

Department of Impresa e Management

Master's degree in Marketing – Major in Market Relationship
and Customer Engagement

Chair of Neuromarketing

*Power of mobile hand gestures: swiping vs scrolling on
ecommerce and their influence on consumers' purchase
intention, with the moderator role of different types of
products and the mediation of visual fluency.*

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1. Introduction

The advancement of the World Wide Web has resulted in the creation of a new form of retail transactions, electronic commerce (e-commerce), or web shopping. Thus, customers' involvement and behavior in online purchasing have become an important trend (K, C Ling; 2010). Thanks to Internet technology's continuous developments, consumers can purchase products or services from the web-retailers and search for product information on the Internet. Consumers could interact in a virtual environment via the website interface and enjoy web shopping with different experiences (Alba, J., et al; 1997).

Today's consumers can shop from anywhere at any time with just a few clicks of their fingers (Kim, J., et al; 2004).

Therefore, web retailers should develop effective and efficient web-shopping strategies to attract new and potential customers. Following the web design hierarchy of needs of Steven Bradley, in particular the third need "Proficiency" (Page, S., 2015), e-commerce owners should add particular features, like various Calls to Action, sort of gamification, and methods of navigation. The main theme of this study will cover this last aspect, in particular, the hand gesture of Scrolling and Swiping on e-commerce and how they could influence consumer online purchase intention with the moderating effect of the product type difference (hedonic versus utilitarian), mediating by the variable of visual fluency.

The structure of this master thesis begins with an overview of topics that led to this study, subsequently, there will be an extensive discussion of the current literature, focusing on specific factors that influence the user experience on a mobile commerce website when using the two hand gestures. Then, we will present the conceptual model with the hypotheses built on the current knowledge, followed by the conducted research and its results. The final section provides a general discussion and conclusion of the findings, as well as their practical implications.

1.1 The rise of E-commerce

In a scenario of global economic recession, E-commerce, which increasingly figures not as an opportunity or an innovation but as an inevitable choice to remain competitive, represents a phenomenon that is constantly growing and increasingly linked to the "Social" and "Mobile" trends. The digital revolution of recent years, with the new Internet era, Web 3.0, new technologies, and the advent of social media, has brought two realities, the social and the technological, to meet. Social media, mobile devices, new tools, and applications, increasingly accessible, simple and pervasive, have significantly transformed marketing and communication strategies, by making them exploited not only as promotion and loyalty platforms but also as

sales ones. It is seen as electronic communications and digital information processes in business transactions are used to create, modify, and redefine value generation relations between organizations and individuals (E. E. Grandon and J. M. Pearson; 2004).

The following graph (**Figure 1**) shows that by 2021, the population of "Internet Users" has grown to more than 5 billion people, representing 66.2 percent of the world's population.

WORLD INTERNET USAGE AND POPULATION STATISTICS 2022 Year-Q1 Estimates						
World Regions	Population (2022 Est.)	Population % of World	Internet Users 31 Dec 2021	Penetration Rate (% Pop.)	Growth 2000-2022	Internet World %
Africa	1,394,588,547	17.6 %	601,327,461	43.1 %	13,220 %	11.5 %
Asia	4,350,826,899	54.8 %	2,790,150,527	64.1 %	2,341 %	53.1 %
Europe	841,319,704	10.6 %	743,602,636	88.4 %	608 %	14.2 %
Latin America / Carib.	663,520,324	8.4 %	533,171,730	80.4 %	2,851 %	10.1 %
North America	372,555,585	4.7 %	347,916,694	93.4 %	222 %	6.6 %
Middle East	268,302,801	3.4 %	205,019,130	76.4 %	6,141 %	3.9 %
Oceania / Australia	43,602,955	0.5 %	30,549,185	70.1 %	301 %	0.6 %
WORLD TOTAL	7,934,716,815	100.0 %	5,251,737,363	66.2 %	1,355 %	100.0 %

NOTES: (1) Internet Usage and World Population Statistics estimates are for January 31, 2022. (2) CLICK on each world region name for detailed regional usage information. (3) Demographic (Population) numbers are based on data from the [United Nations Population Division](#). (4) Internet usage information comes from data published by [Nielsen Online](#), by the [International Telecommunications Union](#), by [GfK](#), by local ICT Regulators and other reliable sources. (5) For definitions, navigation help and disclaimers, please refer to the [Website Surfing Guide](#). (6) The information from this website may be cited, giving the due credit to [www.internetworldstats.com](#). Copyright © 2022, Miniwatts Marketing Group. All rights reserved worldwide.

Figure 1: Table regarding world internet usage and population statistics¹

Linked to this we can see how there has been a consequent increase in the use of e-commerce, as well. In 2021, over 2.14 billion people worldwide have bought goods and services online, up from 1.66 billion global digital buyers in 2016².

In 2020, the health emergency caused by Covid 19 led to a boom in online shopping, with Internet sales growing by 34.6 percent, according to Istat³. In contrast, in 2021 there has been a slower growth in the e-commerce sector, with a 13.3 percent of increments, due to the gradual reopening of stores.

The Covid-19 pandemic has rapidly forced numerous entities to become predominantly oriented to electronic commerce in the last few months, especially due to social distancing and restriction. It is also true that electronic commerce has allowed the survival of numerous businesses all over the world, whose owners have had to improve their digital skills and develop better technologies to have a presence in the Internet world (Pejić-Bach, M., 2021).

A relevant finding for this study is how nowadays the use of e-commerce via mobile devices is increasing more and more. Data from 2020 showed that 67 percent of global online retail traffic

¹ <https://www.internetworldstats.com/stats.htm>

² <https://www.statista.com/statistics/251666/number-of-digital-buyers-worldwide/>

³ <https://www.lineaecommerce.it/istat-2020-anno-dellecommerce-con-346-2822.html>

comes from mobile devices,⁴⁴ although most online sales still take place on the desktop, as many e-commerce are not optimized for mobile. Just think of how many retailers and brands have tried to get around the shortcomings of the mobile Web by releasing mobile shopping applications, offering users a more streamlined shopping experience in a controlled environment⁵. With the significant increase in mobile commerce sales, designing user experiences that promote buyer decisions and increase sales is highly desirable for retailers and their digital marketing and production companies. Mobile commerce enables a new way of information exchange and purchases to consumers, it represents convenience and merchants associate it with huge earning potential. “The essence of mobile commerce revolves around the idea of reaching customers, suppliers, and employees regardless of where they are located. Mobile commerce is about delivering the right information to the right place at the right time” (Siau, K., et al; 2003).

1.2 Swiping versus Scrolling

Previous data highlight that by 2022 it will be necessary to have an e-commerce site that is completely mobile responsive and with a User Experience that ensures the most fluent customer journey possible. This, which could promote purchaser decisions and increase sales, is highly desirable to retailers and their marketing and digital production companies (Vanderschantz, N., et al; 2020).

For this reason, E-commerce designers should follow the Responsive Web design to respond to the user’s behavior and environment based on screen size, platform, and orientation. It is not only about adjustable screen resolutions and automatically resizable images, it concerns also touchscreens (Friedman, V., 2018). Consumers are more reluctant to buy on smartphones due to the difficulty of navigation, as the comScore Mobile Hierarchy report states⁶.

⁴ <https://www.lineaecommerce.it/istat-2020-anno-dellecommerce-con-346-2822.html>

⁵ <https://www.statista.com/statistics/439576/online-shopper-conversion-rate-worldwide/>

⁶ <https://www.comscore.com/Insights/Presentations-and-Whitepapers/2017/Mobiles-Hierarchy-of-Needs>



Figure 2: Graph representing a gap between the share of minutes and dollars spend and the five reasons⁷.

This is where the most important variable in this study comes in, users interact with hand gestures to navigate via a mobile device. In addition, with the advancement of technology and the improvement of user-interface interactivity, physical interactions with the technology are becoming increasingly important aspects of behavioral attitudes, intentions, and outcomes (Choi, B.C.F., et al; 2016).

Two of the types of interaction regarding gestures on the touchscreen, are swiping and scrolling. Nowadays, the attention given to the choice between these two gestures mainly concerns the app design, particularly on social media, like Instagram, TikTok, and Tinder. It is important to highlight that some social media can track the way you skim your smartphone display and consequently send you important data about your mood, tastes, and personality, using this feedback to modify the content shown on your display⁸. Precisely, Tinder is the pioneer of swiping, using a combination of conceptual design and user experience to effectively engage users every day, with its 60 million monthly active users and 1.6 billion daily swipes⁹. This quick decision is based on immediate emotional reactions. In this specific case of dating application, swipe takes advantage of the easy options provided and acts as a facilitator thanks to the speed with which the action is performed; this impacts on the intimacy and the most intimate demands of the users (Baldi, R., 2017). TikTok, the new social network, which during the pandemic reached so many users until the end of 2021¹⁰ with more than 1 billion people signed up, mainly uses a scrolling methodology. The platform plays on the fact that people can see content passively through the scrolling video selection mode (C. Montag, H., et al; 2021). Finally, there is Instagram that with scrolling of feed content first and adding swiping in stories

⁷ <https://www.smartinsights.com/ecommerce/ecommerce-analytics/ecommerce-conversion-rates/>

⁸ <https://www.mydigitalfc.com/miscellany/technology/060519/swiping-on-your-smartphone-reveals-a-lot-about-you-to-your-social-media-company.html>

⁹ <https://expandedramblings.com/index.php/tinder-statistics/>

¹⁰ <https://newsroom.tiktok.com/it-it/un-miliardo>

reaches 1.21 billion users worldwide in 2021. They represent over 28 percent of the world's internet users, making position the social network as the fourth most popular social media platform in the world in terms of user numbers ¹¹. Is this combination of the two gestures also successful for e-commerce, or should one be chosen? The goal of this thesis is precisely to be able to find the best solution.

1.3 Neuromarketing role

A somewhat strange result is the fact that even though the number of e-commerce visitors has increased exponentially, actually, only a few visits convert to purchases. As seen in Statista's 2020 analysis, only 2.17 percent of global e-commerce website visits were converted into purchases¹². At this point, it becomes evident how classic marketing techniques are not enough and neuromarketing is a tool of enormous relevance in the field of e-commerce and its design. It is possible to understand at a deeper level what factors really affect the consumer when he or she is placed in front of a buying process. The shopping experience is guided and made easier, attractive, and able to generate more sales traffic. To optimize the so-called Conversion rate, which records the percentage of users who have completed the desired action, neuromarketing relies on six principles of persuasion:

- **Reciprocity** can be found in free trials, in the natural anchor effect, and content marketing;
- **Commitment and consistency** used in digital marketing;
- **Social proof and conformity** bets everything on reviews and the use of testimonials;
- **Authority** according to which customers trust information from authority figures;
- **Scarcity** makes one believe there is a limited number of a product or that there is a very close expiration date;
- **Likeability** works on the fact that more attractive people have a higher likelihood to be helped and credible.

But layout and design are the key aspects that this branch of marketing is concerned with. They impact how the audience perceives the brand. The impression it makes on them can either get them to remain on the page, learn about the business or make a purchase (Page, S., 2015). The psychology concerns the layout, the color scheme, the headlines, and of course the way of navigation. The importance of web design lies in this: if a brand does not have an excellent online presence, it will lose a significant amount of its market share and make way for its competitors. Retail brands need to pay special attention because design reigns supreme in this space (Vilardi, R.,2020). Navigating a website efficiently and pleasurably is an important aspect

¹¹ <https://www.statista.com/statistics/183585/instagram-number-of-global-users/>

¹² <https://www.statista.com/statistics/439576/online-shopper-conversion-rate-worldwide/>

that all web designers and businesses should be concerned about (Sharma, S., et al.; 2020). Indeed, regarding the pyramid of web design needs, and in particular the need for usability, it is important to focus on this, because its major goal is to economize and minimize the cognitive effort of the user by proposing products that are easy to understand, easy to use, easy to remember, avoid or make recoverable errors, and thus gratify the user. And that is why the use of swiping or scrolling should also be studied through neuromarketing.

In the next section, my main intention is to illustrate, through a literature review, how gestures can influence or can be influenced by the perception of consumers.

2. Theoretical and conceptual framework

The first step taken has been to analyze the literature on the topic of hand gestures, that has led to the idea of linking them with purchase intention, visual fluency, and difference in product type. The research was mainly carried out with the electronic databases of Google Scholar, Scopus, and Academia.edu, using particular keywords and narrowing the range to more or less recent articles.

Since, to date, there is little research concerning the comparison between the two hand-gestural modes, this study aims to analyze both in the context of e-commerce. This led to the research questions, namely:

RQ1: To what extent does the choice of hand gestures in an e-commerce influence the purchase intention of a possible customer?

RQ2: How does the choice of hand gestures on an e-commerce affect the perceived visual fluency of it, also considering the difference in product type?

Starting from these questions, a conceptual model was developed. It can be seen in **Figure 3** and consists of a moderation and mediation effect analysis.

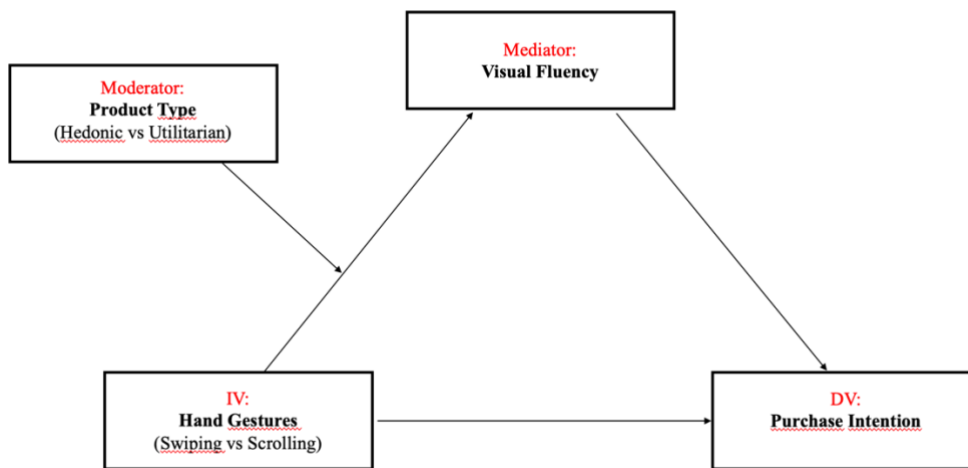


Figure 3: Conceptual model showing the moderation effect of Product type and the mediation role of the Cognitive load

2.1 Variables

Based on the research in this field, I am going to explain in the next paragraph, the study proposes 5 hypotheses. The first one is related to the effect that the independent variable (Hand gestures) can have on the Dependent variable (Purchase Intention); while the second one regards the mediation role of the visual fluency that has on the relation already mentioned. The third one affirms that swiping gesture has a positive effect on visual fluency and the fourth one states that visual fluency, in turn, influences positively the purchase intention. The last refers to the impact that the moderator (Product Type) has on the relation between the IV and the Mediator.

H1: Hand gestures in e-commerce influence purchase intentions. In particular, swiping gestures will have a positive impact compared to the scrolling ones.

H2: The causal relation between Hand gestures and purchase intentions is explained by visual fluency.

H3: Consumers will perceive more visual fluency with scrolling gestures compared to e-commerce with swiping gestures.

H4: Visual fluency will positively influence the purchase intention. Especially, when respondents show a high visual fluency, also the purchase intention will be high.

H5: The product type will have an impact on the relation between hand gestures and visual fluency. When participants are provided with some e-commerce selling utilitarian products, the perceived visual fluency is high.

2.1.1 Hand gestures

Regarding the main variable of the study, it is necessary to start with the definition of the two hand gestures. According to the Treccani encyclopedia, swiping means "Movement made by swiping the fingertip or stylus across the screen or keyboard of a smart mobile device¹³" and scrolling is understood in computing, "as the vertical scrolling of text or an image on a computer screen so that they disappear on one side of the screen and new data appear on the opposite side¹⁴". Considering the fact that smartphones are frequently used in environments where the user is distracted by another task, for example by walking or by driving, both gestures have been shown to allow users to spend less time looking at their smartphone while engaged in other things. It is also important to note that these two gestures are functional for web browsing via smartphone but have limitations regarding other activities during browsing such as copy and paste, drag and drop, and multiple selections (Roth, V., et al; 2009). Making a comparison between these two instead, Choi, B.C.F., et al; (2016), on the other hand, define swiping or horizontal scrolling as an interface where the app presents the user with an image of a product, and the user swipes right or left. In their paper, Jewon, K., et al; (2016), describe vertical scrolling as the standard method of exploring search results pages and for social media. It was specifically developed for mouse-based navigation on a digital screen (Choi, B.C.F., et al.; 2016). According to the U.S Department of Health and Human Services (2003), scrolling provides users either to roll the scroll wheel on their mouse or to manually move the scroll bar that is possible to find on the right side of the browser screen.

Moreover, scrolling is common because the full content of applications is typically larger than a display screen. To see all the content, users scroll in order to examine details in documents and other digital materials (Sharma, S., et al.; 2020). Related to the model, instead, it is interesting to highlight the papers of Dou, X., et al; and Choi, B.C.F., et al, both of 2016, that propose swiping as the gesture that leads to more purchase intention since it stimulates greater enjoyment and playfulness; those are in support of my first hypothesis. Furthermore, swiping is a quick movement done with the thumb. Thanks to it, users can take decisions quickly and spontaneously. The swipe logic could represent a technical aspect of interaction but also can lead to possible behavioral changes in the interaction with contents (Fernandes, S., et al; 2019). The present literature also found that taking into consideration the so-called Need for Touch, people with high NFT reported a greater preference for horizontally scrolling products (i.e., swiping) (Ren, H., et al; 2017). According to Dou, X., et al, (2016) swiping positively influences the intention behavior to use the website thanks to the perceived enjoyment with a key role. Moreover, the gesture is considered more fluid, intuitive, and easier to use, all factors

¹³ <https://www.treccani.it/vocabolario/ricerca/swipe/>

¹⁴ <https://www.treccani.it/enciclopedia/scrolling/>

that increase user satisfaction in browsing the site or application. In relation to psychological aspects, swiping is seen as more intuitive and natural, and it is better because related to the gesture of flipping through a book or newspaper (Choi et al.; 2016). Their study has revealed that adding the horizontal swipe interaction in scroll websites increases the interest, users' engagement, and also their curiosity about the website. Actually, an important aspect is also the combination of these two gestures, in fact, as reported by a thesis from the Ghent University, a scrolling page for categories with a horizontal way of swiping for products within categories is perceived to be easier to use and more time-efficient, it leads consequently to a positive attitude towards the mobile commerce website and the brand (e.g Amazon homepage). Finally, swiping or the one-touch gesture in the horizontal direction was rated to have higher performance and has requested lower physical demand, compared with scrolling or diagonal logic (Jeong, H. et al; 2017).

With regard to scrolling, however, page length can influence the user experience significantly. Returning to the concept of usability, mentioned in the previous sections, one of the world's leading experts on user-friendly design, Jacob Nielsen, states that scrolling reduces usability and a web page should not exceed three screens in length (Nielsen, J.; 2014). Scrolling over time, however, has become more typical and people have become more familiar with it, in fact as Hinojosa, C. (2014) affirmed, long homepages surfable with scrolling keep visitors more time on the site and could generate specific advantages. While the study of Koukouletsos, K., et al; (2014) showed that long pages appear more attractive and interesting, users find the navigation and orientation difficult, also locating a specific item on the page that was previously scrolled is perceived as complicated.

In **Figure 4** it is shown a representation of what scrolling and swiping gestures consist of.

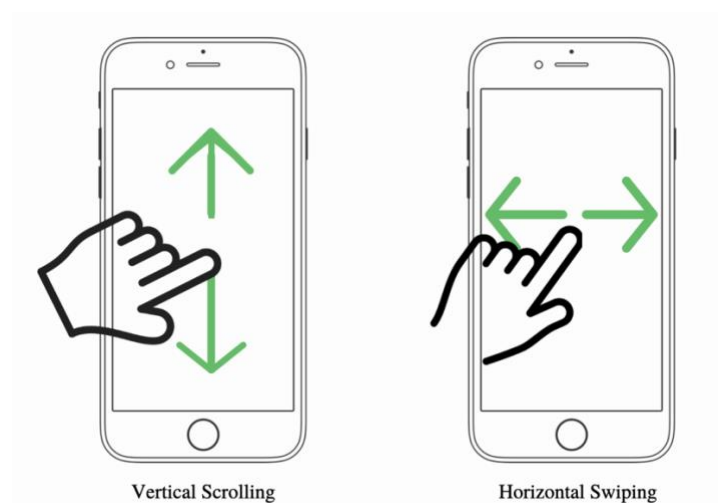


Figure 4. Scrolling and Swiping touch-screen gestures

2.1.2 Product type

The first pairing that came to mind was product type difference, which mainly characterizes e-commerce; in fact, existing statistics differentiate e-commerce sales by product category. According to a Statista report of 2018, the most purchased products are those related to fashion or footwear (57% and 47%) and electronics (40%)¹⁵, this has led to the idea for conditions of the survey used in the next steps of this research. Utilitarian consumption refers to products that provide more functional and practical benefits, while hedonic items are consumed for affective or sensory needs (Huber, F., et al; 2018). Convenience, cost-saving, information availability, and selection affect utilitarian motivation; while hedonic one is influenced by adventure, authority, and status (To, P., et al; 2007). A distinction must then be made between utilitarian and hedonic needs. Utilitarian needs concern a cognitive decision-making process and include practical, rational, concrete, and economic needs (e.g., foods and stationery). To meet this type of need, products are evaluated on the basis of their intrinsic characteristics, on how useful or functional they are in solving a problem. In contrast, hedonistic ones involve experiential decision making and include emotional, social, irrational, abstract, sensory, expression, and aesthetic needs. These are those products that we buy because they provoke some feelings, and this is exactly what happens in the complex luxury market (e.g., automotive, art objects). These distinctions must be taken into high regard and companies must understand the right placement of their product, service, etc. to best reach their target consumers.

I thought of using it as a moderator to use an aspect more directed toward e-commerce owners than criteria related to consumer personality traits. Consumers look for risk reduction strategies to make a more comfortable purchase, to make the risk come below their acceptable level (Chu, K., et al; 2008). This last concept is linked to findings showing that consumers are strongly influenced by their perception of the risk when making decisions about purchasing products and not services (Xiao, L., et al; 2003). In addition, according to Chiu, C., et al; (2012), perceived risk plays a moderated role in the effect of utilitarian and hedonic products that have on repeat purchase intentions. Since both positively influence the purchase repetition, a higher level of perceived risk increases the effect of hedonic value on repeat purchase intention, while the opposite occurs with the effect of utilitarian value.

Previous literature has illustrated that the perception of high levels of utilitarian and hedonic value from online experiences, leads to users' positive behavioral intentions, such as repeat purchase and continued use. It is important to highlight the paper of To, P., et al; (2007), which results show that utilitarian motivation is the strongest predictor of intention to search and intention to purchase. While examining the nature of the decision task it has emerged that a

¹⁵ <https://www.statista.com/statistics/276846/reach-of-top-online-retail-categories-worldwide/>

hedonic item is relatively preferred over the same utilitarian item in forfeiture choices (selection of item to give up) than in acquisition choices (Dhar, R., et al; 2000).

Related to the moderation role I have thought for my study, I have taken as a support of my fifth hypothesis, the research of Akdim, K., et al; (2022). The impact of utilitarian variables, such as perceived usefulness, and perceived ease of use is generally greater for utilitarian Apps, and they show a significant effect on the intention to use the App. Furthermore, as stated earlier in the thesis, good web design leads to increased purchase behavior; in online shopping, the web interface acts as intermediary between customers and retailers, its design should combine utilitarian and hedonic elements to create a holistic shopping experience (Liu, F., et al; 2020). Hence, it is important to use the right elements, and it has been shown that putting utilitarian elements that facilitate the shopping experience causes an increase in purchase intention (Bridges, E. et al; 2008). In addition, as Cherry, T., et al; (2001) stated “consumers’ responses to a hedonic store’s visual complexity may differ from their responses in a grocery store”, so there is difference between hedonic and utilitarian shopping experience.

In contrast, hedonic value is characterized by dimensions such as adventure, and gratification, and has a positive impact on impulse buying (Gültekin, B., 2012). According to the study of Bettiga, D., et al; (2020) “Previous research argued that hedonic product experiences lead to stronger emotional responses of arousal, pleasure, and engagement than utilitarian ones”.

Product type difference, as shown, is a topic much covered in previous literature but not connected to touchscreen gestures. A widely used approach in marketing to identify why consumers decide to buy is contrasting the hedonic value of a good with its utilitarian value, but will this also have an effect in the field of hand gestures and mobile e-commerce?

2.1.3 Visual Fluency

The thought of using visual fluency as a variable starts from the fact that the appearance of online websites influences consumer shopping behavior. In fact, researches in the sector are focusing on Online Visual Merchandising practices (Ha, Y., et al; 2010; Im, H., et al; 2010) since visual online presentation has a key role in the shopping experience and consequently, on the purchase decision process of the visitor. In this section, we will almost jointly discuss both visual fluency but also processing fluency because they are two closely related concepts and that is why the scale used later in the study survey, combines the two notions.

The existing literature states that the subjective experience of processing fluency can influence a variety of judgments, including perceptual characteristics, assessment of the truth of a statement, or one’s liking of an object.

The concept of visual fluency is developed on the basis of the acknowledgment that the processing of any visual stimulus requires cognitive work. The amount of this needed is presented in the speed and accuracy of visual processing as well as in the subjective experience of easiness. (Jacoby, L.L., et al; 1989).

Related to the model, since swiping interface leads to greater levels of cognitive absorption it is possible to deduce that the scrolling interface is seen as more visually fluent and requires less effort (Choi, B.C.F., et al; 2016). This could be used as support for hypothesis number 3. Many variables can influence the ease with which a stimulus can be processed and could increase both processing fluency and conceptual fluency; they together are synthesized into the visual fluency.

In addition, it is important to highlight the finding according to which visual fluency influences the liking of a stimulus (Winkielman, P., et al; 2008), which could be connected to a consequent purchase intention; this could demonstrate the fourth hypothesis.

As Lennon, S.J., et al; (2010) quote “Visual information quality is one of the most important elements that determines online shoppers' experience on a website”. Here, neuromarketing could play an important role, visual stimuli are judged by aesthetical evaluation, and an object (that could be a product or in this case a website) is considered aesthetic when it satisfies certain qualities, like the Golden Ratio that follows the Fibonacci numbers sequence (S.Page; 2015). Consequently, an aesthetic evaluation of the website is an important predictor to consider in establishing preferences (Shenkman, B., et al; 2000). Numerous articles suggest that aesthetic pleasure is a function of processing fluency; increasing fluency will also increase the perception of aesthetics, through factors such as figural goodness, symmetry and information density or frequency of exposure., and mere exposure effect (Bornstein, R.F., et al; 2011).

In the field of mobile apps, it is fundamental to cite the paper of Montazemi, A., et al; (2013), this shows that in mobile Apps with good interfaces and formats, the content is perceived as more accessible and users feel that it is possible to interact with the app in an easier way; obviously, this leads to more satisfied consumers.

In the advertising sector, processing fluency is able to increase the attention and processing depth of the advertisement, thus, its self-reported subjective results are relevant in the prediction of consumers' attitudes, and marketers can use it to improve the way they advertise their products (Storme, M., et al; 2015).

Another factor to keep in mind is the cognitive bias of “likeability”, a tendency of human beings to regard items with symmetry and good looks as better, which then causes positive attitudes about that item, which is why beautiful and well-known celebrities are used as endorsers in advertisements. In fact, according to Forgas, J.P. people rely on these visual fluency variables

to create impressions for themselves and this is in turn influenced by people's mood, a positive feeling increases visual fluency the negative one eliminates it altogether.

The opposite is, obviously, the visual complexity; it refers to the amount of detail or intricacy in visual stimuli (Snodgrass, J.G., et al; 1980) and as its reverse, it is an important variable that influences first impressions and emotions toward aesthetic preferences concerning the stimuli (Tuch, A.N., et al; 2009).

In e-commerce world, extant research affirms that people tend to prefer context-less to contextual images, because detailed image contexts make the image more complex, consequently decreasing viewers' fluency perceptions and, in turn, liking (Maier, E., et al; 2018).

Therefore, in store environment, high fluency causes positive emotional response and pleasure, while the complexity provokes an increment in the arousal of consumers, increasing their intention to buy (Groeppe-Klein, A., et al; 2001).

Coming to the area of mobile online shopping, characterized by short and interactive sessions, processing fluency plays a central role, influencing both satisfaction with the mobile online store and choice satisfaction (Sohn, S., 2017). In addition, in a low-involvement context, fluency with cognitive effort could attract users' attention enhancing situational involvement. Here, the gap is known, there is a lack of research regarding just how to navigate an e-commerce, the following study aims to fill this gap.

2.1.4 Purchase Intention

The goal of all companies that also rely on marketing experts is to sell their products; therefore, purchase intention is a key variable to be analyzed in purchasing processes, both in offline and online environments. Honestly, it is one of the easiest variables to evaluate when doing these studies, but it is still true that it is the most effective and applicable one in all fields, leading to real managerial implications. Varied are the aspects that influence purchasing, both concerning this study and not. By analyzing the elements set forth above, it can be seen, for example, that the quality of the online store environment increases the shopping pleasure (Eroglu, S.A., et al; 2003) which leads to more purchase intention. It could be associated with hypotheses H1 and H4, can be associated with those assumptions, along with everything stated in the previous sections regarding the individual variables in the model. What influences it can also vary from culture to culture (Boudhayan, G., et al; 2010). Purchase intention is often associated with subsequent purchases, but it is fair to analyze the factors that lead to an increase or decrease in this association. Results of Morwitz, V.G., et al (2007) paper show that "intentions are more correlated with purchases: 1) for existing products than for new ones; 2) for durable goods than

for non-durable goods; 3) for short than for long time horizons; 4) when respondents are asked to provide intentions to purchase specific brands or models than when they are asked to provide intentions to buy at the product category level; 5) when purchases are measured in terms of trial rates than when they are measured in terms of total market sales, and 6) when purchase intentions are collected in a comparative mode than when they are collected monadically". As already mentioned, this variable can be applied in different fields, one example that is very relevant to date is sustainability, and thus based on the Theory of Planned Behavior, it is assumed that purchasing intentions are positively influenced by attitude and environmental consciousness, in turn directly and positively affected by previous purchase experience (Salome, C., et al; 2021), so it is inferred that an attitude toward a particular product implies an intention to purchase it and that prior online purchase experience may also have an effect on online purchase intentions (e.g., Shim, M.A.E., et al. 2001). In addition, a predictor of online purchase intention is the search intention in turn influenced by main factors, such as utilitarian value and hedonic value of Internet information search, perceived benefits of Internet shopping, perceived risk of Internet shopping, and Internet purchase experience (Kim, J., et al; 2004). Purchase intention is part of behavioral intentions, and behavioral intentions are cognitive plans to perform a definite action or possible behavior on an object, and according to the Theory of Planned Behavior behavioral intention influences behavior and stimulates actions.

As foreshadowed in the introduction, it is important to discuss purchase intention and increasingly understand what can increase it, as there is significant evidence revealing a vast number of consumers' purchase abandonment, who can be described as users who search for something on the Internet, browse e-commerce but then do not conclude the process with a purchase. Another key aspect is also trust, it is in fact shown that when consumers feel more trust, there is more willingness to purchase through electronic media (Sanchez-Alzate, J., et al; 2016). Connecting to this is to consider that it is still perceived as risky to make purchases on the Internet, online retailers or service providers can develop appropriate methods to help consumers reduce their perceived risks; a low level of perceived risk is also expected to promote purchase intentions and reactions to actual sales (Mitchell, V., 1999).

So given the importance of this variable, it is useful to apply it in this model. The next section will go on to describe the methodology used and the results obtained, and thus whether purchase intention will be affected or not.

3. Study

After having gathered secondary data from the literature review and highlighting the research gap, the study proceeded with a quantitative investigation of the topic. In order to answer the

previous research questions and to test the hypotheses, quantitative research was carried out. The next sections will explain in detail the methodology used and the data analysis performed through SPSS.

With quantitative research, statistical and structured data are collected, which support drawing general conclusions from the research. The concrete data obtained allow decisions to be made based on objective observations. Furthermore, while it is true that quantitative research provides numerical values based on samples, these results can nevertheless be transferred to an entire population group by extrapolation. Statistical analysis in quantitative research aims to provide a solid database to explain causal relationships between different variables.

3.1 Participants, Variables, and Methods

An online survey on Qualtrics was created. In regard to the sampling method, two non-probability sampling techniques have been involved: the convenience and the snowball sample. I started by sending the link of the survey to my contacts, especially friends and relatives, and then I asked some of them to share the questionnaire also with their friends. In addition, a platform to recruit possible participants who met certain requirements was used. In the message shared with people, there was highlighted the possibility to complete the survey also in English, in this way non-Italian speakers could contribute to the research. The survey flow consisted of 5 main blocks. In the introduction, a general overview of the topic and scope of the research was provided, also highlighting an approximate time required to complete the survey. Moreover, the respondents have been assured the anonymity of their answers. In addition, the task respondents would go to implement concerning the conditions created, was explained. The second block presented the condition of the experiment. For this step, a timer of 30 seconds was set to make sure that the respondents were able to copy the link of the e-commerce and reflect on the task assigned to them. The third block represented the core part of the survey, where participants were kindly asked to answer some questions about the experimental scenarios. In the fourth block, instead, two manipulation checks were placed to analyze the attention of respondents; finally, they were asked to provide some demographic data, such as age and gender. In addition, it was requested to take the survey via smartphone, because it is considered as the most likely device to highlight m-commerce (Chang, Chen, Zhou, 2009).

Depending on the condition, respondents had to evaluate one of the stimuli manipulated.

The latter were presented, randomly, to participants in the form of links they had to copy and paste into a new page. In doing so, they found themselves on an e-commerce site. Subsequently, they were assigned to one of the following four experimental stimuli:

- **Condition 1:** The Shoppest is an e-commerce of luxury bags. It has a simple layout and consists of a homepage, presenting the website logo and all available products, and a detailed page for each product. In addition, information was provided regarding the characteristics and the fixed price of each product. More relevant is that the site is navigable through the Swiping gesture. (**Swiping and Hedonic product**)
- **Condition 2:** The Shoppest is an e-commerce of laptops. It has a simple layout and consists of a homepage presenting the website logo and all available products, and a detailed page for each product. In addition, information was provided regarding the characteristics and the fixed price of each product. More relevant is that the site is navigable through the Scrolling gesture. (**Scrolling and Utilitarian product**)
- **Condition 3:** The Shoppest is an e-commerce of laptops. It has a simple layout and consists of a homepage presenting the website logo and all available products, and a detailed page for each product. In addition, information was provided regarding the characteristics and the fixed price of each product. More relevant is that the site is navigable through the Swiping gesture. (**Swiping and Utilitarian product**)
- **Condition 4:** The Shoppest is an e-commerce of luxury bags. It has a simple layout and consists of a homepage presenting the website logo and all available products, and a detailed page for each product. In addition, information was provided regarding the characteristics and the fixed price of each product. More relevant is that the site is navigable through the Scrolling gesture. (**Scrolling and Hedonic product**)

What changed were only the gestural modes of navigation and the type of product sold; all so as not to influence the participant and distract him from the main task. In **Figure 4** it is represented a mockup of two of the conditions created.

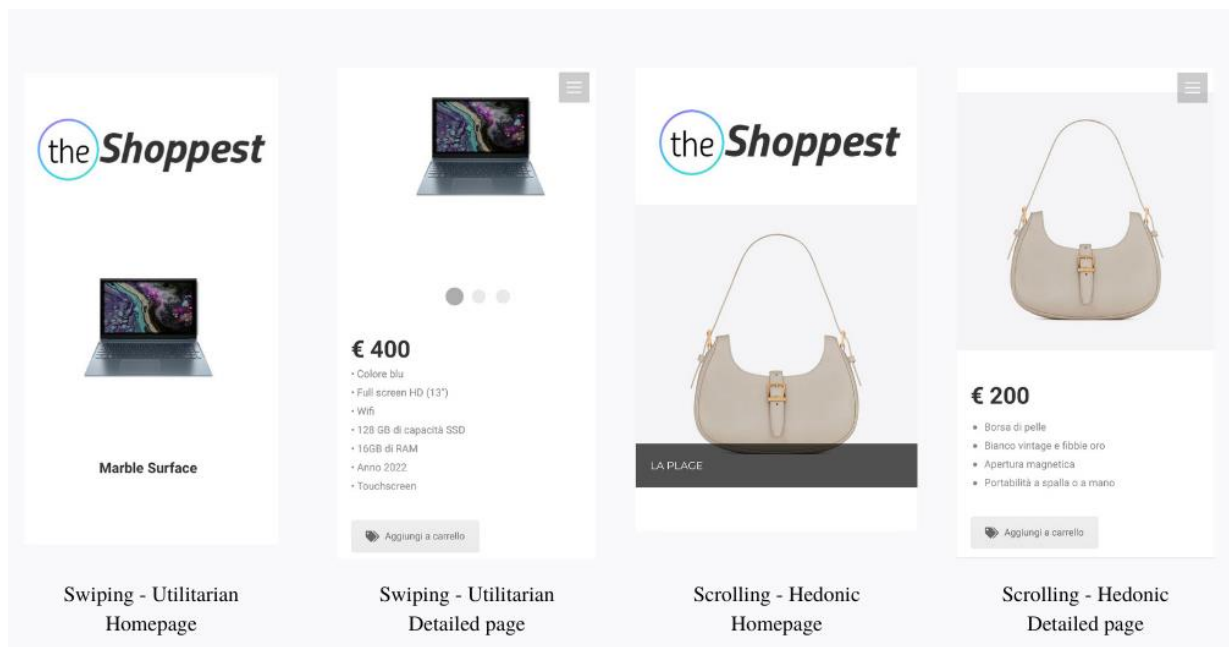


Figure 4: Mockup of the Condition 3 and Condition 4

Three scales were used to measure the variables that compose the conceptual model already described (visual fluency, purchase intention, and product type). They were developed based on previous literature and using existing scales.

The first variable was assessed through a three items bipolar scale, seven-point semantic differentials are used to measure the ease with which a person is able to process a visual stimulus, in this case, the e-commerce. It is a combination of perceptual fluency (items #1 and #2) and conceptual fluency (item #3) (Labroo, A., et al; 2008) (“Now, I ask you to indicate how much more the following statements reflect your judgment about the e-commerce just saw”; 1. Not at all attractive / Very attractive, 2. Not at all eye-catching / Very eye-catching, 3. Difficult to process / Easy to process; $\alpha = .97$). Authors referred to the scale both as ease of processing and a fluency index.

For the purchase intention, the dependent variable, a seven-point Likert scale was used to measure the respondent's likelihood of a future purchase (Jarvenpaa, S., et al; 2000) (“How likely is it that you would return to this store’s website?” 1= very unlikely / 7 = very likely, 2. “How likely is that you would consider purchasing from this store in the next 3 months?” 1= very unlikely / 7 = very likely, 3. “How likely is it that you would consider purchasing from this store in the next year?” 1= very unlikely / 7 = very likely, 4. “For this purchase, how likely is it that you buy from this store?” 1= very unlikely / 7 = very likely; $\alpha = .95$).

The product type was measured through a bipolar scale developed for the experiment with a short explanation of what Hedonic and Utilitarian products mean (“I kindly ask you to evaluate the products just shown on the website”, Hedonic/ Utilitarian).

Moreover, as manipulation checks, two easy questions were asked; for the attention check on the hand gestures, after a short explanation of the difference between Swiping and Scrolling (“Regarding the e-commerce you just viewed, what hand gesture mode did you use to navigate?” 1 = Swiping, 2 = Scrolling); for the type of product (“Now I would like to ask you about the e-commerce you just viewed, what products were there?” 1 = Luxury bags, 2 = Laptops).

Finally, respondents had to write their age and select their gender.

3.2 Results

After having gathered an adequate number of responses, I proceeded with the analysis on SPSS. The sample was initially composed of 250 respondents. However, this number was reduced while clearing the dataset. By deleting the incomplete answers, the answers of the respondents that failed the attention checks, and incorrect answers in the age question, the sample arrived at a total of 200 final responses. Once cleared the dataset, I analyzed the sample with descriptive statistics; discovering that 54,5% of respondents were female and the average age was 36, with a maximum of 78 years old and a minimum of 18 years old. With the cleaning of the dataset, the most viewed condition was found to be the first, that of luxury bags e-commerce surfable with the swiping gesture (27,5%).

Secondly, two factor analyses were performed.

In the first factor analysis, firstly, I looked at the commonalities table to see if there were values lower than 0.5. However, since all the items had commonalities above 0.50, no item was dropped.

Next, to understand how many factors we needed to extract, the total explained variance table was checked. Following the Eigenvalue and the percentage of cumulative variance explained criteria, all factors were retained with an Eigenvalue higher than 1.0. Moreover, I checked this result also by looking at the scree plot, keeping all the factors before the elbow point of 1.

The same results appeared in the second factor analysis, so in both, it was not possible to create the matrix of rotational components since only one component was extracted.

The next step was a reliability analysis for the visual fluency and purchase intention scales. It was possible to consider all the items of the scales as reliable since their elimination would not bring relevant changes in Cronbach’s alpha (α), which was equal to 0.97 for the visual fluency and 0.95 for the purchase intention. Keeping in mind that Cronbach’s alphas between 0,6 and 0,7 were considered as lightly reliable, values between 0,7 and 0,8 as moderately reliable, values above 0,8 as very reliable, and Cronbach’s alphas above 0,9 as extremely reliable.

In the following **Table 1** it is possible to see a resume of Factor and Reliability analysis.

Construct	Item	Factor loadings	Cronbach's α
Visual fluency	VF1. Not at all attractive/Very attractive	0.974	0.943
	VF2. Not at all eye-catching/Very eye-catching	0.972	0.948
	VF3. Difficult to process/Easy to process	0.962	0.963
Purchase intention	PI1. How likely is it that you would return to this store's website?	0.901	0.946
	PI2. How likely is it that you would consider purchasing from this store in the next 3 months?	0.932	0.932
	PI3. How likely is it that you would consider purchasing from this store in the next year?	0.949	0.923
	PI4. For this purchase, how likely is it that you buy from this store?	0.940	0.928

Table 1.

3.2.1 Main effect, Moderation, and Mediation effect

In order to test the five hypotheses, already mentioned related to the conceptual model, a regression analysis was conducted using Model 7 of Process (Hayes, 2017). All regression analyses were carried out with 5000 bootstrap samples to estimate bootstrap confidence intervals. This was launched by setting the previously created mean of Purchase intention as the dependent variable, the mean of Visual fluency as the mediator, the Product type as the moderator (with 0= Utilitarian; 1= Hedonic; considering the hedonic as the reference group); lastly, Hand gestures as the independent variable (with 0=Scrolling; 1=Swiping; considering the last as the reference group). With this model, it was possible to see the so-called Moderated mediation effect, that characterizes this study. Looking at findings following a top-down approach, it is possible to see that the moderated mediation index is not significant (index = -0.146; boot standard error (SE) = 0.10; 95% CI = -0.026) and also the interaction of a path is not significant (b = -0.38; se = 0.26; $p = 0.15$). This suggests that there is no moderation of Product type on the relation between Hand gestures and Visual fluency. This result shows no significant differences, indicating that the participants processed the e-commerce in the same way, both if it sells utilitarian or hedonic products. Thus, **H5** was rejected.

In this case, to better analyze the effect of mediation instead, another regression analysis was carried out. This regression was launched using Model 4 of Process, keeping the same variables except for the moderator. Findings showed that the independent variable (Hand gestures) has a significant effect on the Visual fluency (b = -3.41; se = 0.13; $t = -25.74$; $p = 0.00$) and on the

Purchase intention ($b = -2.09$; $se = 0.17$; $t = -12.62$; $p = 0.00$). In addition, the results indicated the presence of a negative and significant indirect effect of Hand gestures on the dependent variable ($b = -1.31$; boot standard error (SE) = 0.31; 95% CI = -1.93, -0.68); which signals that Visual fluency acted as a mediator of the effect of the IV on Purchase intention. So, there is a mediation. Lastly, the Visual fluency has a significant effect on the Purchase intention ($b = 0.38$; $se = 0.08$; $t = 4.52$; $p = 0.00$). These findings suggest that Hand gestures influence the dependent variable both with and without the mediator, so there is a partial mediation. Considering the Swiping gesture as the reference group, it is possible to see that it has a negative effect on the Purchase intention, so when the e-commerce is surfable by swiping, the intention to buy of consumers decreases; additionally, it has a negative effect also on visual fluency and this, consequently, could be a predictor of a lower purchase intention. Thus, an e-commerce with scrolling gesture is perceived as more visually fluent, since the mediator positively influences the dependent variable, a high visual fluency leads to an increase in purchase intention. Therefore, it follows from these results that the hypotheses **H2**, **H3** and **H4** are confirmed, whereas **H1** is rejected.

4. Discussion

As can be seen from everything presented above, technology is advancing and along with it user interfaces, which increasingly offer great interactivity. Connected to this, given the importance that the two gestures, swiping and scrolling, the main topic of the study, are assuming, the research compared the two logics, investigating the role they play on purchase intention, but also the impact on users' visual fluency and how this, in turn, can mediate the relationship between gestures and purchase intention, with the moderation of product type difference.

The results show that first and foremost contrary to expectation the role of the moderator is not significant; therefore, whether the product is hedonistic or utilitarian the relationship between gestures and visual fluency remains the same. Instead, it was important to see that the study found that scrolling is the gesture that positively affects purchase intention, contrary to what previous literature claimed, thus rejecting Hypothesis 1. While it was satisfying to see that the other 3 hypotheses were confirmed, namely the fact that visual fluency mediates the main relationship, that the latter has a positive influence on purchase intention, as many pieces of research already stated and finally that again it is scrolling that has a positive effect on visual fluency, so users perceive a website to be less visually complex when it is navigable through scrolling technique. One reason this has been shown may be because we are more surrounded by sites or apps that use this logic, as opposed to swiping; so, the factor of typicality or

familiarity with that gesture may also come into play. According to existing literature, the latter is also important in e-commerce and acts as a predictor of purchase intention (Suki, N., 2013). In addition, scrolling in turn is influenced by several elements in the e-commerce design, besides the visual, also the text, and the formatting, and then it can also be analyzed even through neuromarketing tools such as eye-tracking to create heat maps and see where the user's attention goes.

Overall, we believe these results might offer relevant theoretical and managerial insights, as well as generate questions to be answered by future research.

4.1 Theoretical implications

It can be stated that there was little or almost no literature regarding typical browsing gestures in the e-commerce context. We started by considering how the majority of previous studies have explored the concept of the two gestures without making a comparison between them in an e-commerce environment. Thus, the study advances extant research, by comparing them and applying them online, in many ways, by providing insights regarding the effect one of them has on purchase intention, and by bringing together several variables never seen altogether.

Importantly, and in line with previous research, it was the demonstration that the visual appearance and the design of e-commerce play a key role in its usability, in users' perceptions, and that the more fluid and visually simple an online store is considered, the higher the purchase intention will be.

In addition, the results of the statistical analysis have proved the existence of a mediating effect of visual fluency on the main effect given by the gestures' influence on the purchase likelihood. A relevant finding to add to the present literature was that although the information, logo, colors, and structure of the e-commerce remained unchanged in the conditions presented to the participants, it turned out scrolling makes the site perceived more visually fluent.

While regarding the role of moderation, through the results of the moderated mediation analysis, it came out that the product difference does not affect significantly. This also carries a theoretical impact, since the previous literature is full of papers regarding the difference between hedonic and utilitarian products and all the effects they have on several important variables, such as purchase intention or search intent. It would then be necessary to analyze the reason for this result perhaps given by the fact that people, strangers to the world of marketing, are still unclear about the difference between the product, what hedonic and utilitarian mean, and what needs these satisfy. However, what precisely has gone against the existing literature is the demonstration that scrolling has a positive effect on purchase intention, instead of swiping, which instead has always been seen as intuitive and natural, because it is associated

with the fact that people are used to reading books by turning pages horizontally, despite also the fame that is being gained by tinder pioneering swiping that gives immediate gratification. So, this also could lead to a revolution of research in the field and seeing scrolling from different perspectives.

4.2 Managerial Implications

Obviously, the study also brings a contribution from a managerial point of view, partly because the dependent variable analyzed is purchase intention, which, as mentioned before is mainly what companies aim to influence, especially in e-commerce where the main problem lies in shopping cart abandonment. The research can offer relevant insights to managers interested in understanding how to effectively use these results and increase their sales by changing the design of their web stores. It is important to point out that these gestures are unique to mobile devices and therefore e-commerce must be mobile responsive. This study, therefore, is useful in helping not only managers but also web designers in developing mobile web store interfaces according to its results.

As the results show scrolling is the gesture that positively influences purchase intention, given these outcomes managers/e-commerce owners should try to design their e-commerce by making them navigable through scrolling, of course not forgetting about all the other factors that make a website more visually fluid. In addition, according to an interview done by TikTok, it was found that 25 percent of respondents said they search for or purchase a product immediately after seeing it on TikTok; therefore, it would be optimal for users to then find the same experience in e-commerce as TikTok, characterized precisely by scrolling. To best complete the browsing experience, web designers must take into account all the appropriate visual elements to make people perceive the best possible visual fluency, for example, following from an aesthetic point of view the golden ratio and considering the cognitive bias of likeability. This is because high fluency causes positive emotions and pleasure in users, causing an increase in purchase intention.

Since there are so many types of scrolling managers should understand which one makes their own e-commerce less visually complex. They are normal scrolling with default pagination, infinite scrolling, infinite scrolling with a load more button, and infinite scrolling with pagination (Sharma, S., et al; 2020), although according to studies it turns out that infinite scrolling is the one that makes everything smoother, with no interaction required and no interruptions than pagination or the one with "load more" buttons.

It is also important to point out that these are applicable findings across all industries, from fashion and luxury to electronics or grocery, as product type has not been shown to have an

impact in this regard. This will help online retailers transform scrolls from well-intentioned but ineffective tools into powerful and essential components of any content-based user interface. In conclusion, retailers need to pay attention to the elements that can characterize the user experience in the online environment, improving the qualitative and quantitative KPIs of their e-commerce, such as conversion rate, one of the main goals to be achieved in this field.

5. Limitations and Future research

It is important to acknowledge that the study presents some limitations.

Analyzing it also from a neuromarketing point of view, a relevant limitation is that qualitative or quantitative analysis (used in this study) is not enough, but one would need to go ahead with neuromarketing experiments, such as using eye tracking to study where attention is focused and EEG for arousal and the valence of emotion that browsing these particular e-commerce elicits in participants. This is because as is well known, the human mind is only 10 percent conscious, while 90 percent resides in the subconscious; therefore, the answers given in the survey may be influenced by external factors and by the sentience fallacy may not be totally rational.

A limitation, on the other hand, referring to the result of scrolling, since there are few theoretical contributions to this effect, is the fact that it can cause inattention if it is too long since the average user is lazy; therefore, one should take into account the cognitive bias of the primacy and recency effect, according to which people remember only the information presented at the beginning or end of a piece of content, such as an e-commerce, information site, etc., and obviously try to entice the user to continue scrolling.

Previous studies suggest that product categories influence users' preference on a website, on the contrary, this paper showed that it does not have an impact in this regard, and therefore it would be necessary to analyze the reason for this result.

Limitations could also be had on the generalizability of the study since the sample does not have a very large number, but more importantly, it was not required in the survey to specify one's nationality, so it is not known how these results might change depending on the culture, nationality of the respondent. In addition, the sample was mainly composed of people of average age, between 24 and 44 years old, with fashion being 25 years old, so there is little data on different generations.

Another limitation is that it was emphasized to take the survey only through their smartphones, obviously, it is not known whether they actually followed this request, plus it could also expand the study to the difference between using large devices such as tablets or computers and the already analyzed smartphones.

Certainly, the limitations of our work can serve as ideas for future research.

As announced earlier, given the existence of different types of scrolling, one should analyze the one that is most meaningful, which therefore improves the visual aspect by making the e-commerce more fluid and of course that increases purchase intention as much as possible and consequently given a better shopping experience will, in turn, lead to increased sales.

For what concerns new future research suggestions one might think of analyzing the same model but adding the variable of the type of device used, it is easy to see how the graphics of different operating systems, such as iOS or Android vary, as preferences regarding the latter vary.

Related to visual fluency, further investigation needs to be done. According to Karimov, F.P., et al. (2011), who developed a general classification scheme for website design, visual design, such as layout and color gives customers their first impressions; one should analyze what are the main elements that influence it and could obviously increase it, facilitating even more the relationship between gestures and purchase intention; for example, background color. The latter according to (Biers, K., et al; 2005) has an impact on consumers' browsing time on a website, and retail studies indicate that the longer consumers stay in a retail environment, the more likely they are to make a purchase; therefore, see which colors are best to make what is claimed true, keeping in mind the main factors for web design, such as Appropriateness of the color, Von Restoff effect, the meaning of color, preference according to gender and the difference between passive and active colors (Page, S., 2015).

In addition, one could also analyze how the number of products displayed on a page could affect the perception of visual fluency in navigable e-commerce by scrolling, whether therefore it is better for there to be one, a few, or many products presented.

Finally, making the analysis even more contemporary, one could think of also studying and linking sensory marketing, which refers to "marketing that engages the consumers' senses and affects their perceptions, judgments, and behavior" (Krishna, A., 2012), especially with sound branding, thus see how background music could enhance the shopping experience and the subsequent purchase intention in an e-commerce scrolling; plus new technologies are being developed to make almost all the senses involved online, studied of course through neuromarketing (Petit, O., et al; 2015).

6. Conclusion

This thesis aims to further research regarding the two main gestural modes by which people navigate the Internet, horizontal swiping, and vertical scrolling. Previous studies have mainly dealt with these modes in the context of apps and social networks, the most illustrative case is Tinder, pioneer of swiping or TikTok with its perpetual scrolling. With my thesis, I wanted to

study an application case of e-commerce, where the search gap was present. The main question I wanted to answer is "how do swiping and scrolling affect a consumer's willingness to purchase mediated by visual fluency and with the moderating effect by product type?". This is because visual fluency and product type (hedonic and utilitarian) per se have, as previously reported in literature, a relevant effect on purchase intention and because the latter is one of the main goals of managers.

After extensive research and acquisition of secondary data, the study continued collecting primary data through a survey in which people were asked to browse an e-commerce created specifically for the study; these varied in gesture type (swiping or scrolling) and product type displayed; laptop represented utilitarian products and luxury handbags for hedonic ones.

Once finished the analysis and comprehension of the obtained results, 3 of the 5 hypotheses were confirmed and it emerged as the most important finding that, contrary to expectation, it is scrolling that causes more purchase intention with a positive effect on the latter. In addition, the empirical findings demonstrate visual fluency plays a mediating role, which is also influenced by scrolling and in turn positively impacts purchase intention. Instead, contrary to the previous literature, in this case, the difference in product type has no significance in the model and it should be analyzed the reason.

Thus, the study brings different contributions at theoretical level, revolutionizing what had previously been stated by instead associating swiping with a more natural and intuitive gesture preferred by people.

Moreover, it leads to managerial implications in the field of developing the right structures, strategies, and the right web design. Especially regarding purchasing intention, since as mentioned many times before, one of the main problems of e-commerce is shopping cart abandonment, so the goal is to optimize the Conversion rate.

Like most research, this study had several limitations, many of which involve the future use of neuromarketing tools.

With this work, I hope to encourage other researchers in the field to deepen the investigation on the topic, which is growing in importance as the use of mobile e-commerce becomes more and more developed.

I would like to conclude with a famous quote from Rich Miner, "Smartphones are reinventing the relationship between businesses and customers", just to highlight both how important a company's online presence is and how given all the data from mobile marketing it is vital to activate specific strategies for these devices.

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Sitography

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MASTER THESIS RESUME

The advancement of the World Wide Web has resulted in the creation of a new form of retail transactions, electronic commerce (e-commerce), or web shopping. Thus, customers' involvement and behavior in online purchasing have become an important trend. Thanks to Internet technology's continuous developments, consumers can purchase products or services from the web-retailers and search for product information on the Internet. Consumers could interact in a virtual environment via the website interface and enjoy web shopping with different experiences.

Today's consumers can shop from anywhere at any time with just a few clicks of their fingers. The main theme of this study will cover this last aspect, in particular, the hand gesture of Scrolling and Swiping on e-commerce and how they could influence consumer online purchase intention with the moderating effect of the product type difference (hedonic versus utilitarian), mediating by the variable of visual fluency.

The structure of this master thesis begins with an overview of topics that led to this study, subsequently, there will be an extensive discussion of the current literature, focusing on specific factors that influence the user experience on a mobile commerce website when using the two hand gestures. Then, we will present the conceptual model with the hypotheses built on the current knowledge, followed by the conducted research and its results. The final section provides a general discussion and conclusion of the findings, as well as their practical implications.

It is inevitable to begin by talking about ecommerce, highlighting the importance it has taken on and is taking on more and more, with new realities, dimensions and strategies. We are in the era of Internet 3.0, which is transforming marketing and communications. It figures not as an opportunity or an innovation but as an inevitable choice to remain competitive, represents a phenomenon that is constantly growing and increasingly linked to the "Social" and "Mobile" trends. Social media, mobile devices, new tools, and applications, increasingly accessible, simple, and pervasive. Internet is used in business transactions to create, modify, and redefine value generation relations between organizations and individuals.

There are more than 5 billion of people using the Internet, and this has obviously led to a consequent increase in the use of ecommerce and the presence of online businesses. And 2020 was the year with more online sales, mainly due to the health emergency caused by Covid 19. Nel 2021, instead, over 2.14 billion people worldwide have bought goods and services online. Right during the global pandemic, it is also true that electronic commerce has allowed the

survival of numerous businesses all over the world, whose owners have had to improve their digital skills and develop better technologies to have a presence in the Internet world.

Another relevant finding for this study, the use of e-commerce via mobile devices is increasing more and more. Data from 2020 showed that 67 percent of global online retail traffic comes from mobile devices, although most online sales still take place on the desktop, as many e-commerce are not optimized for mobile. Many brands and retailers have attempted to deflect this problem by developing shopping apps that better represent the consumer shopping experience. Mobile commerce enables a new way of information exchange and purchases to consumers and a new frontier to focus on from the perspective of retailers and digital marketers. Connected to this, previous data highlight that by 2022 it will be necessary to have an e-commerce site that is completely mobile responsive and with a User Experience that ensures the most fluent customer journey possible. This, which could promote purchaser decisions and increase sales, is highly desirable to retailers and their marketing and digital production companies.

For this reason, E-commerce designers should follow the Responsive Web design to respond to the user's behavior and environment based on screen size, platform, and orientation. It is not only about adjustable screen resolutions and automatically resizable images; it also concerns touchscreens. This is where the most important variable in this study comes in, users interact with hand gestures to navigate via a mobile device. In addition, with the advancement of technology and the improvement of user-interface interactivity, physical interactions with the technology are becoming increasingly important aspects of behavioral attitudes, intentions, and outcomes.

Two of the types of interaction regarding gestures on the touchscreen, are swiping and scrolling. Nowadays, the attention given to the choice between these two gestures mainly concerns the app design, particularly on social media, like Instagram, TikTok, and Tinder. The latter is the pioneer of swiping, while TikTok is characterized by scrolling. Instagram combines these two gestures, with scrolling of feed content and swiping in its stories.

The goal of this study is to be able to find the best solution between scrolling and swiping in ecommerce environment.

I also analyzed the role that neuromarketing can play in this context, given that a somewhat strange result is the fact that even though the number of e-commerce visitors has increased exponentially only a few visits convert to purchases.

So, classic marketing techniques are not enough and neuromarketing is a tool of enormous relevance in the field of e-commerce and its design. It is possible to understand at a deeper level what factors really affect the consumer when he or she is placed in front of a buying process. The shopping experience is guided and made easier, attractive, and able to generate more sales

traffic. To optimize the so-called Conversion rate, which records the percentage of users who have completed the desired action, neuromarketing relies on six principles of persuasion.

But layout and design are the key aspects that this branch of marketing is concerned with. The importance of web design lies in an excellent online presence to have significant amount of market share. Navigating a website efficiently and pleasurably is an important aspect that all web designers and businesses should be concerned about.

It is important to focus on the need of usability that has as main goal the capacity to economize and minimize the cognitive effort of the user. And that is why the use of swiping or scrolling should also be studied through neuromarketing.

These were the main topics on which I relied to develop all the analysis and study that I will subsequently go on to expose.

The first step was the literature review, initially on swiping e scrolling that has led to the idea of linking them with purchase intention, visual fluency, and difference in product type.

The research was mainly carried out with the main electronic databases, like Google Scholar. Since, to date, there is little research concerning the comparison between the two hand-gestural modes, this study aims to analyze both in the context of e-commerce. This led to the research questions, namely:

RQ1: *To what extent does the choice of hand gestures in an e-commerce influence the purchase intention of a possible customer?*

RQ2: *How does the choice of hand gestures on an e-commerce affect the perceived visual fluency of it, also considering the difference in product type?*

Starting from these questions, a conceptual model was developed. It can be seen in **Figure 3** and consists of a moderation and mediation effect analysis.

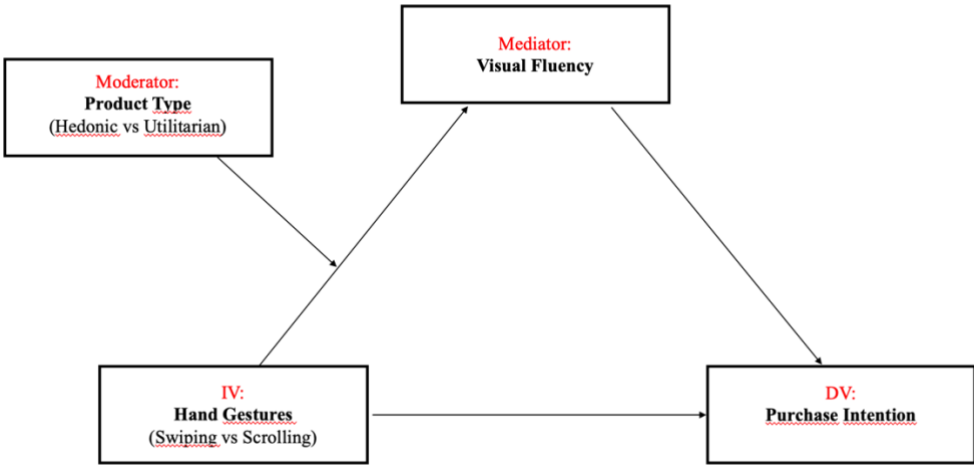


Figure 1: Conceptual model showing the moderation effect of Product type and the mediation role of the Cognitive load

Based on these variables and findings demonstrated by the previous literature reviewed, 5 hypotheses were proposed.

H1: Hand gestures in e-commerce influences purchase intentions. In particular, swiping gestures will have a positive impact compared to the scrolling ones.

H2: The causal relation between Hand gestures and purchase intentions is explained by the visual fluency.

H3: Consumers will perceive more visual fluency with scrolling gestures compared to an e-commerce with swiping gestures.

H4: Visual fluency will positively influence the purchase intention. Especially, when respondents show a high visual fluency, also the purchase intention will be high.

H5: The product type will have an impact on the relation between hand gestures and visual fluency. When participants are provided with some e-commerce selling utilitarian products, the perceived visual fluency is high.

The first variable analysed, as mentioned earlier, was hand gestures. It is necessary to start with the definition of the two hand gestures. According to the Treccani encyclopedia, swiping means "Movement made by swiping the fingertip or stylus across the screen or keyboard of a smart mobile device" and scrolling is understood in computing, "as the vertical scrolling of text or an image on a computer screen so that they disappear on one side of the screen and new data appear on the opposite side".

Both gestures have been shown to allow users to spend less time looking at their smartphone while engaged in other things. It is also important to note that these two gestures are functional for web browsing via smartphone but have limitations regarding other activities during browsing such as copy and paste, drag and drop, and multiple selections.

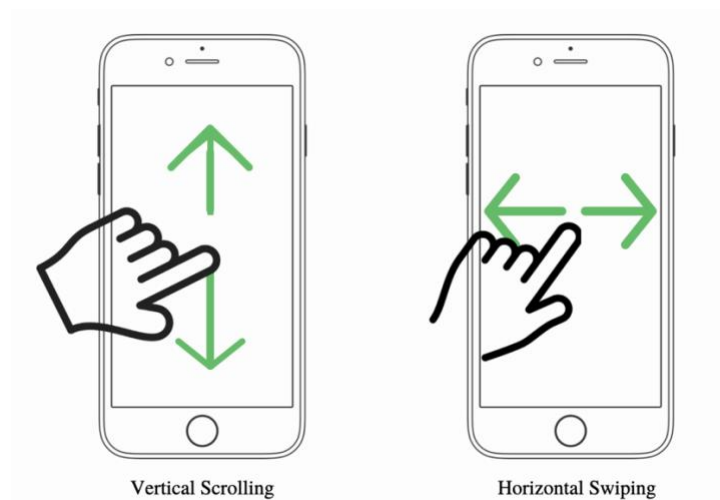
B.C.F Choi et al (2016) define swiping or horizontal scrolling as an interface where the app presents the user with an image of a product, and the user swipes right or left. In a paper was described vertical scrolling as the standard method of exploring search results pages and for social media.

Related to the model, instead, it is interesting to highlight the papers that propose swiping as the gesture that leads to more purchase intention since it fosters greater playfulness and enjoyment; those are in support of my first hypothesis. The gesture is considered more fluid, intuitive, and easier to use, all factors that increase user satisfaction in browsing the site or application. In relation to psychological aspects, swiping is better because related to the gesture of flipping through a book or newspaper, thus it is seen as more intuitive and natural.

An important aspect is also the combination of these two gestures, in fact, a scrolling page for categories with a horizontal way of swiping for products within categories is perceived to be easier to use, more time-efficient, with a consequent positive attitude towards the mobile commerce website and the brand (e.g Amazon homepage).

Returning to the concept of usability, mentioned in the previous sections, one of the world's leading experts on user-friendly design, Jacob Nielsen, states that scrolling reduces usability and a web page should not exceed three screens in length. It has been affirmed that long homepages surfable with scrolling keep visitors more time on the site and could generate specific advantages. While another study showed that long pages appear more attractive and interesting, users find the navigation and orientation difficult, also locating a specific item on the page that was previously scrolled is perceived as complicated.

In **Figure 2** it is shown a representation of what scrolling and swiping gestures consist of.



The first pairing that came to mind was product type difference, which mainly characterizes e-commerce; in fact, existing statistics differentiate e-commerce sales by product category.

Utilitarian consumption refers to products that provide more functional and practical benefits, while hedonic items are consumed for affective or sensory needs.

In fact, a distinction must then be made between utilitarian and hedonic needs. Utilitarian needs concern a cognitive decision-making process and include practical, rational, concrete, and economic needs (e.g., foods and stationery). In contrast, hedonistic ones involve experiential decision making and include emotional, social, irrational, abstract, sensory, expression, and aesthetic needs.

I thought of using it as a moderator to use an aspect more directed toward e-commerce owners than criteria related to consumer personality traits.

Previous literature has illustrated that the perception of high levels of utilitarian and hedonic value from online experiences, leads to users' positive behavioral intentions, such as repeat purchase and continued use.

To support my fifth hypothesis, I relied on papers that stated that the impact of utilitarian variables, such as perceived usefulness, and perceived ease of use is generally greater for utilitarian Apps, and they show a significant effect on the intention to use the App. Furthermore, as stated earlier in the thesis, good web design leads to increased purchase behavior; in online shopping, the web interface acts as intermediary between customers and retailers, its design should combine utilitarian and hedonic elements to create a holistic shopping experience. It is important to use the right elements, and it has been shown that putting utilitarian elements that facilitate the shopping experience causes an increase in purchase intention.

Product type difference, as shown, is a topic much covered in previous literature but not connected to touchscreen gestures. A widely used approach in marketing to identify why consumers decide to buy is contrasting the hedonic value of a good with its utilitarian value, but will this also have an effect in the field of hand gestures and mobile e-commerce?

The thought of using visual fluency as a variable starts from the fact that the appearance of online websites influences consumer shopping behavior. In fact, research in the sector are focusing on Online Visual Merchandising practices since visual online presentation has a key role in the shopping experience and consequently, on the purchase decision process of the visitor. I will almost discuss both visual fluency but also processing fluency because they are two closely related concepts and that is why the scale used later in the study survey, combines the two notions.

The concept of visual fluency is developed on the basis of the acknowledgment that the processing of any visual stimulus requires cognitive work. Related to the model, since swiping interface leads to greater levels of cognitive absorption it is possible to deduce that the scrolling interface is seen as more visually fluent and requires less effort. This could be used as support for hypothesis number 3.

In addition, it is important to highlight the finding according to which visual fluency influences the liking of a stimulus, which could be connected to a consequent purchase intention; this could demonstrate the fourth hypothesis.

Here, neuromarketing could play an important role, visual stimuli are judged by aesthetical evaluation, and an object (that could be a product or in this case a website) is considered aesthetic when it satisfies certain qualities, like the Golden Ratio that follows the Fibonacci numbers sequence. Consequently, an aesthetic evaluation of the website is an important predictor to consider in establishing preferences.

In e-commerce world, extant research affirms that people tend to prefer context-less to contextual images, because detailed image contexts make the image more complex, consequently decreasing viewers' fluency perceptions and, in turn, liking.

Coming to the area of mobile online shopping, characterized by short and interactive sessions, processing fluency plays a central role, influencing both satisfaction with the mobile online store and choice satisfaction.

Here, the gap is known, there is a lack of research regarding just how to navigate an e-commerce, the following study aims to fill this gap.

The goal of all companies that also rely on marketing experts is to sell their products; therefore, purchase intention is a key variable to be analyzed in purchasing processes, both in offline and online environments. Honestly, it is one of the easiest variables to evaluate when doing these studies, but it is still true that it is the most effective and applicable one in all fields, leading to real managerial implications. Varied are the aspects that influence purchasing, both concerning this study and not. By analyzing the elements set forth above, it can be seen, for example, that the quality of the online store environment increases the shopping pleasure (Eroglu et al; 2003) which leads to more purchase intention. It could be associated with hypotheses H1 and H4, can be associated with those assumptions, along with everything stated in the previous sections regarding the individual variables in the model.

As I have already mentioned, it is important to discuss purchase intention and increasingly understand what can increase it, as there is significant evidence revealing a vast number of consumers' purchase abandonment, who can be described as users who search for something on the Internet, browse e-commerce but then do not conclude the process with a purchase.

After having gathered secondary data from the literature review and highlighting the research gap, the study proceeded with a quantitative investigation of the topic.

In order to answer the previous research questions and to test the hypotheses, quantitative research was carried out.

The analysis started with an online survey on Qualtrics answered by my contacts and people recruited on a specific platform ¹. The survey flow consisted of 5 main blocks. In the introduction, a general overview of the topic and scope of the research was provided. In addition, the task respondents would go to implement concerning the conditions created, was explained. The second block presented randomly one of the four conditions of the experiment. The third block represented the core part of the survey, where participants were kindly asked to answer some questions about the experimental scenarios. In the fourth block, instead, two manipulation checks were placed to analyze the attention of respondents; finally, they were asked to provide some demographic data, such as age and gender. In addition, it was requested to take the survey via smartphone, because it is considered as the most likely device to highlight m-commerce. The stimuli were ecommerce created for the study, what changed were only the

gestural modes of navigation and the type of product sold; all so as not to influence the participant and distract him from the main task.

Three scales were used to measure the variables that compose the conceptual model already described (visual fluency, purchase intention, and product type). They were developed based on previous literature and using existing scales.

After having gathered an adequate number of responses, I proceeded with the analysis on SPSS. I analyzed answers of 200 final respondents. Once cleared the dataset, two factor analyses were performed with all items' communalities above 0.50. The next step was a reliability analysis for the visual fluency and purchase intention scales, both with Cronbach's alpha above 0.9, so extremely reliable.

In order to test the five hypotheses related to the conceptual model, a regression analysis was conducted using Model 7 of Process to show the moderated mediation effect. The results, instead, have shown a no significant effect of the moderator role, thus H5 was rejected.

In this case, to better analyze the effect of mediation, another regression analysis was carried out with Model 4 of Process. These findings suggest that Hand gestures influence the dependent variable both with and without the mediator, so there is a partial mediation. Considering the Swiping gesture as the reference group, it is possible to see that it has a negative effect on the Purchase intention, so when the e-commerce is surfable by swiping, the intention to buy of consumers decreases; additionally, it has a negative effect also on visual fluency and this, consequently, could be a predictor of a lower purchase intention. Thus, an e-commerce with scrolling gesture is perceived as more visually fluent, since the mediator positively influences the dependent variable, a high visual fluency leads to an increase in purchase intention. Therefore, it follows from these results that the hypotheses **H2**, **H3** and **H4** are confirmed, whereas **H1** is rejected.

Given the importance that the two gestures, swiping and scrolling, are assuming, the research compared the two logics, investigating the role they play on purchase intention, but also the impact on users' visual fluency and how this, in turn, can mediate the relationship between gestures and purchase intention, with the moderation of product type difference.

The results show that first, contrary to expectation, the role of the moderator is not significant; therefore, whether the product is hedonistic or utilitarian the relationship between gestures and visual fluency remains the same. Instead, it was important to see that the study found that scrolling is the gesture that positively affects purchase intention, contrary to what previous literature claimed, thus rejecting Hypothesis 1. While it was satisfying to see that the other 3 hypotheses were confirmed.

The study advances extant research, by comparing the two gestures and applying them online, by providing insights regarding the effect one of them has on purchase intention, and by

bringing together several variables never seen altogether. But what precisely has gone against the existing literature is the demonstration that scrolling has a positive effect on purchase intention, instead of swiping. So, this also could lead to a revolution of research in the field and seeing scrolling from different perspectives.

A contribution from a managerial point of view was also suggested. This study, therefore, is useful in helping not only managers but also web designers in developing mobile web store interfaces according to its results.

For example, e-commerce owners should try to design their e-commerce by making them navigable through scrolling, of course thinking what type of scrolling is the right one and not forgetting about all the other factors that make a website more visually fluid.

It is important to acknowledge that the study presents some limitations.

Analyzing it also from a neuromarketing point of view, a relevant limitation is that quantitative analysis is not enough, but it needs to go ahead with neuromarketing experiments, due to some fallacy of the mind. Limitations could also be had on the generalizability of the study. For what concerns new future research suggestions one might think of analyzing the same model but adding the variable of the type of device used or to test the difference between mobile devices and large desktops.

Related to visual fluency, it is needed to investigate on what elements could influence it, like background color. In addition, one could also analyze how the number of products displayed on a page could affect its perception.

I would like to conclude with a famous quote from Rich Miner, “Smartphones are reinventing the relationship between businesses and customers”, just to highlight both how important a company's online presence is and how given all the data from mobile marketing it is vital to activate specific strategies for these devices.