

USING AUGMENTED REALITY (AR) TO ENHANCE THE USABILITY AND USER EXPERIENCE (UX) OF E-COMMERCE PLATFORMS IN THE RETAIL INDUSTRY

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ABSTRACT

Usability and User Experience are the core elements of human-computer interaction. With the increasing dominance of online-based retailing platforms, there is an emerging need for an evolution in the human-computer interaction experience. This paper investigates how usability and user experience is being enhanced through the inclusion of novel and innovative features as opposed to just providing the user with an attractive user interface. For this analysis, the case of IKEA's augmented reality (AR) app, IKEA Place, will be used as a basis to explore how AR can be used as a means to improve usability and user experience on e-commerce platforms that are run by the retail industry. The improvement of usability and user experience directly links to factors such as a customer's purchase confidence and their perception of the products that are being sold to them. This paper analyses how IKEA's implementation of AR works and how it benefits them by ultimately providing their customers with a better experience. This analysis then juxtaposes IKEA's case against other retailers who do not have such an implementation. Through this juxtaposition, the paper will solidify the case for augmented reality being an efficient and beneficial tool that retailers should exploit to their advantage. However, the potential for how retailers could use AR is not just limited to IKEA's implementation. There are many features that AR provides that could prove to be advantageous if retailers tap into their full potential. This paper will conclude with a rundown of those features and suggest how retailers could incorporate them.

Keywords: Usability, User Experience (UX), User Interface (UI), qualitative/quantitative research, Augmented Reality (AR), human-computer interaction, E-commerce platforms, IKEA.

1. INTRODUCTION

This paper's overarching goal is to analyse how Retailers could use Augmented Reality (AR) to complement and enrich the usability and user experience of their e-commerce platforms to their benefit.

The retail industry is currently using AR in multivarious ways to their benefit. McDonald's uses AR with their happy meal boxes by pairing them with an app that uses a phone's camera to bring the featured animated characters to life (Scholz and Smith, 2016). Virtual fitting rooms (VFR) are used by certain retailers that, through the use of AR, allow their customers to try on the clothes they sell without having to be in store (Pachoulakis, 2012). AR is also being used for stock management, where through a dedicated app, employees can locate stock by scanning the items through the camera without having to manually look through piles of boxes and matching their product numbers (Moore, 2021).

As augmented reality (AR) has grown in popularity in recent years due to advances in mobile technology, businesses have begun to use it to allow customers to visualise and test products before purchasing them. Ikea, Apple, Royal Mail, Adidas, Curry's PC World, Pinterest, Asos, John Lewis, GOAT, Walmart, and Lululemon are just a few examples of organisations using AR. (Wright, 2020).

The most prominent benefit of augmented reality to retailers is the innovative yet practical customer experience that the medium enables them to provide. This experience translates into not just an overall better customer experience but also adding to the customer purchase confidence by reducing the uncertainty that they would have as they are provided with a realistic depiction of the product before they buy it (Porter and Heppelmann, 2021). This customer confidence then translates into an increase in purchases of the products that the retailers are selling and inherently boosts their revenue (Alves and Reis, 2020).

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2. BACKGROUND/ LITERATURE REVIEW

2.1 The Concept of Usability and User Experience

The ISO defines usability as the degree to which a system, product or service can be used by their respective users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use (ISO, 2010). The ISO defines user experience as a person's perceptions and reactions that stem from the usage or the anticipated use of a product, system, or service (ISO, 2010).

2.2 Augmented Reality (AR)

In computer programming, augmented reality is the process of combining or "augmenting" video or photographic displays by overlaying the images with valuable computer-generated data. (Britannica Academic, 2016.)

Louis Rosenberg's AR system at USAF Armstrong's research laboratory in 1992 was most likely the first fully functional AR system. This AR system was known as virtual Fixtures, and it was a highly complex robotic system designed to compensate for the early 1990's lack of high-speed 3D technological graphics processing power. Between the 1990s and now, there have been numerous advances in augmented reality (The Interaction Design Foundation, 2020).

In its current form, augmented reality is deployed through four main visualisation technologies – Head-mounted displays, handheld devices, static screens and projectors (Masood and Egger, 2019). Head-mounted displays (HMD) includes the Microsoft HoloLens 2, Google Glass Enterprise Edition and the Magic Leap One. Handheld AR devices (HHD) essentially comprise mainly the consumer-level smartphones available in the market.

2.3 AR Supporting Companies and Businesses Strategically

Over the years, a growing number of companies have adapted AR experiences to aid their retailing process. This ever-increasing adaption could be credited to the strategic benefits of providing those experiences to customers. AR is seen to generate strategic business value in two ways: First, by becoming a component of the products themselves, and second, by boosting performance across the value chain in product development, manufacturing, marketing, service, and various other areas. (Porter and Heppelmann, 2017).

A critical strategic advantage AR brings to the table is the competitive differentiation that is made possible through its ability to provide consumers with experiences exclusive to the medium (Grzegorzczuk, Sliwinski and Kaczmarek, 2019). In the case of e-commerce retailing, the traditional method used by most companies is to provide a web interface that would include static 2d images and videos of a product supported by text-based information for their potential buyers (Aslam, Hussain, Farhat and Arif, 2019). The implementation of AR, which allows potential buyers to get a real-time 3D simulation of the product, into this mix provides its implementers with an edge that would make them stand out from the crowd. This makes them a much more attractive choice when a potential customer has to choose between a plethora of online retailers.

The appeal for AR stems from the way humans digest information. This could be linked to the cognitive load theory - which refers to the amount of working memory used when taking in information (Lai, Chen, and Lee, 2018). Cognitive overload is a phenomenon that occurs when too much information is given to a person, going beyond their working memory capacity, resulting in a slowdown of their ability to process that information (Fox, Park, and Lang, 2007). This slowdown in processing information could potentially negatively impact the decision-making of a buyer when they are using an interface that requires them to process a lot of information to grasp an accurate understanding of the product they want to buy. AR could alleviate the possibility of a cognitive overload through its ability to display information through an easier-to-digest true to life representation of a product in a real-time and live setting. This, as a result would make the decision-making process of a buyer a far simpler task to undertake before a purchase is to be made. A 2020 data report released by Shopify, an e-commerce giant, highlighted that those interactions with products on their site that contain 3D/AR content displayed a 94% higher conversion rate than products without those experiences (Papagiannis, 2020). This could be credited to the enhancement of the user interface through the provision of an AR experience. It has been found that customer trust and loyalty are influenced by the quality and intuitiveness of the user interface that is provided to them. (Aslam, Hussain, Farhat and Arif, 2019).

Further studies report that AR has a significant relation to customer purchase confidence with regards to purchasing products online. A 2021 study reported that 71% of consumers say they would purchase more often if they used AR, while 61% said they prefer retailers that provide AR experiences (Sokhanych, 2021). Factors such as customer purchase confidence, customer trust and loyalty are key influencers of profitability and performance for a business (Mullins et al., 2014). AR helps boost these key influencers while also providing businesses with a competitive edge in the retail industry.

2.4 E-commerce

E-commerce is an intriguing blend of business models and new information technology that refers to a business or commercial transaction over the internet (Laudon and Laudon, 2019).

The thriving e-commerce technology in business causes a revolution in the circulation system. E-commerce alters the trade pattern, improves the circulation of merchandise, capital, and information, and gives organisations a competitive advantage by effectively lowering production costs (Qin, Z. 2009). In Internet-based e-commerce, people first use email to conduct daily "business correspondences" and then use the internet to disseminate information. Since 1995, businesses have gradually turned to the internet to share information. As a result, the public can gain direct access to enterprise information, goods, and services via the internet, which leads to the exploration of the information issuing system represented by Web technology and becomes the primary application of the internet. (Qin, Z. 2009).

E-commerce platforms usually fall into one of three main models – B2B (Business to Business), B2C (Business to Consumer), C2C (Consumer to Consumer) (Laudon and Laudon, 2019).

3. METHODOLOGY

3.1 Choice of research type

Research conducted are made through various methods. Despite many available methods, they all fall under two categories – Primary research and Secondary research.

Primary research entails collecting new first-hand data (new data gathered on a specific topic). On the other hand, secondary research uses data collected through primary research (Surbhi S, 2017). For this research to be conducted for this paper, the researchers are limited to collecting and analysing secondary information as the primary research was not feasible due to environmental factors (COVID-19) and time constraints. Using secondary research provides the study a fast and easy research speed and a broader understanding of the subject matter.

3.2 Quality of the Information

3.2.1 Models and tests used in this research

CRAAP test (Blakeslee S, 2010)

The CRAAP test (Currency, Relevance, Authority, Accuracy, Purpose) is an evaluation method meant to check the objective reliability of the information sourced from various academic resources (Fielding, 2019).

C.A.R.S checklist (Harris R, 2021).

The CARS Checklist (Credibility, Accuracy, Reasonableness, and Support) is intended to be simple to learn and apply. Few sources will meet all the criteria for this report, and even those that do may not be of the highest quality. However, using the CARS checklist criteria, it was more likely to separate the high-quality information from the low-quality information.

3.3 Formal Research Methods

From start to completion, formal research follows a sequence of predictable and organised processes. In consideration of this report, the researchers studied several research methods, and the **case study research** approach is the sole method this report will commit to (Galliers, 1991). Through this research method, this paper will analyse the selected case and highlight the findings that will be made.

4. CASE STUDY: IKEA.

4.1 An introduction to the company

IKEA is a home goods retailer that operated more than 300 locations worldwide and was the world's largest furniture seller in the early twenty-first century. IKEA specialises in low-cost items sold in compact "flat-pack" form for the customer's in-home assembly (IKEA, 2021).

4.2 Implementation of augmented reality within IKEA'S e-commerce platform

IKEA's e-commerce platforms come in their website and mobile apps. The mobile app consists of the main IKEA app, the IKEA Place app, and the IKEA Better Living app. The IKEA app is essentially their mobile store through which their customers can purchase their products and have them delivered to their doorsteps. The IKEA Place app, which will be the focus of this report, is their AR experience app that allows their customers to visualise IKEA's furniture in spaces around their household virtually (IKEA, 2021).

While not being the app where the commercial transactions of IKEA take place, the IKEA Place app is a complementary component to the main IKEA store app. The app uses a new AR technology to allow the customer to see through their mobile phone the accurate dimensions of the product they want to buy (Ozturkcan, 2020).

4.3 Analysis

An inherent real-world problem with purchasing online is that the customers cannot get a real-life feel of the product once it arrives at their homes. This situation is especially true for IKEA, which sells large-scale household items. IKEA Place was launched to solve that problem. The app provides a 3D representation of their furniture, with accurate life details such as texture, fabric, lighting, and shadows, placed within a chosen space by the user, with 98% accuracy (Pardes, 2017).

IKEA's Place app, which employs sophisticated technology, has simplified users' purchasing journeys to the point where they no longer need to leave their homes to purchase furniture. The e-commerce app design ensures that

the user is taken care of at every step of their journey and that they do not leave the app without purchasing something (Paliwal, 2021). Even so, the full potential of AR has yet to be realised, which includes improving performance across the value chain in product development, manufacturing, marketing, service, and a variety of other areas (Porter and Heppelmann, 2017). As of now, Ikea is only scratching the surface of augmented reality, focusing solely on marketing strategies.

5. ANALYSIS OF FURTHER CASE STUDIES

5.1 CASE STUDY: Nike.

5.1.1 An introduction to the company

Nike Inc. is an international corporation specialising in the design, evolution, manufacturing, and global marketing and sales of apparel, footwear, accessories, equipment, and services. (NIKE COMPANY, 2022.).

As a massive worldwide corporation, Nike has dominated the Apparel Accessories Sports equipment (shoe industry) by being a prominent participant in the athletic footwear industry in the US. Nike maintained a 35.6 per cent stake in the sports shoe and footwear industry in 2017, with Jordan, also owned by Nike, coming in second with a 15.7 per cent share. Nike's brands collectively accounted for more than half of the overall US market. (Statista, 2022)

5.1.2 Implementation and Analysis of augmented reality within Nike's e-commerce platform.

While Nike has succeeded in controlling most of the shoe market in the United States, the client's pain points are still considered in the organisation's required emphasis. In 2019, Nike debuted a new feature that allows customers to find the best shoe size by utilising augmented reality on their mobile phones via the Nike app. (Nike News, 2019)

According to Nike's data, approximately 60% of people at any given time are walking around in the incorrect measurement of their shoes, and half a million people complain about acquiring the inaccurate shoe measurement each year in the United States and also Canada alone. (Nike News, 2019)

The feature, dubbed Nike Fit, is essentially a scanning solution. Using a combination of computer vision, data science, machine learning and recommendation algorithms to measure the entire shape of both feet allows customers to discover the best dimension for relying on the Nike footwear design. (Nike News, 2019)

5.2 CASE STUDY: Sephora.

5.2.1 An introduction to the company

Sephora is firmly focused on advancing the Sephora Collection brand, democratising new appeal fads with an ever-expanding range of items. Sephora was founded in 1969 in France by Dominique Mandonnaud, who quickly gained an online reputation as a beauty specialist. Its cutting-edge circulation model has revolutionised the shopping experience, elevating Sephora to the pinnacle of the beauty industry. With an exceptional selection of over 250 brands and 16,000 products, it provides its customers with access to high-end and specific niche brands in stores where they are free to touch, smell, and check them. (Sephora, 2022.)

5.2.2 Implementation and Analysis of augmented reality within Sephora's e-commerce platform

Entering stores or making online purchases, particularly in the cosmetics industry, can be frustrating. Sephora has ingeniously created a mobile Sephora Virtual Artist that is easily accessible. This augmented reality tool lets customers try on thousands of lipstick shades, eyeshadow, false lashes, and other makeup items sold by Sephora. It also allows customers to digitally go through beauty tutorials on their faces to learn how to achieve specific looks. Sephora Virtual Artist is currently available in the Sephora app and select stores. Face tracking and computer vision were integrated into the Sephora Virtual Artist, built using Stanford University technology. (Rayome, 2018)

5.3 CASE STUDY: Houzz.

5.3.1 An introduction to the company

Houzz makes use of a home design photo database that contains millions of photos of home interiors and exteriors. Homeowners can browse images by area, style, and area and bookmark photos in individual collections known as

idea books on the website. Adi Tatarko and her husband Alon Cohen established Houzz as an online platform in February 2009 in response to the difficulties they encountered throughout their home remodelling project. The website gained popularity through word-of-mouth. They began receiving emails from property owners and house experts outside the Bay Area requesting that they add new categories on Houzz and expand to other places.

5.3.2 Implementation and Analysis of augmented reality within Houzz's e-commerce platform

The feature, part of "Houzz's View in My Area 3D tool", allows buyers to virtually cover their flooring with tile, true-to-scale. The application detects the orientation of the flooring. It allows users to determine how much floor tile they require and order the correct amount or purchase furniture, all from the Houzz app on their smartphones. Managing the issue with online purchasing, as customers cannot get a real-life feel of the product prior to it arriving at their residences. (Potuck, 2019)

6. RESULTS OF ANALYSIS

The AR features depicted below provide a comprehensive view of all possible features available in all industries, which is cross-referenced with multiple organisations for different industries (Nike (Shoe Industry), Sephora (Cosmetic Industry), and Houzz (Interior Design Industry)) to determine Ikea's use of AR accurately.

The possible improvements can be made to effectively increase productivity, profit margins, usability, and user experience of the customers on the platform while using the theories of generalisation and relatability. The relatability theory entails discovering similarities between cases in one study and cases in other studies, whereas the generalisation theory entails discovering similarities universal across multiple case studies.

AR Feature	Description	Reference	IKEA	NIKE	Sephora	Houzz	Theory
Fixed to screen space	According to typical app UI, all items are bound to the screen area and have no relation to the actual world.	(Engine Creative, 2021.)	✓	✓	✓	✓	general
Real-time Object Detection	Users of the installation can place physical objects on a surface to act as obstacles in the simulation for pedestrians.	(Savenije, Geraerts and Hürst, 2020.)	✗	✗	✗	✗	general
Object related	The UI is associated with a specific object or trigger in real-world space.	(Engine Creative, 2021.)	✓	✗	✓	✓	relatable
Registration and alignment in 3d	Detect and recognise by measuring distances between points, segments, and planes	(Bottani and Vignali, 2019)	✗	✓	✗	✓	relatable
Real-world related	The AR UI interacts with the user's surroundings and the physical world.	(Engine Creative, 2021.)	✓	✗	✗	✗	

TABLE 1 IKEA VS NIKE, SEPHORA, AND HOUZZ

Fixed to screen space is a universal AR feature because it is used by everyone in all industries. **Real-time Object Detection** is a feature that is not commonly found in the retail industry because it is primarily used in the gaming industry to create a fully immersive experience. **Object-related** is not a universal feature, but it is relatable to the use of AR in some industries. **Registration and alignment in 3D** are not a universal feature, but it is relatable to the use of AR in some industries. The use of **Real-world related** augmented reality (AR) to interact with the user's surroundings and the physical world is not common in the retail industry, but it is used by Ikea to improve usability and user experience.

Based on an analysis of the available AR feature set, it is possible to conclude that IKEA effectively employs the technology. They incorporate most of the above-mentioned features in their IKEA Place app, but not all Augmented reality technology is available to the retail industry, such as Real-time Object Detection, which is mostly used in the gaming industry. In comparison to NIKE and Sephora, Ikea has implemented their application to ensure the potential benefits of AR to the retail sector in general. However, given Houzz's use of AR and the fact that they both work in the same industry, Ikea's inclusion of registration and alignment in 3D would improve the user's usability and user experience, and would in turn increase sales, productivity, and profit margin.

7. CONCLUSION

Through the analysis conducted, it could be concluded that retailers can reap significant benefits if they incorporate AR into their e-commerce platforms. As reported by multiple studies, these benefits are driven by the enhancement of the overall user experience that is made possible by the technology. When implemented right, AR does this by not just being a novel visual experience but also enhancing the decision-making process of a retailer's customers. The current implementations AR themselves aren't limited to just one type of industry, which displays the versatility of the technology.

In the case of IKEA, IKEA Place makes it easier to perform purchasing decisions at the comfort of one's own home, to be inspired, and to try many different products, styles, and colours in real-life settings without having to visit a physical store. This AR experience that lets their customers visualize their products virtually and accurate to size, is a major enhancement to the practice of just providing them with pictures and product descriptions stated in text form. However, it needs to be noted that IKEA themselves have not provided any data on the success of their AR implementation, making it challenging to draw analytical data to support the case. Additionally, while IKEA's implementation of AR services their retailing process, its use of AR is limited to that alone. They are yet to incorporate AR further into their business processes like product development, manufacturing, service, and other areas of AR.

While there are reported benefits to retailers if they are to incorporate AR into their retailing process, not all retailers are prepared to do so. A report published by Mobile Marketer showcased that 52% of retailers were not prepared to incorporate AR into their retailing process (Williams, 2019). They find it to be a huge undertaking for which they aren't very sure that they would see a positive ROI. The report also showcased that as of 2019 only 1% of retailers had adopted AR/VR into their customer buying experiences (Williams, 2019). However, it the percentage is said to be growing. The COVID-19 pandemic has caused many people to shift and adapt to online marketplaces. According to report published by Statista, the percentage of people in the UK, who have been purchasing online more, since the pandemic, has grown from 41% to 71% between the March 2020 and February 2021 (Statista, 2021). With the increasing consumer shift to online shopping and the interest in A technology, more retailers are bound to be adopting the technology as a means of evolution as time progresses.

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