Analysis of the Impact of UI/UX Design on Consumer Behavior in E-Commerce: A Study of Shopping Interfaces

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***Abstract* - The UI/UX design of shopping interfaces can significantly affect consumer behavior and the chance of making purchases. We analyze a variety of shopping interfaces to see how much they affect consumers' purchasing decisions. The study included questions on user experience, simplicity of use, aesthetic design, and other variables that are known to impact consumer behavior. We surveyed 51 consumers who attend the Georgia Institute of Technology that were enrolled in PSYC 2803 during Spring 2023 and had recently used various shopping interfaces and e-commerce websites. The survey questioned the time that respondents spent shopping, the things they buy, and their preference for websites. We also gathered information on the number of things bought and how frequently they were bought. According to the surveys we have conducted, consumer preference towards an interface was strongly influenced by the familiarity and the appeal of the interface, while the interface's popularity was significantly affected by the clutter and the lack of appeal of the interface.**

***Index Terms* - UI/UX, shopping interfaces, consumer behavior, e-commerce**

I. INTRODUCTION

The digital age has enabled people to retrieve and share information faster than ever before. Web technologies have enabled businesses and consumers to communicate and share information across time zones and borders without physical constraints. One of the many such industries that have sparked due to the rise of the internet is e-commerce. E-commerce or electronic commerce can be defined in different ways but it's generally defined as a digital platform that enables businesses or individuals to carry out transactions with others. Unlike traditional shopping, e-commerce takes place entirely online and consumers and businesses can view and purchase products without having to step foot inside a physical store.

A. Growth of E-Commerce

The e-commerce industry has been rapidly growing in the past several decades. Dolfen [5] conducted an analysis of credit card purchase history from 2007 to 2017 to measure consumer spending habits over a decade. The researchers chose Visa cards so that sales could be classified into different industry classification (NAICS) and so are able to capture a large part of US consumer spendings habits. The study found that some

categories had larger jumps in online purchases compared to others. For example, the clothing category jumped from 22% in 2007 to 37% in 2017 while the food category only increased from 5% to 6% in the same period. The study concluded that in general online purchases increased from 8% in 2007 to 15% in 2017 resulting in a 7% increase in overall online sales.

One of the limitations of the study was that it was conducted in 2017. However, the e-commerce market has seen drastic changes after the onset of the COVID-19 pandemic in 2020. Consumers and businesses now found themselves to be ordering online more often due to travel restrictions and quarantine periods. Bubanja [1] found that from 2019 to 2022, the percent of total retail sales in the business-to-customer market (B2C) market that were e-commerce increased from 13.6% to 20.4%. The study also found that e-commerce sales in the US reached $4.2 trillion by the end of 2020 and is projected to reach $6.3 trillion by 2024. COVID-19 has impacted businesses and retailers across the industry and has led businesses to invest more in the Information and Communication Technologies (ICT) infrastructure needed to support e-commerce sites.

Outside of the US, e-commerce has seen an enormous growth in worldwide markets. Cumming [3] estimates that e-commerce orders across nations have increased from 3.2 billion in 2015 to 9.3 billion in 2020 across European and Asian markets. These trends are a direct result of the growing trends in digitalization and the

researchers approximate that e-commerce markets will be worth $4.820 trillion by 2026.

Aside from shipping and consumption, e-commerce is also useful in the manufacturing process. Global Value Chain (GVC) is a process where an item is produced in separate stages and each stage can be manufactured in different countries to improve speed and efficiency. Kang & Dorothea [9] conducted a meta-analysis of 14 different Asian countries from 2007 to 2019 to understand the size of impact that e-commerce has had on the global value chain (GVC). E-commerce can facilitate GVC growth by making it easier to research parts or find parts that may be obscure. The study was able to identify a pattern between GVC exports and e-commerce sales and determined that growth in internet technology can increase GVC growth and thus further globalization across foreign markets.

B. Website UI/UX and E-Commerce

It's clear that E-commerce is a widely growing market in today's technology-connected world. E-commerce mostly takes place on the World Wide Web (WWW), which enables users to quickly browse across websites to find information. Being able to find information quickly on a retailer's website is a key component in creating good user-centered design. Having good design can impact the usability and pleasure that a customer experiences when using the interface and this can affect the likelihood of the consumer purchasing an item from that service again in the future according to Jongmans [8]. When evaluating

a website's design, User Interface (UI) and User Experience (UX) are two terms that are used in determining a website's aesthetics and usability.

According to a literature review by Gunawan [7], there are many different standards and tools that are used to evaluate a website's UI and UX such as color, placement of components, and flow. In one study, Cheng [2] created a questionnaire and used a 7-point Likert Scale to identify which attributes were considered most important to the UI design of a website by consumers. Specifically the attributes that were being measured included color (hue, saturation, brightness), price (expected vs actual), and nationality. 703 participants from Germany and Taiwan took the questionnaire and the results were evaluated in four separate categories: online store perception, perceived usefulness, trust, emotion pleasure/arousal. The researchers found that in terms of color, interfaces with white backgrounds were associated with the highest levels of perception, usefulness, and trust when compared to red and blue backgrounds. However, red backgrounds were found to have higher levels of arousal. In terms of price, while it's generally known by the law of supply and demand that lower price leads to higher levels of item purchases, the study interestingly found that item prices that were shown to be discounted led to more attention. Specifically, prices that were marked as under some promotion would receive more attention than if the product were priced higher or lower from the start.

Aside from color and price, the complexity and ordering of a site can also influence a customer's preference in using the website. Deng [4] conducted a study to analyze a user's preference in browsing through 24 homepages varying in four levels of Order and six levels of Complexity. Order is defined as the way the content is organized on the page in terms of coherence, fittingness and clarity while Complexity is defined as information rate, diversity, and variety of information. The study found that the user's preference for the levels of complexity and order differs significantly based on whether the user is engaging in utilitarian or experiential shopping [4]. When the user prefers utilitarian shopping, they prefer higher levels of Order and moderate levels of complexity but if they prefer experiential shopping, Complexity is a larger factor with higher levels of Complexity resulting in more engagement.

Aside from the pleasure and aesthetics that good design brings, it's important for e-commerce sites to design for marginalized groups such as disabled people who may face unique challenges that others may not typically face when accessing information online. For example, those with physical disabilities such as the handicapped face challenges that can make it harder for them to go to a physical store. Sohaib [10] have found that e-commerce has made it easier for these groups to be able to purchase items that they would otherwise have difficulty in doing so. On the other hand, if an interface is poorly designed, it can have an opposite effect in certain situations where there's no alternative option. For example,

those who are blind and rely on screen readers may have trouble using an interface if it's not well-designed to include assistance for these users. Using audio objects and cloud computing to increase internet accessibility can help mitigate these issues and provide support for those who need it [10].

Despite the countless benefits that e-commerce has to offer to individuals, it's also important to consider the potential disadvantages that some consumers face when using such interfaces. One problem consumers may face is that they may get addicted to using an interface. According to Durrani [6], this can sometimes lead to behavior such as Compulsive Buying Behavior because individuals find it harder to control themselves when buying products online than in-person due to not having to carry items by hand. The researchers have found that university students aged 18-24 seemed to be most vulnerable to exhibiting such behaviors when shopping online and concluded that Compulsive Buying Behavior can lead to negative life satisfaction in the long-term.

C. Limitations in Current Studies

The design of an E-commerce website can have significant impacts on user's retention and pleasure in using the platform. There are still some large gaps in prior research that haven't been identified yet in the E-commerce space. Prior studies have stated that further research needs to be done to evaluate which design factors are important and identify trends in current e-commerce markets to better understand

the technological shifts. And these studies tend to focus on design mockups and specific qualities like color rather than the usability of current websites.

To address these limitations we will be collecting qualitative data on current popular shopping websites to see which factors are seen as most useful among users and what other features can be added to improve the e-commerce experience as a whole. We will be testing this by showing four popular shopping interfaces and gathering data on perception and usability from the respondents. We propose that if users are more familiar with the interface, then they would rank it higher in terms of favorability of the interface.

II. METHODS

The sample consisted of 51 undergraduate students who are currently enrolled in PSYC 2803 at the Georgia Institute of Technology. There were 23 (45.1%) students who identified as male and 28 (54.9%) students who identified as females. 19 (37.3%) of these students indicated that they are employed at the moment, while the rest (62.7%) stated that they are not currently employed. An online-based survey was administered in the 10th week of the course. The survey questioned the students on a variety of topics concerning their online buying habits. The questions addressed subjects about how frequently and for how long they shop online, what kinds of things they buy, which e-commerce sites they prefer to use, how

they prefer to shop, and what influences them when they shop online.

A. Measures

The survey is made up of several parts, where demographic information, online spending habits, and the perceptions of 4 shopping interfaces (Amazon, AliExpress, Ebay, Walmart) are measured.

1) Demographics:

The questions measure the responders' gender (man, woman, non-binary, prefer not to say, and other for self-identification), age, employment status, and income.

2) Online spending habits

Online spending habits measure how much individuals spend their time browsing for products online, what type of products they typically purchase, and which e-commerce website they utilize to make their purchases. Optionally, the responders can also provide information on whether they purchase things online, in-person the most, or they browse online but buy the product in person. This section is made up of answers that are selected from a list of answers, with the category question allowing users to select multiple items from the list of answers.

3) Perceptions of shopping interface

This section measures how several e-commerce websites rank for searching products in general and how the interfaces rank for a specific item on a one to ten scale (10 meaning most favorite, 1 meaning least favorite). Additionally, what respondents' liked/disliked about the interface they selected as least/most favorite, what presentation style (whether they prefer

image-focused or detail-focused) respondents preferred, and what filtering methods they preferred are measured with a long answer answering method.

III. RESULTS

A. Description of Statistical Analysis

Descriptive analysis was used to examine the characteristics of several interfaces such as the frequency of keywords used by respondents to describe the features of the data and responses. We conducted ANOVA, Tukey's honest significance test, and frequency tables to examine which interfaces are favored by respondents, followed up by what keywords respondents' provided to describe what is favorable about the interface they've selected as their most favorite/least favorite. The ANOVA procedure as well as the Tukey's HSD were conducted with an alpha threshold of 0.05.

B. Descriptive Statistics

Descriptive statistics of measures (e.g., mean, standard deviation, and IQRs) are described in Table 1 and Table 2 for General View and Item View respectively. Each of the views for General and Item is also presented in box-plot form to provide a visual representation of the data (Figure 1 and Figure 2). The descriptive analysis indicates that respondents on average liked Amazon's general view the most while they disliked AliExpress' general view the least. When item view was discussed, the respondents stated that they like Amazon's item view the most while they disliked AliExpress' item view the least.

When we asked our respondents about what specifically they liked about the particular interface they selected as their favorite, which was Amazon, they stated that they found Amazon visually appealing and were familiar with the interface (top graph in Figure 3). When asked about what they disliked about the particular interface they selected as their least favorite, which was AliExpress, they stated that they found AliExpress cluttered and unpleasant (bottom graph in Figure 3).
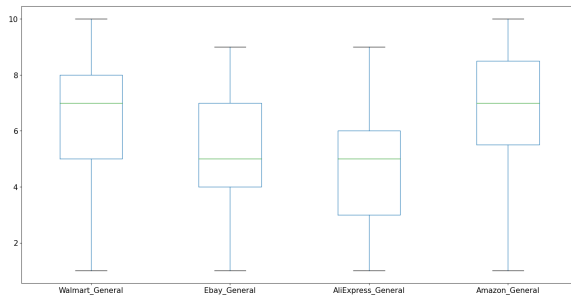
Figure 1. *Box Plot of General Search*

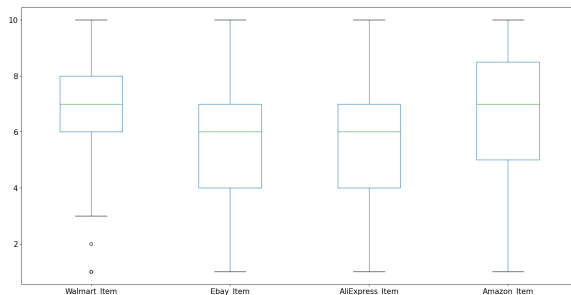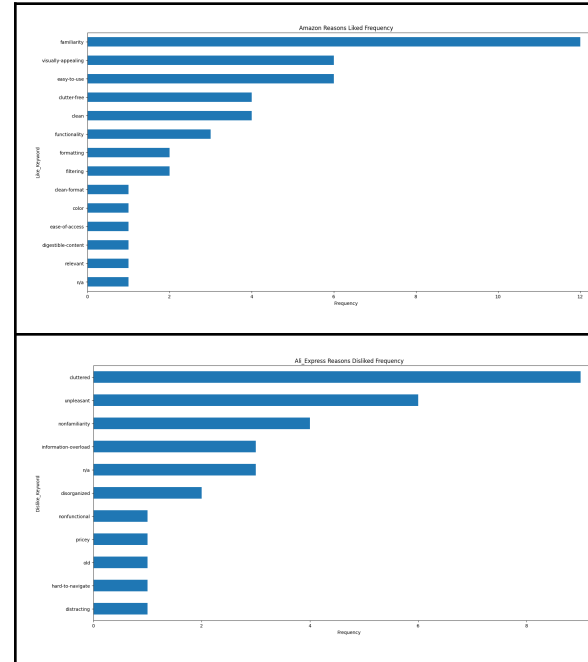Figure 2. *Box Plot of Item Search*

Figure 3. *Frequency Table of Common Keywords*

C. Inferential Statistics

The inferential statistics portion of our analysis consists of the analysis of interfaces as general and item using ANOVA and Tukey's HSD to find whether the interfaces had statistically significant preferences from respondents. Our null hypothesis for both views was that the interfaces did not have any difference from each other.

a) General View

Based on the results from Table 3, where $p < 0.05$, we rejected the null hypothesis which stated that there were no statistically significant differences between the four interfaces. This indicates that there

is indeed a difference between the interfaces. Further analysis using Tukey's HSD showed that there were statistically significant differences between AliExpress and Amazon, AliExpress and Walmart, and Amazon and eBay interfaces. This suggests that these three pairs of interfaces have statistically significant differences in comparison.

b) Item View

Based on the results from Table 4, where $p < 0.05$, we rejected the null hypothesis which stated that there were no statistically significant differences between the four interfaces. This indicates that there is indeed a difference between the interfaces. Further analysis using Tukey's HSD showed that there were statistically significant differences between AliExpress and Amazon, AliExpress and Walmart, and Amazon and eBay interfaces. This suggests that these three pairs of interfaces similar to how the general view has presented, have statistically significant differences in comparison.

IV. Discussion

The data we have collected in this study provide valuable insights into the shopping habits of college students. Specifically, the study examined their online shopping habits, what kind of things they purchase, which e-commerce websites they find appealing and prefer to shop from, and what they're influenced by when they shop online.

From our analysis, we were able to statistically identify the difference among different e-commerce websites based on the perceptions of the respondents we analyzed and gained more insight as to what made the interface more/less favorable. Our research indicates that while AliExpress was the least desired website for both views, Amazon was the most favored website for both general and item views. Along with preferences, we also looked at how the interfaces were regarded by the respondents. We discovered that while AliExpress was more likely to be characterized as cluttered and unpleasant, respondents were more likely to characterize Amazon's interface as visually appealing and recognizable.

From the frequency table we could understand the reasoning in why users ranked the shopping interfaces the way they did. The reasonings behind these choices match with what similar studies have found previously in the attributes that will more likely impact overall satisfaction. In Cheng [2], the study found that colors such as white and discounted prices lead to higher levels of perception in the interface. Similarly, in Deng [4], the order and complexity in which the website is layed out can have major impacts in a user's preference for a platform. The results in our study described a high-ranking platform like Amazon to be "easy-to-use", "clutter-free", and "formatting" while a low-ranking platform like Ali-Express to be "information overload", "unpleasant", and "cluttered". These keywords are similar to the previous studies as they have found that orderly and visually appealing interfaces to be perceived better than complicated and unorganized designs. Nevertheless, Jongmans [8] mentioned that all corporations can benefit

from conducting research to understand improvements in user-centric design and this applies to all four of these interfaces as well.

Our hypothesis, as stated in the introduction section of the paper, was that if the users were more familiar with the interface, then they would rank it higher in terms of favorability of the interface. Our study's result indicated that the users ranked the interfaces that they found to be more familiar as higher compared to other interfaces they had interacted with. This result was statistically significant through ANOVA and Tukey's HSD as well as the keyword analysis of our respondents' reasoning as to why their most preferred interface is the top interface they had selected as.

Our study consists of a couple of limitations that should be considered when interpreting the results. The familiarity of the interfaces to the respondents may have introduced bias into the interface that they have interacted with and introduced a bias towards their perception of how an interface might be considered superior or inferior to one another. In addition, the nature of the data that was collected during the survey may have limited the ability for us to quantify and statistically indicate the users' preferences towards an interface which could impact the accuracy of the conclusions drawn from the respondents' perspective. These limitations highlight the importance of careful consideration and interpretation of the data in order to draw accurate conclusions that represent the data collected accordingly.

To address the limitations identified in this study, several suggestions can be proposed. One could use a Likert-scale method for measuring the agreement of users' preference towards an interface over another in order to mitigate the risks of familiarity and preference over one another. Additionally, a wider range of interfaces without any branding or hypothetical interfaces could be introduced so that the familiarity of the users could be minimized which truly reflects the users' preference towards an interface over another without the familiarity bias.

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APPENDIX

Table 1. *Preferences with General Search*

index	Walmart_General	Ebay_General	AliExpress_General	Amazon_General
mean	6.18	5.24	4.57	6.75
std	2.13	1.93	2.10	2.38
min	1.0	1.0	1.0	1.0
25%	5.0	4.0	3.0	5.5
50%	7.0	5.0	5.0	7.0
75%	8.0	7.0	6.0	8.5
max	10.0	9.0	9.0	10.0

Table 2. *Preferences with Item Search*

index	Walmart_Item	Ebay_Item	AliExpress_Item	Amazon_Item
mean	6.73	5.60	5.52	6.88
std	2.33	2.02	2.14	2.35
min	1.0	1.0	1.0	1.0
25%	6.0	4.0	4.0	5.0
50%	7.0	6.0	6.0	7.0
75%	8.0	7.0	7.0	8.5
max	10.0	10.0	10.0	10.0

Table 3. *Tukey Test with General Search*

```
F-value: 10.4126652154737
P-value: 2.1361747930869428e-06
   Multiple Comparison of Means - Tukey HSD, FWER=0.05
=====================================================
 group1    group2 meandiff p-adj   lower   upper  reject
-----------------------------------------------------
AliExpress  Amazon   2.1765    0.0  1.0768  3.2761   True
AliExpress    Ebay   0.6667 0.3977  -0.433  1.7663  False
AliExpress Walmart   1.6078 0.0011  0.5082  2.7075   True
    Amazon    Ebay  -1.5098 0.0026 -2.6094 -0.4102   True
    Amazon Walmart  -0.5686 0.5388 -1.6683   0.531  False
      Ebay Walmart   0.9412  0.122 -0.1585  2.0408  False
-----------------------------------------------------
```

Table 4. *Tukey Test with Item Search*

```
F-value: 5.435884102030747
P-value: 0.0012967640192580608
   Multiple Comparison of Means - Tukey HSD, FWER=0.05
=====================================================
 group1    group2 meandiff p-adj   lower   upper  reject
-----------------------------------------------------
AliExpress  Amazon   1.3725 0.0107  0.2367  2.5084   True
AliExpress    Ebay    0.098  0.996 -1.0378  1.2339  False
AliExpress Walmart   1.2157 0.0307  0.0798  2.3516   True
    Amazon    Ebay  -1.2745  0.021 -2.4104 -0.1386   True
    Amazon Walmart  -0.1569 0.9843  -1.2927   0.979  False
      Ebay Walmart   1.1176 0.0556 -0.0182  2.2535  False
-----------------------------------------------------
```

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