Swiping vs. Scrolling in Mobile Shopping Applications

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Abstract. Smartphone gestures are an essential feature of app design that influence both behavioral attitudes and user performance. Due to the popularity of Tinder, a number of high profile shopping applications have adopted interfaces utilizing the swiping gesture to navigate and make sequential evaluation decisions. To understand the impacts of adopting a swipe-based interface over a traditional scroll-based interface, we construct an experiment to study the two types of haptic interactions. The results suggest that the swiping interface leads to greater cognitive absorption and playfulness in shopping applications. We find convincing support that cognitive absorption and not playfulness is significant in increasing reuse intentions and task performance.

Keywords: Gestures · Cognitive absorption · Playfulness · Mobile shopping apps

1 Introduction

Recently, there has been a plethora of mobile shopping apps on Android and iOS platforms enabling users to discover and purchase products on their smartphones. These apps are virtual marketplaces featuring thousands of products from international chains and independent retailers. To lighten the cognitive burden associated with choice overload, apps encourage users to save products that they may be interested in purchasing to a consideration list. At any point in time, the user can review the list of saved items to make actual purchases.

There are two prevailing haptic interfaces for saving products to consideration set lists. The first is a scroll-based interface where the user views items on a product discovery screen and uses the scrolling gesture to navigate through the set of products. To save an item, the user taps on the image and is directed to an individual product page. The user has the option of saving the product by tapping a soft button on the screen or tapping on a soft back button to return to the product discovery page. The second method is a swipe-based interface where the app presents the user with an image of a product, and the user swipes right (left) to save (dismiss) the item. After swiping, the next item appears on the

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screen. Typically, tapping on the item will also lead the user to the individual product page.

There is an emergent literature demonstrating that differences in haptic interfaces can impact user experience with respect to enjoyment and level of engagement [17]. As a result, small differences in haptic navigation can potentially impact task performance and behavioral attitudes towards the application. In the case of mobile shopping apps where the user is required to identify a manageable list of products that they like and may consider purchasing (from the thousands of available items), we theorize that haptic navigation utilizing swiping will foster greater cognitive absorption and playfulness than those relying on scrolling.

Cognitive absorption and playfulness are two important constructs within the IS literature that can impact task performance (the user's ability to save products that they like) and reuse intention. If the user experiences a greater level of cognitive absorption, then there will be greater levels of engagement and enjoyment while using the app. This will potentially lead to more accurate assessments of the streamed products as well as a greater intention to reuse the app. Although playfulness is associated with higher reuse intention, the influence on task performance in many cases is less clear. Within the context of mobile shopping apps, playfulness may reduce task performance, because the user may spontaneously save products that they are not actually interested in. Saving products that are not of sufficient interest can cause the user to forgo purchases due to the phenomenon of choice overload. Therefore, understanding the influences of cognitive absorption and playfulness is critical for designing a successful shopping app.

We designed an experiment to test the impact of haptic navigation on cognitive absorption and playfulness and the resulting consequences on task performance and reuse intention by manipulating the haptic interface of a shopping application. The study suggests that the swiping interface is more playful and facilitates greater cognitive absorption, compared to the scrolling interface. Cognitive absorption is found to improve task performance and increase reuse intention. Although we find some support that playfulness reduces task performance and increases reuse intentions, the results are not statistically significant. These findings are particularly relevant given the popularity of the dating app Tinder, which has inspired a large number of high profile shopping apps to adopt a swiping interface.

2 Theoretical Background

Cognitive absorption is a multi-dimensional construct describing "a state of deep involvement with software" [1]. The five dimensions are temporal dissociation (TD), focused immersion (FI), heightened enjoyment (HE), control (CON), and curiosity (CUR). TD is a user's failure to register the passage of time while using the software. FI is a level of concentration where the user ignores anything outside of the software. HE is the intrinsic interest and pleasure related to using

the software. CON is the user's perception of being in charge of the interaction with the software. CUR is the arousal of sensory and cognitive interest from the interaction with the software. Playfulness is a related construct to cognitive absorption and represents the degree of cognitive spontaneity in interactions with software [19].

Both cognitive absorption and playfulness are intrinsic motivations. Consequently, both constructs are connected to the technology acceptance model (TAM), which demonstrates that perceived ease of use (PEoU) and perceived usefulness (PU) influence attitude and the behavioral intentions to use IT. Agarwal and Karahanna [1] demonstrate that cognitive absorption positively influences PEoU and PU, which in turn positively impact intention to use. Moon and Kim [11] formally integrate playfulness into TAM and finds that playfulness positively relates to PEoU and behavioral attitudes towards IT. The potential antecedents to cognitive absorption and playfulness stem from the inter-related literatures on flow and engagement and can be classified into cognitive aspects (such as control, challenge, and involvement) and IT characteristics (such as feedback, variety, and speed) [1,5].

Although the influence of both cognitive absorption and playfulness are often seen as antecedents to factors that influence behavioral intentions and IT usage, Burton-Jones and Straub [4] argue that in many cases these two-step processes should be recast into a single richer measure of outcomes. To support this idea, Burton-Jones and Straub empirically study the relationship between system usage and task performance in cognitively engaging tasks and find that cognitive absorption directly increases performance. While the impact of cognitive absorption on task performance is typically positive, playfulness can have both positive and negative impacts on performance [20].

3 Research Model and Hypothesis Development

This study examines two modes of haptic navigation, i.e., scrolling navigation and swiping navigation. The effects of haptic navigation on individuals' usage experience are investigated in terms of cognitive absorption and playfulness. Furthermore, we assess the effects of these two perceptions on individuals' behavioral responses, namely reuse intention and decision uncertainty. The research model analyzed is presented in Fig. 1.

3.1 Effects of Haptic Navigation

Swiping is seen as an intuitive and more natural action (closely related to flipping through a book or magazine) compared to scrolling, which was specifically developed for mouse-based navigation on a computer screen [17]. The natural mapping ability and intuitiveness of an interface positively influences the engagement process and cognitive absorption [12], which implies that the haptic gesture of swiping may lead to increased cognitive absorption.

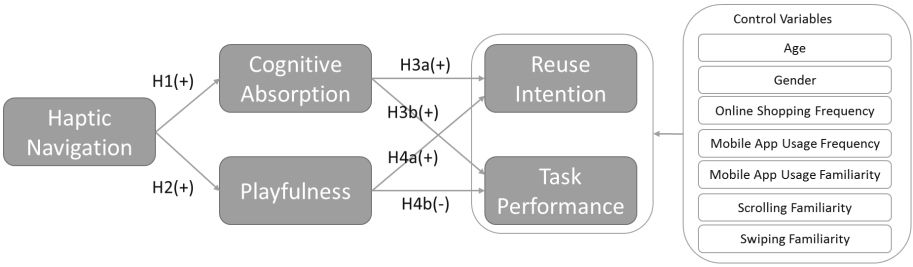

Fig. 1. Research model

Users are likely to experience heightened enjoyment when positively evaluating and subsequently saving a product compared to rejecting (swipe navigation) or passing over (scroll navigation) a product. This implies that it is also important to consider the differences between swiping and tapping. [7] examine the impact of adding swiping to a tap-only mobile website on engagement and usage intention. The analysis suggests that swiping leads to a greater sense of control, enjoyment, user engagement, and increases re-use intentions. Furthermore, the discussion proposes that swiping creates curiosity within the user because swiping "resembles turning the pages of a book, which appears to promote exploration of content" [7]. Thus, we postulate that users are likely to experience greater enjoyment when saving items in a shopping app with the swipe gesture rather than a two stage process based on scrolling and tapping.

In the swipe interface, users cannot revisit rejected items, making each decision final. Although users rarely scroll upwards, users are aware that they can view previous items in the scrolling interface. This implies that products are never completely dismissed from consideration. The knowledge of being able to revisit items implies that items that the user was close to saving may remain in memory. This creates a greater cognitive load, which can diminish the experience of flow, and hence lessen cognitive absorption and playfulness [14,21]. The finality of the swiping interface promotes greater engagement, while also potentially creating greater satisfaction from making a decision.

The differences in haptic navigation can lead to varying levels of stimuli created by the product images. In the swiping interface, the user is focused on a single task of saving or rejecting the image on the screen by swiping right or left. In the scrolling interface, user attention is divided between the dual tasks of searching and evaluation, resulting in weaker stimuli from images. Since scrolling is almost always unidirectional, the haptic motion of scrolling is more repetitive and predictable. Conversely, the swiping motion is used to make decisions, which implies that the directional movement is less predictable compared to scrolling, and provides the user with a greater sense of haptic variety.

Predictability demands less attention from the user and stimulates less curiosity and interest [2]. The repetitiveness and predictability of scrolling enables the user to disengage with the application. Scrolling may become habitual,

resulting in a lack of engagement and mind-wandering, which impairs task-relevant stimuli [15]. This suggests that products displayed in the swiping interface will produce a stronger visual signal and have higher cognitive absorption compared to the scrolling interface. In addition, the swiping interface is likely to be more playful, since users perceive playfulness when they experience curiosity, interest, and their attention is focused while interacting with software [11].

Consumer evaluation and choices are influenced by consumer imagery-based responses [13]. Mental imagery and fantasies involving the ownership of the product are stimulated by product images and influence consumer attitudes towards the product [16]. Within the context of mobile shopping for clothing and accessories, user imagery such as the fit of the item, events where the user can wear the item, and how the item coordinates with the user's existing wardrobe, will likely influence the user's evaluation of the product. Thus, the weaker stimuli in the scrolling interface may impact the user's level of creativity, imagination, and fantasy, which are important elements of playfulness when using software.

Scrolling navigation epitomizes the traditional method of online shopping, whereas swiping is a comparatively novel approach to shopping navigation and evaluation. Interestingness, which is associated with the emotion dimension of positive activation, can be triggered by novelty [8]. In addition, interactions with novel features promote greater cognitive thought and engagement relative to familiar features, where users may have transitioned from controlled information processing towards automatic behavior [18]. Novelty in a product or service can result in emotions such as delight, which contributes to the level of playfulness [10].

Given the haptic nature of the gesture, lower cognitive load, the greater level of engagement, visualization strength, and novelty associated with the swiping navigation, we propose the following:

H1. Compared with scrolling navigation, swiping navigation will lead to a higher level of cognitive absorption.
H2. Compared with scrolling navigation, swiping navigation will lead to a higher level of playfulness.

3.2 Effects of Cognitive Absorption

Cognitive absorption implies that the user is immersed and experiencing enjoyment while using the mobile device to find products. Consistent with the literature that has demonstrated behavioral intention to use software is positively impacted by cognitive absorption, we posit that cognitive absorption will lead to higher reuse intention of mobile shopping apps. Moreover, the engagement from cognitive absorption implies that users will be more focused on evaluating items, which will lead to greater performance in saving choice items. Thus, we posit the following:

H3a. Stronger cognitive absorption will increase reuse intention.
H3b. Stronger cognitive absorption will increase task performance.

3.3 Effects of Playfulness

There is strong evidence in the literature that playfulness also increases reuse intention, and we expect that to hold in the context of mobile shopping applications. A key element of playfulness is spontaneity. Within the context of mobile shopping, spontaneity may lead users to positively evaluate items on impulse and without deliberation of whether the user truly likes the item. As a result, unlike cognitive absorption, playfulness may have a negative effect on task performance. Therefore, we posit the following:

H4a. Stronger playfulness will increase reuse intention.
H4b. Stronger playfulness will decrease task performance.

4 Experimental Design

An experiment was conducted to test the proposed hypotheses. The two modes of haptic navigation, namely scrolling navigation and swiping navigation, were manipulated by presenting subjects with a scrolling (swiping) mobile app interaction interface.

We recruited 57 subjects from a large public university to participate in the experiment. Subjects were randomly assigned to one of the two experimental conditions in which they were presented with a mobile shopping app with a scrolling (swiping) interface. To ensure adequate familiarity with the shopping app, a simple demonstration session was first performed to familiarize subjects with the shopping app. Afterwards they were instructed to spend 15 min to use the app and "save" as many items as they liked.

At the end of the 15-min period, subjects were asked to complete a questionnaire assessing measurement items of the research variables (i.e., cognitive absorption and playfulness). Subsequently, they were given the opportunity to revisit the list of saved items to discard any merchandise from the list as they deemed necessary. Subjects were then instructed to complete a final survey capturing their behavioral intentions. Finally, subjects were debriefed and thanked.

5 Data Analysis

5.1 Subject Demographics and Measurement

Of the 57 subjects, 23 were female. The age of the subjects ranged from 18 to 25. No significant differences were found among subjects with regards to age, gender, online shopping frequency, and mobile app usage familiarity, indicating that the subjects' demographics were fairly homogeneous across different conditions.

The measurement items are presented in Table 5 (found in the Appendix). The measurement scale proposed by Agarwal and Karahanna [1] was adapted to measure cognitive absorption (Cronbach's alpha = 0.91). Seven items measuring playfulness were adapted from Webster and Martocchio [19]

Table 1. Results of factor analysis.

	1	2	3
Temporal Dissociation	**0.98**	0.2	-0.07
Focused Immersion	**0.98**	0.19	-0.08
Heightened Enjoyment	**0.97**	0.22	-0.08
Control	**0.98**	0.2	-0.07
Curiosity	**0.98**	0.2	-0.07
Playfulness 1	0.23	**0.93**	0.21
Playfulness 2	0.22	**0.91**	0.24
Playfulness 3	0.2	**0.92**	0.23
Playfulness 4	0.19	**0.91**	0.29
Playfulness 5	0.19	**0.93**	0.14
Playfulness 6	0.2	**0.92**	0.26
Playfulness 7	0.16	**0.91**	0.27
Reuse Intention 1	-0.13	0.33	**0.93**
Reuse Intention 2	-0.13	0.33	**0.93**
Reuse Intention 3	-0.13	0.35	**0.93**

(Cronbach's alpha = 0.98). Three items measuring reuse intention were adapted from Jarvenpaa [9] (Cronbach's alpha = 0.95). Task performance was captured by computing the ratio between the final number of saved items and the initial number of saved items. A high (low) value denotes a small change in the number of saved items and better (poor) task performance. Exploratory factor analysis shows that, in general, items load well on their intended factors and lightly on the other factor, indicating adequate construct validity (see Table 1).

5.2 Results on Cognitive Absorption and Playfulness

This study investigates two modes of haptic navigation mechanisms, namely scrolling navigation and swiping navigation. First, to investigate the impact of haptic navigation on cognitive absorption and playfulness, an independent sample t-test was conducted. As shown in Table 2, the results indicate that the difference in terms of cognitive absorption between the two modes of haptic

Table 2. Comparing cognitive absorption and playfulness across two navigation mechanisms.

	Average	Scrolling Navigation	Swiping Navigation	
Cognitive Absorption	4.09	3.1	4.92	t = 41.04***
Playfulness	4.18	2	6.01	t = 48.18***

Note: *** p< .001

navigation mechanisms were significantly different (t = 41.04, $\rho < .001$). The respective means suggest that compared to the scrolling navigation condition (mean = 3.10), swiping navigation (mean = 4.92) led to significantly stronger cognitive absorption. Therefore, H1 is supported.

Furthermore, results of the independent sample t-test revealed that the difference in terms of playfulness between the two modes of haptic navigation mechanisms were significantly different. (t = 48.18, $\rho < .001$). The respective means suggest that compared to the scrolling navigation condition (mean = 2.00), swiping navigation (mean = 6.01) led to significantly stronger cognitive absorption. Therefore, H2 is supported.

5.3 Results on Reuse Intention and Task Performance

Linear regressions were performed to investigate the effects of cognitive absorption and playfulness on reuse intention and task performance respectively. To control for the potential confounding effects, the regression analysis was performed with the consideration of gender, age, online shopping frequency, mobile app usage frequency, mobile app usage familiarity, scrolling familiarity, swiping familiarity, perceived usefulness, and perceived ease of use as the control variables.

As shown in Table 3, cognitive absorption had a significant positive effect on reuse intention (β=1.4, $\rho < .05$). Hence, H3a is supported. However, contrary to expectation, playfulness was found to have no significant effect on reuse intention (β=0.29, ρ=.35), and hence H4a is not supported.

As shown in Table 4, cognitive absorption had a significant positive effect (β=0.19, $\rho < .01$). The positive coefficient suggests that higher absorption reduces the number of discarded items, indicating higher task performance. Hence, H3b is supported. Contrary to expectation, playfulness is not found to

Table 3. Linear regression results for reuse intention.

	Unstandardized Coefficients		Standardized Coefficients	t-stat	Sig
	B	Std. Err	β		
Constant	-5.54	5.27		-1.05	0.3
Cognitive Absorption	1.4	0.66	0.64	2.11	< .05
Playfulness	0.29	0.31	0.29	0.94	0.35
Age	-0.12	0.07	-0.14	-1.83	0.07
Gender	-0.45	0.28	0.11	-1.63	0.11
Mobile App Usage Frequency	0.22	0.26	0.1	0.84	0.4
Mobile App Usage Familiarity	0.17	0.24	0.05	0.7	0.49
Scrolling Familiarity	0.59	0.48	0.09	1.23	0.23
Swiping Familiarity	-0.06	0.27	-0.02	-0.21	0.84
Online Shopping Frequency	0.11	0.09	0.09	1.24	0.22
Perceived Usefulness	-0.17	0.36	-0.04	-0.47	0.64
Perceived Ease of Use	0.03	0.35	0.01	0.08	0.93

Note:
Dependent Variable: Reuse Intention
R Squared = .81 (Adjusted R Squared = .75)

Table 4. Linear regression results for task performance.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Err	β		
Constant	0.37	0.54		0.69	0.5
Cognitive Absorption	0.19	0.07	1.08	2.85	$< .01$
Playfulness	-0.03	0.03	-0.36	-0.91	0.37
Age	0.01	0.01	0.12	1.33	0.19
Gender	-0.03	0.03	-0.1	-1.13	0.26
Mobile App Usage Frequency	-0.02	0.01	-0.22	-2.34	0.02
Mobile App Usage Familiarity	-0.01	0.03	-0.02	-0.13	0.9
Scrolling Familiarity	-0.06	0.05	-0.11	-1.15	0.26
Swiping Familiarity	0.01	0.03	0.04	0.38	0.71
Online Shopping Frequency	-0.02	0.09	-0.23	-2.43	0.05
Perceived Usefulness	-0.03	0.04	-0.08	-0.84	0.4
Perceived Ease of Use	0.01	0.04	0.04	0.37	0.71

Note:
Dependent Variable: Task Performance
R Squared = .82 (Adjusted R Squared = .60)

have a significant effect on task performance (β=-0.03, ρ =.37), and hence H4b is not supported.

6 Discussion and Conclusion

6.1 Discussion of Results and Implications

As technology advances and user-interfaces offer greater interactivity, physical interactions with the technology are becoming increasingly important aspects of behavioral attitudes, intentions, and outcomes. User engagement is particularly important for smartphone, since the devices are often used in conjunction with other activities or in distracting environments [3,7]. Given the recent popularity of utilizing swiping gestures in mobile shopping apps, we investigated the impact of this interface on cognitive absorption and playfulness over traditional interfaces using scroll based navigation.

Our results support the hypothesis that a swiping interface leads to greater levels of cognitive absorption and playfulness compared to a scrolling interface. Furthermore, we find support that cognitive absorption positively influences task performance and reuse intentions, even when accounting for perceived ease of use and usefulness of the technology. These results have important implications for app design by providing empirical support for swiping as a more engaging and playful method of navigation. Although our results pertain to shopping, they may be applicable to other mobile apps involving navigation and sequential evaluation.

Contrary to expectation, playfulness did not exhibit a significant impact on task performance. The literature on playfulness has produced contradictory results in terms of its impact on task performance. Thus, playfulness within shopping applications may have both positive and negative aspects that influence

performance, which resulted in an insignificant effect. Although the overall effect of playfulness on performance was not significant, it was inversely related to improvements in task performance. The insignificant effect of playfulness on intention to reuse suggests that continued use of the app is based more on its utilitarian value as a tool for shopping rather than the hedonic experience it provides.

6.2 Limitations and Future Research

An important limitation of the study is that we only considered task performance in one direction, i.e. users were able to review the merchandise that they saved and decide which items to remove. A more complete measure of task performance would be to allow the users to revisit a sample of non-saved items to assess whether they rejected items that they were actually interested in. Another important limitation of the results is the impact of time. The subjects were instructed to use the app for a duration of 15 min. However, measures of absorption and playfulness while using the app for shopping may depend on time. Understanding the interaction between interface design and usage duration is an interesting avenue for future research.

Appendix

Table 5. Measurement items.

Cognitive Absorption (CA)	Adapted from Agarwal and Karahanna [1]
TD1	Time appears to go by very quickly when I am using the mobile shopping app
TD2	I lose track of time when I am using the mobile shopping app
TD3	Time flies when I am using the mobile shopping app
TD4	I believe I have spent more time on the mobile shopping app than I had intended
FI1	While using the mobile shopping app, I am able to block out most other distractions
FI2	While using the mobile shopping app, I am absorbed in what I am doing
FI3	While using the mobile shopping app, I am immersed in the shopping task I am performing
FI4	When using the mobile shopping app, my attention does not get diverted very easily (R)
HE1	I have fun using the mobile shopping app
HE2	Using the mobile shopping app provides me with a lot of enjoyment
HE3	I enjoy using the mobile shopping app
HE4	Using the mobile shopping app bores me (R)

(*continued*)

Table 5. (*continued*)

Cognitive Absorption (CA)	Adapted from Agarwal and Karahanna [1]
CTL1	When using the mobile shopping app, I feel in control
CTL2	I feel that I have no control over my interaction with the app
CTL3	The mobile shopping app allows me to control my interaction with the app
CUR1	Using the mobile shopping app excites my curiosity
CUR2	Interacting with the mobile shopping app makes me curious
CUR3	Using the mobile shopping app arouses my imagination
Playfulness (PLY)	Adapted from Webster and Martocchio [19]
PLY1	When using the mobile shopping app I am Spontaneous
PLY2	When using the mobile shopping app I am Imaginative
PLY3	When using the mobile shopping app I am Flexible
PLY4	When using the mobile shopping app I am Creative
PLY5	When using the mobile shopping app I am Playful
PLY6	When using the mobile shopping app I am Original
PLY7	When using the mobile shopping app I am Inventive
Perceived Ease of Use (PEoU)	Adapted from Davis [6]
PEoU1	Learning to operate the mobile shopping app is easy for me
PEoU2	I find it easy to get the mobile shopping app to do what I want it to do
PEoU3	It is easy for me to become skillful at using the mobile shopping app
PEoU4	I find the mobile shopping app easy to use
Perceived Usefulness (PU)	Adapted from Davis [6]
PU1	Using the mobile shopping app enhances my effectiveness in shopping
PU2	I find the mobile shopping app useful in my shopping activities
PU3	Using the mobile shopping app improves my sense of fashion
Reuse Intention (RI)	Adapted from Jarvenpaa et al. [9]
RI1	In the medium term, it's likely that I will use the app again
RI2	In the long term, it's likely that I will use the app again
RI3	All things considered, it's likely that I will use the app again

Note:
All items are measured using 7-point Likert scale.
(R)indicates reversed items.

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