FR, Cronley ML, Kellaris JJ, Posavac SS (2004) The role of selective information processing in price-quality inference. J Consum Res 31(2):368–374
25. Koufaris M (2002) Applying the technology acceptance model and flow theory to online consumer behavior. Inf Syst Res 13(2):205–223
26. Lamberton C, Stephen AT (2016) A thematic exploration of digital, social media, and mobile marketing: research evolution from 2000 to 2015 and an agenda for future inquiry. J Mark 80(6):146–172
27. Leonardi PM (2011) When flexible routines meet flexible technologies: affordance, constraint, and the imbrication of human and material agencies. MIS Q 35(1):147–167
28. Luan YJ, Sudhir K (2010) Forecasting marketing-mix responsiveness for new products. J Mark Res 47(3):444–457
29. Luo X, Andrews M, Fang Z, Phang CW (2013) Mobile targeting. Manag Sci 60(7):1738–1756
30. Lurie NH (2004) Decision making in information-rich environments: the role of information structure. J Consum Res 30:473–486
31. Lurie NH, Ransbotham S, Liu H (2014) The characteristics and perceived value of mobile word of mouth. Marketing Science Institute Working Paper Series. Report No. 14–109
32. Manchanda P, Rossi PE, Chintagunta PK (2004) Response modeling with nonrandom marketing-mix variables. J Mark Res 41(4):467–478
33. Maniar N, Bennett E, Hand S, Allan G (2008) The effect of mobile phone screen size on video based learning. J Softw 3(4):51–61
34. Novak TP, Hoffman DL (2016) Visualizing emergent identity of assemblages in the consumer internet of things: a topological data analysis approach. doi:10.2139/ssrn.2840962
35. Petty RE, Cacioppo JT (1986) The elaboration likelihood model of persuasion. In: Berkowitz L (ed) Advances in experimental social psychology, vol 19. Academic Press, San Diego
36. Pornpitakpan C (2004) The persuasiveness of source credibility: a critical review of five decades' evidence. J Appl Soc Psychol 34(2):243–281
37. Sarnato V (2013) New survey finds Americans treat mobile devices like their best friends. Brighthand. February 24. Retrieved from http://www.brighthand.com/news/new-survey-finds-americans-treat-mobile-devices-like-their-best-friends/.
38. Schlosser AE, Barnett White T, Lloyd SM (2006) Converting web site visitors into buyers: how web site investment increases consumer trusting beliefs and online purchase intentions. J Mark 70(April):133–148

39. Shankar V, Inman JJ, Mantrala M, Kelley E, Rizley R (2011) Innovations in shopper marketing: current insights and future research issues. J Retail 87(1):S29–S42
40. Shiv B, Fedorikhin A (1999) Heart and mind in conflict: the interplay of affect and cognition in consumer decision making. J Consum Res 26(3):278–292
41. Simonson I (2015) Mission (largely) accomplished: what's next for consumer BDT-JDM researchers? J Mark Behav 1(1):9–35
42. Soman D, Ainslie G, Frederick S, Li X, Lynch J, Moreau P, Mitchell A, Read D, Sawyer A, Trope Y (2005) The psychology of intertemporal discounting: why are distant events valued differently from proximal ones? Mark Lett 16(3–4):347–360
43. Suh K-S, Lee YE (2005) The effects of virtual reality on consumer learning: an empirical investigation. MIS Q:673–697
44. Sultan F, Rohm A (2005) The coming era of "brand in the hand" marketing. MIT Sloan Manag Rev 47(1):83–90
45. Turkle S (2008) Always-on/always-on-you: the tethered self. In: Katz JE (ed) Handbook of mobile communication studies. MIT Press, Cambridge, pp 121–137
46. Turkle S (2012) Alone together: why we expect more from technology and less from each other. Basic Books, New York
47. Wang RJ-H, Malthouse EC, Krishnamurthi L (2015) On the go: how mobile shopping affects customer purchase behavior. J Retail 91(2):217–234
48. Ward AF, Duke K, Gneezy A, Bos MW (2017) Brain drain: the mere presence of one's own smartphone reduces available cognitive capacity. J Assoc Consum Res 2(2):140–154
49. Yadav MS, Pavlou PA (2014) Marketing in computer-mediated environments: research synthesis and new directions. J Mark 78(1):20–40