Exploring the role of flow in Augmented Reality for mobile retailing:

Implications for practice and research

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ABSTRACT

Augmented Reality (AR) try-on services have been proven to enhance customer engagement and purchase intentions by enabling users to experience the sense of flow. While few studies focused on the design principles of mobile AR services, little has been done regarding the role of flow in consumer experience whilst interacting with try-on services. This paper reviews the current design principles of mobile AR and examines its influence on consumers' flow state. Through a task-based semi-structured interview with consumers (n=9), it was possible to observe that all participants did not enter the flow state due to a lack of perceived control and familiarity with the technology. Finally, this paper provides recommendations for enhancing the flow experience of mobile AR try-on services. It is expected that this paper might be of interest to retailers and researchers willing to explore mobile AR as a tool to enhance the customer experience and digital transformation strategy.

Keywords: Augmented reality, flow experience, mobile augmented reality, e-retailing, consumer experience, user experience, IKEA Place, digital transformation

INTRODUCTION

Digital transformation brings opportunities to develop new business models, by reshaping the way organisations deliver customer value. The ability to integrate different channels is a core strategy that allows consumers to make decisions across several platforms, switching between physical and digital touchpoints (Berman, 2012). Digital transformation also brings new challenges for organisations, such as the alignment of business goals with new strategies (Matt et al., 2015), quick learning capabilities (Mattila, Yrjölä and Hautamäki, 2021), consumer privacy concerns (de Ruyter et al., 2020) and employee

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adoption (Alavi and Habel, 2021). Thus, it is imperative to learn how the adoption of new technologies can change established business practices and models.

Under the wave of digital transformation, the retailing industry is seeing an impact on its brick-and-mortar physical stores. The traditional stores are being transformed to adapt to digital changes and organisations are modifying the way they interact with customers during the shopping process (Yadav and Pavlou, 2014). The high connectivity and interactivity levels of new technologies can enhance customer's shopping experience (Javornik, 2016). For instance, Lee and Xu (2020) acknowledged that Augmented Reality (AR) has a great potential, minimising the gap between physical and online stores (Beck and Crié, 2016), and enhancing both hedonic and utilitarian consumer values during the shopping experience (Lee and Xu, 2020).

Since AR is becoming each time more mainstream and utilised by different businesses (particularly in retail), there is a need to understand which practices need to be changed or adapted in order to provide consumer and business value. AR has been predicted to provide a vast increment in productivity and efficiency for retailing. For instance, 54% of retailers have planned to implement this technology into their business (Microsoft, 2019). AR combines both real and virtual environments, allowing the user to interact with 3D objects in real-time (Azuma, 1997). AR has the potential to adapt to new consumer needs (Caboni and Hagberg, 2019; Lee and Xu, 2020) since it combines virtual objects with consumer's physical environment through the use of mobile technology. This AR shopping experience provides a more intuitive way for the customer to obtain product information such as product size, colour and fitness and encourages consumers to try the product on by interacting with a product virtually (Cook et al., 2020).
AR applications for retailing could be divided into three types: (i) online web-based applications, (ii) in-store applications and (iii) mobile applications (Caboni and Hagberg, 2019). Mobile AR applications have great potential to increase profits and market share (Lee and Leonas, 2018; Scholz and Duffy, 2018; Caboni and Hagberg, 2019) since it evokes ubiquitous shopping behaviour. One example is the mobile application "IKEA Place" from the Swedish furniture company IKEA. This application allows users to evaluate where they prefer to place the company's products using their mobile phone and camera (Rese et al., 2014; Lee and Leonas, 2018). Other examples are the accessory brand Ray-Ban and the makeup brand Sephora (Caboni and Hagberg, 2019). Since consumers are shopping more online, interactive mobile AR applications are considered to be a new method for optimising the customer journey (Lee and Leonas, 2018; Scholz and Duffy, 2018; Caboni and Hagberg, 2019).

Although AR shopping has captured the attention of retail researchers and practitioners, there are still two major challenges remaining: (i) technical problems regarding accuracy and calibration (Pachoulakis and Kapetanakis, 2012; Javornik, 2016) and (ii) lack of optimal user experience (Beck and Crié, 2016; Yaoyuneyong et al., 2016; Hilken et al., 2017; Poushneh and Vasquez-parraga, 2017a; Caboni and Hagberg, 2019; Javornik et al., 2019). While research indicates that AR would positively impact customer experience (Wedel et al., 2020;Romano et al., 2020) there is still an opportunity to study AR and its design elements (Chen, 2020). Since flow mediates consumer perception of AR and purchase intentions (Javornik, 2016), there is a need to understand which design elements influence consumers' flow state in AR.

This chapter starts by reviewing the role that AR plays in digital transformation. This is followed by a literature review on customer experience in AR services. AR design elements from leading technology companies like Google, Facebook and Apple are further analysed. Flow theory is subsequently reviewed to gain more detail about how customers perceive AR. This is followed by a task-based semi-structured interview, in which participants were asked to interact with a specific application ("IKEA Place") and asked questions related to flow status and experience. The results showed that although participants were familiar with the technology, there were many challenges related to lack of control and high complexity

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levels when manipulating 3D objects. The main contributions of this study are the mapping of design elements for mobile AR try-on retailing services and recommendations for further business application (e.g., rely on AR try-on services to enhance hedonic values) and improvement of consumer experience (e.g., through the enhancement of usability elements in the User Interface (UI), adoption of familiar gesture metaphors in the 3D environment, etc.).

BACKGROUND

The role of AR in digital transformation

Digital transformation has four common elements, such as changes in value creation, structural changes, use of technologies (including attitude of the organisation towards new technologies) and financial aspects (Matt, Hess and Benlian, 2015). Particularly in B2B sales, digital transformation has left its mark by forcing organisations to quickly learn and relearn new practices. By identifying the need to unlearn and what needs to be changed, managers need to be aware of new technologies that can facilitate digital selling (Mattila, Yrjölä and Hautamäki, 2021). Since AR overlays reality with digital content, there is a huge opportunity to understand how AR can be effectively integrated within organisational practices. Current AR practices in mobile involve sensors and perceptions towards the environment and interactions (Qiao et al., 2019). With the adoption of 5G, the rendering of these digital layers and the quality of the experience might be improved. As Qiao et al. (2019) mention, upcoming 5G interactions might make current issues such as latency and tracking more effective. AR also provides opportunities for consumers to "see" a product in its context of use (de Ruyter et al., 2020). For example, the "IKEA Place" app allows consumers to visualise the products in their own living room. Thus, a crucial element for AR (particularly applied in advertising) is context mapping (de Ruyter et al., 2020). However, due to its high contextual nature and integration with user data, privacy concerns emerge as an important aspect to be considered when adopting AR applications. Also, since the connections with consumers are now cross-channel, AR becomes another touchpoint that can converge the consumer towards a meaningful experience (Ernst & Young, 2011). Due to its interactive nature, AR can be promising for retailers, particularly for fashion and cosmetics brands to engage with consumers (Watson, Alexander and Salavati, 2018), moving away from the transactional nature of consumer-brand relationship (Scholz and Duffy, 2018).

Customer experience in AR service

The term "customer experience" or "consumer experience" (CX) refer to consumer's dynamic reaction of multidimensional, cognitive, emotional, behavioural, sensorial and social responses, while interacting with a product or service, particularly across all phases of the customer journey (Wedel et al., 2020). Since CX involves consumer behavioural and affective reflections during the consumer journey, User Experience (UX) is also part of CX. In this context, UX is about the user interaction with a product or service through a particular User Interface (UI), which can include AR (Irshad and Rambli, 2014). The customer journey is conveyed through the orchestration of several touch points (Kietzmann et al., 2018) and is divided into the pre-purchase, purchase and post-purchase phases (Sands et al., 2016).

During the pre-purchase phase, consumers are influenced by internal and external stimuli (Pine and Gilmore, 2011); the former is derived from individuals, which includes purchase and involvement (Puccinelli et al., 2009) and the latter comes from environmental factors such as design elements and technology (Jain and Bagdare, 2009). The key element in the purchase stage is consumer decision making (Wedel et al., 2020). When consumers pay more attention to the product features, it contributes to product choice (Garaus & Wagner, 2016). Due to that, consumers learn more about the product and that raises their confidence (Romano et al., 2021, Wedel et al., 2020). Consumers could also decide to complain about the product, which can influence negative behaviour such as product return or negative WOM (Wedel et al., 2020).

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AR allows consumers to try products virtually, which narrows down the consumer choice (Wedel et al., 2020). During the pre-purchase stage the main factors of consumer experience are recognition, consideration and search (Lemon & Verhof, 2016). AR helps consumers to browse, try and find suitable products. After trying the product, consumers can decide. AR plays a crucial role in outfit curation (Wedel et al., 2020), providing real-time visual representations that can be easily changed. Outfit curation has a similar role to the salesperson in the physical store. Since AR plays a similar function, it enhances the shopping experience (Bazaki and Wanick, 2019). Subsequently, hedonic value is delivered through AR try-on interactions. Consumers can have a playful experience during the purchase stage (Wedel et al., 2020). However, in the post-purchase stage, there might be some discrepancy between the "virtual" and the actual product. This means that consumers' utilitarian value is not always satisfied (Wedel et al., 2020).

User experience (UX) in mobile AR

AR services aim at enhancing customer experience through customer value (Chen, 2020). Hedonic and utilitarian (Olsson and Salo, 2011; Poncin and Mimoun, 2014; Rese et al., 2014; Dacko, 2017; Hilken et al., 2017; Yim et al., 2017) values positively impact the process when people experience AR.

Research is relatively vast in AR and User Interface (UI). Most UI design guidelines focus on usability and tangible UI principles (Dünser et al., 2007; Kim et al., 2017). Yet, specific solutions are not explored. Providing an easy and intuitive interface is the main target of academic and business areas. For instance, Apple (2020) proposed hiding some unnecessary UI design when guiding users through AR systems. Also, keeping screen space to a minimum could enhance users' perceived ease of use. However, onboarding and instruction features should be included in order to immerse users to the AR experience.

From the perspective of hedonic values, Chen (2020) found that AR can provide enjoyment and playful experiences to consumers. Javornik (2016) concluded that AR provides more hedonic values than utilitarian ones. The same point was pointed out by Guo (2013), who emphasised that hedonic values enhanced by UX are a great *stimulus* for people to feel entertained during the process. For instance, offscreen exploration and sensory feedback, such as audio or haptic design, can enhance the consumer experience.

In order to follow industrial standards, AR design guidelines from leading technology companies such as Apple, Google and Facebook/Meta were used to capture key design elements. These include the design guidelines from ARCore (Google, 2020), ARKit (Apple, 2020) and SparkAR (Facebook, 2020). The main elements contain components from both physical and virtual worlds. For example, the user's space is crucial since it determines where the object should be placed and how the interactions happen (Facebook, 2020).

Users who install AR applications in their devices are curious (Olsson and Salo, 2011). Olsson (2012) indicated that users want to see the content embedded with real-world objects. This implies that the object should include real-world information, providing utilitarian values for the user and further impacting consumer purchase intention (Olsson and Salo, 2011; Olsson et al., 2013; Dacko, 2017; Yim et al., 2017). Google listed texture, modelling, shadows, lighting, and depth as design elements that help users perceive the object's density.

In order to place the 3D object into the physical environment, AR systems request the user to detect a plane where the object would be placed. Typically, the system provides an instruction to guide the user to place the virtual plane in a particular position in the physical world. In this case, ARCore, ARKit and SparkAR considered providing visual instructions to guide the user more intuitively. This stage includes selection, translation, rotation, scaling gesture and proximity (Google, 2020).

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Gesture is considered the most crucial element during the manipulation stage since the user uses familiar gestures to interact with the AR experiences (Apple, 2020). Users' familiar gestures can come from smartphone habits, based on 2-dimensional (2D) surfaces.

Flow theory and its development

Flow is "a state in which an individual is completely immersed in an activity without reflective self-consciousness but with a deep sense of control." (Engeser and Schiepe- Tiska, 2012, p.1). The state of flow occurs when two conditions are met: (i) an individual would engage with a challenge at the appropriate level when their capacities are matched; and (ii) an individual has clear goals and receives feedback immediately regarding the progress they make (Nakamura and Csikszentmihalyi 2014). These conditions are mediated by seven components: action awareness, attention, loss of self-consciousness, feeling of control, clear and logically ordered actions, goal and feedback, autotelic experience (i.e. when an individual is motivated to progress or explore more automatically) and temporal distortion (i.e. when an individual has a sense that time passes faster than usual) (Csikszentmihalyi,1975; Nakamura and Csikszentmihalyi, 2014).

Flow has been acknowledged to play an essential role in web e-commerce (Hoffman and Novak, 2009; Carlson and O'Cass, 2011; van Noort et al., 2012). Online shopping can be a great space to achieve the flow state since online customer behaviour is usually grounded in goal-directed and non-directed motivation (Hoffman and Novak 2009). There is a relationship between AR and flow experience that requires attention. Javornik, (2016) found that the way people perceive AR technologies impacts the user's flow state and purchase intentions associated with affective and cognitive responses. The study from Javornik (2016) and Parise et al. (2016), for instance, also acknowledged that flow is a factor that mediates AR services.

MAIN FOCUS OF THE CHAPTER

From our initial literature review, we have identified that AR services can positively impact customer experience and evoke both utilitarian and hedonic consumer values. However, the lack of optimal user experience is the main reason why people cannot immerse themselves in this new service, which may result in a negative experience. Therefore, this chapter addresses two main research questions:

- **RQ1:** Does the mobile AR service trigger the user to engage in the flow status?
- **RQ2:** What kinds of design elements in mobile AR service would influence a user's flow status?

Although people perceive AR as essential to understanding the user's experience, literature on this field is scant. Hence, this research aims at providing suggestions for businesses that plan to adopt AR as a digital transformation strategy to enhance the customer experience in the retail industry. Consequently, the research objectives for this paper are: (i) To understand which current mobile AR design elements would positively influence people to engage in flow status, and (ii) to explore what design elements would affect the user's flow status while interacting with AR mobile try-on retail services.

Research design

This study adopts a qualitative approach via an in-depth case study of an existing app and semi-structured interviews through a task-based activity. Seifert and Hedderson (2010) argued that interviews could provide a more vivid interpretation of flow experience perceptions. Semi-structured interviews are often used in earlier research for examining flow experiences (Nakamura and Csikszentmihalyi 2014). Also, quantitative methods such as self-reporting questionnaires can be efficient to measure flow. Guo and Poole (2009) developed and tested a scale focused on the holistic aspect of online-based activities. They identified the

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measure properties for the online shopping activity and portrayed 28 questions from eight flow characteristics.

For the purpose of our study we have utilised the flow characteristics from Guo and Poole's scale (2009) since they have been developed around online shopping experiences. These characteristics were used as criteria for reviewing the design elements of a popular existing app ("IKEA Place") and categorising the findings from the semi-structured interviews. Figure 1 shows the integration of the flow characteristics from Guo and Poole's (2009) questionnaire with the key points from the design guidelines.

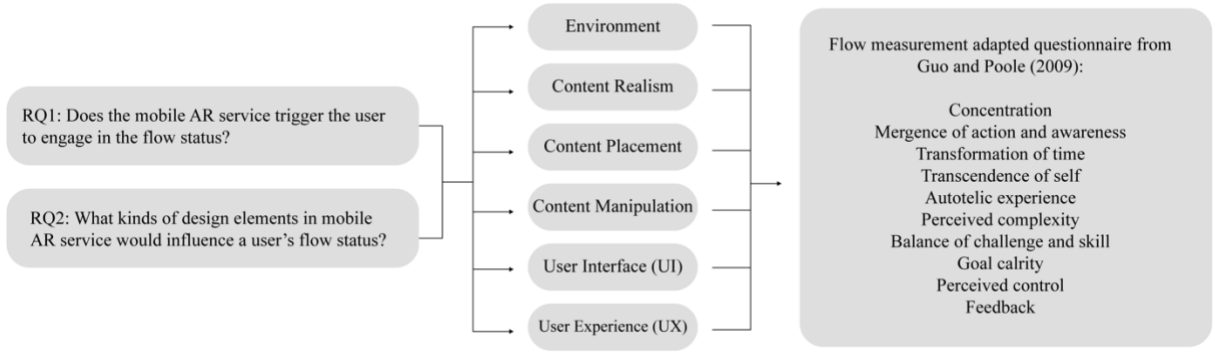

Figure 1. Research design

The design guidelines have been categorised into six main elements, emerged from our initial literature review (see Figure 1):

- Environment;
- Content Realism;
- Content Placement;
- Content Manipulation;
- User Interface (UI);
- User Experience (UX) (including users' expectations, needs, desires towards the type of interaction presented)

Sampling strategy and research process

Digital natives (e.g., Millennials and Generation Z consumers) tend to be more favourable towards cutting-edge services such as AR technologies (Microsoft, 2019). Since this is an exploratory study, a sample size of 5-7 participants should be sufficient to indicate if a problem exists in a product (Nielsen, 2000). Considering this, a convenient sample strategy was utilised and the criteria for the participant selection was based on age (e.g., 22-36 years old).

The next step was the selection of a mobile AR application. Previous studies discussed the app "IKEA Place", which portrays a decent prospect since its first version in 2014 (Huang and Liao, 2015; Scholz and Smith, 2016; Javornik et al., 2016; Caboni and Hagberg, 2019; Davidavičienė et al., 2019; Heller et al., 2019; Alves and Luís Reis, 2020; Ozturkcan, 2021). Since this app attracted attention in both academic and business areas, this study utilises "IKEA Place" as a case study.

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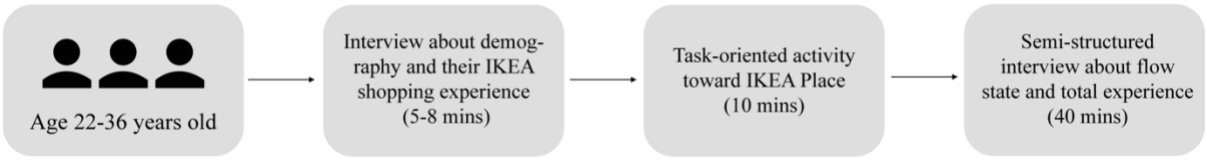

Figure 2. The research process of this study

Since flow experience occurs the application's challenge meets the user's skills, we assigned a task for participants. In the first stage of the interview, participants were asked about their shopping experience in IKEA (e.g., frequency of going to IKEA and what kinds of products they usually buy). After overviewing the function and the products that "IKEA Place" offers, the speaker (Figure 3) was selected to be the compulsory product participants should manipulate during the interview.

Figure 3. Compulsory product selection during the task (IKEA, 2020; screenshot by the authors)

After the task, we conducted a semi-structured interview through a set of predefined questions. Finally, a thematic analysis was utilised by grouping information through codes derived from Guo and Poole's list of preconditions of flow experiences.

Issues, Controversies, Problems

In total, 9 participants (aged 22-36 years, 3 male, 6 female, living in the UK) took part in the study. Most of the participants worked in retail. The results showed that perceptions about being negatively under control and high complexity levels occurred after participants manipulated the 3D object using the app. The most reported issue was the difficulty to control two objects that were closely placed. The second issue was object scale and rotation. This implies that proximity and gesture issues influenced perceived control and perceived complexity. The lack of feedback reported by participants was also related to perceived control and complexity, since the app did not provide sufficient instruction or messages to guide participants. In the next subsections we highlight the issues, controversies and problems according to each design element.

Issue in Environment design element

In order to understand the influence of AR in the physical space, we have categorised the *environment design element* into two sub-codes: virtual and physical. 3 participants mentioned that the "Room Set" function from the app was not suitable to preview one specific product in the physical environment.
Another issue discovered was the product size unreliability. Due to that, participants lost trust and motivation to continue using the app. A participant noticed that the virtual object size was not in a 1-to-1 scale in comparison with a physical object (e.g., a fan) (see Figure 4).

Figure 4. Putting virtual object into physical world (screenshot by the participants)

Issue in Content Realism design element

Modelling and content detail are the sub-codes for the *content realism design element*. When negative experiences occurred during the autotelic experience, participants reported that the virtual product was out of control. The same issue occurred in the environment design element. The 3D object size was unreliable. Another issue was the lack of product information such as texture, shadows and lighting since participants found it hard to judge the product information only by the virtual features.

Issue in Content Placement design element

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Before placing a virtual object, the system had to calibrate and detect the space in the physical world. In "IKEA Place", this is done through plane detection (see Figure 5). In the app, a short animation is played and the user needs to follow it to achieve correct detection. Due to that, the sub-codes of *content placement* are *plane detection* and *optimal placement*.

Figure 5. Plane detection in "IKEA Place" (screenshot by the authors)

Participants reported flow issues during the plane detection stage. They reported that they did not understand the instructions and detection points. Since participants were not familiar with this process, the instructions did not guide them effectively.
Another issue occurred when participants saw objects "floating in the air" (see Figure 6). This was caused by a failure of the system during the plane detection stage. This impacted the sense of realism and object size reliability.

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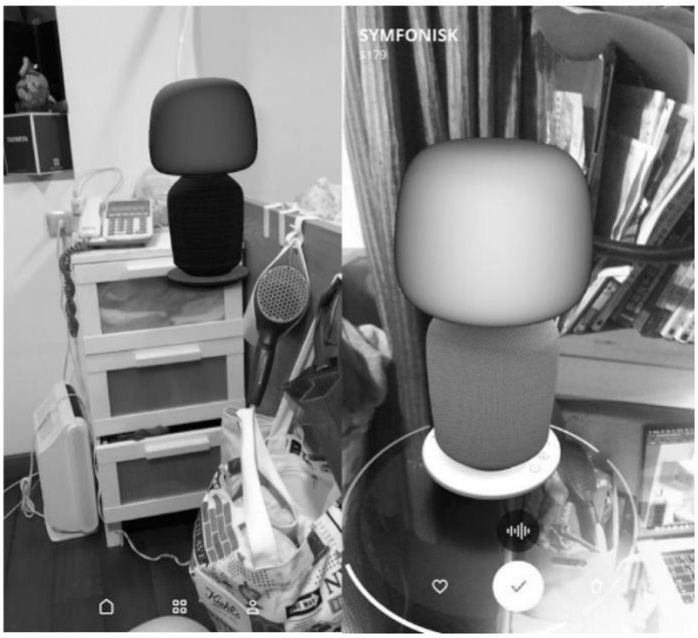

Figure 6. Virtual objects placed in the wrong position due to flawed plane detection (screenshot by the participants)

Issue in Content Manipulation design element

The sub-codes utilised for *content manipulation* are *content selection and proximity*, *content scaling and translation* and *gesture*; these sub-codes are based on Apple (2020), Google (2020) and Facebook/Meta (2020) design guidelines.

The design element that addresses *gesture* was widely reported as participants utilised familiar 2D gestures in the 3D environment. This happened particularly when participants wanted to enlarge the object, by using two fingers to enlarge it. However, scaling products in "IKEA Place" is not allowed since each furniture has a fixed size. Since gesture issues occurred when people scaled and rotated the object, this provided an unbalance of skills and challenge as it did not work as expected. Another issue was proximity when participants selected two closed objects and it was hard to select only one.

Issue in User Experience design element

User experience (UX) includes user perception and responses (ISO, 2018) that occurs before, during and after user interaction. Hence, *offscreen exploration* and *total experience description* are the sub-codes for the *UX design element*; the former focuses on the user's behaviours such as their emotion, and the latter focuses on the whole shopping process.

Participants stated that "IKEA Place" did not assist them to know more details about product information; thus, they would not only rely on "IKEA Place" for purchasing goods online. Participants considered the app more suitable for hedonic values rather than utilitarian ones. As a result, participants would not explore the app's functions since it will not assist their practical needs. The app only gave them the ability to preview "what product will be suitable a space" by trying several furniture rather than "how would the product fit in this space" by product size and its materials. Participants also reported that the current app version showed only a corner rather than a wider view of space such as the view of the whole kitchen or room. By contrast, participants acknowledged that "IKEA Place" concretised their imagination about the space and provided a visual reference in the planning process.

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Issue in User Interface (UI) design element

The sub-code references in *User Interface (UI)* design elements are *condition*, *error*, *onboarding and instruction*, and *browsing product*. All participants reported that finding a product was hard. The logic for classification was complicated and participants mentioned that they needed to browse several times to understand the product category. Since this research asked participants to find the speaker as a product, the product (speaker) could only be found in a particular collection (audio), which is named as "SYMFONISK" (a Swedish name). When participants looked for the product, they ignored the audio collection due to unfamiliarity with the Swedish name. There was one similar category called “TV & Media furniture”, but the speaker did not belong to it, which made participants feel confused.

The other issue reported when looking for products was the cover image. Participants mentioned that the cover image for a collection named SÖDERHAMN (see Figure 7) showed carpet, cushion and sofa, but there were only sofas in this category. This issue shows how important that cover image is in order to provide guidance for users to find the product efficiently.

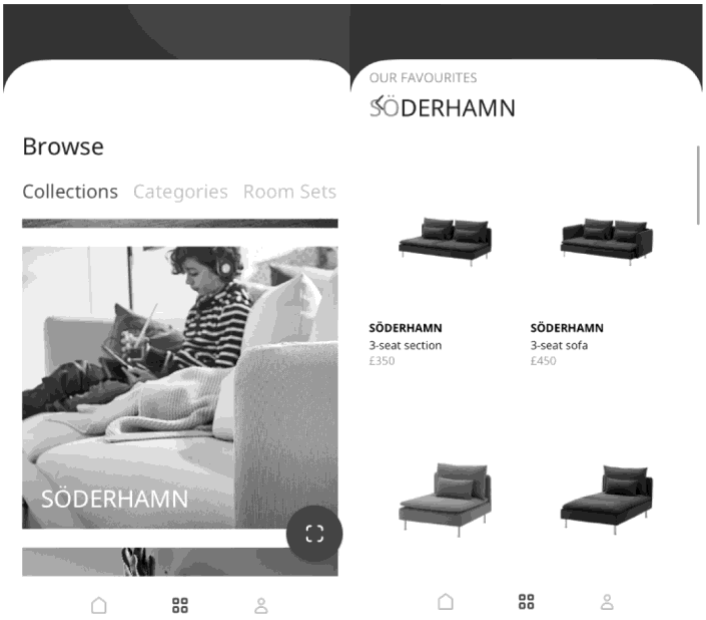

Figure 7. Cover image and product browsing (screenshot by the participants)

Secondly, participants also mentioned that the icons in the app did not provide enough user guidance. This happened after a system error. When participants had to go back to the app, they found all the products they have interacted previously were gone.

SOLUTIONS AND RECOMMENDATIONS

Although it is suggested that online environments can enable flow experiences due to their high level of interactivity and the type of activity (shopping) (Hoffman and Novak 2009), the same did not happen in mobile AR try-on services. In this study, participants reported usability issues that influenced the goal-oriented behaviour of buying goods online. In fact, this study reinforced the idea that mobile AR try-on applications can enhance hedonic and experiential behaviours, but the actual purchase might not happen.

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As RQ1 enquired whether participants would engage in the flow experience, the results show that the majority of participants did not enter into a "flow" state. It is possible that there was a peak of concentration at the beginning of the task, but after encountering many issues regarding perceived control and complexity with the app, participants lost their motivation and goal. Our finding explains that standards and design guidelines that AR services play should be discussed first, since it is suggested that hedonic and utilitarian values are hard to co-exist when usability issues exist. The main reason for that was due to inaccuracy, as participants could not ensure that the virtual product size was the same as the physical product. Participants reported they would not rely only on AR before buying the product. This has a significant impact on businesses looking at having AR try-on services as a digital touchpoint. Since there could be a risk that experiences like these could evoke negative feelings due to usability issues, it is crucial that businesses invest time and resources in user experience design. This chapter suggests that the design elements proposed in Figure 1 (environment, content realism, content placement, content manipulation, UI and UX) should be followed and embedded in try-on AR mobile services.

On the other hand, there was a positive relationship between the experience in AR try-on services and hedonic values due to its interactivity, as AR can be seen as playful and entertaining. However, this interactivity and object manipulation might not be enough to convey engaging user experiences. For instance, participants utilised the mental model from the 2D mobile environment when interacting with 3D in the AR environment, which resulted in disappointment.

The findings revealed that proximity and gesture influenced the sense of perceived complexity as participants found that the app was hard to control. The two design issues identified were: (i) UI elements related to product categories and user instruction and; (ii) problems in the content placement when participants did not understand the visual guidance and failed to calibrate the app via the plane detection process.

Another aspect that could be improved is product browsing. Our findings suggest mobile AR try-on services should provide an option to browse for a specific product at a time. Product classification was also problematic product discoverability. The cover image should also reflect the information that symbolises the product category to facilitate product browsing; this image should be familiar to the user. Another point for improvement is the familiarity with icon design. Icon and instruction design should be based on the user's online experience to reduce cognitive load. Users should be able to quickly recover from error and be rewarded by their progress.

Since the findings show that the floating placement and unreal product scale result from unsuccessful plane detection, the app must have an excellent initial and intuitive calibration. For that, the design of the instructions should be clear for users.

If considering the five layers of UX (surface, skeleton, structure, scope and strategy) proposed by Garrett (2010), we have addressed surface, skeleton and structure, which are usually related to visual design. In our study, participants had issues with plane detection, which is a function that reflects the app UI. Since UX entails more layers (e.g., user needs, product objectives, content requirements and functional specifications), the whole user journey needs to be clarified. The findings also revealed that the information architecture in the AR service should be designed based on the user's interactive experience in 2D environments. Thus, it is suggested that the role AR services play in the whole experience should be identified from the beginning (e.g., from user needs and product objectives) as a tool for customers to obtain practical help and enhance the brand image.

Our finding indicated that the current AR services have problematic issues that can influence all aspects of the consumer journey. Since participants reported the AR app did not make them purchase the product

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straightaway, it is suggested that whole customer journey should be reviewed since there is a lack of connection between the pre-purchase and purchase phases. Thus, companies should develop a holistic customer journey to link all stages of the consumer journey by merging the online touchpoint with the offline touchpoint (physical store) to achieve omnichannel experiences (Lee and Leonas, 2018).

FUTURE RESEARCH DIRECTIONS

Managerial implications

If considering all customer journey stages (e.g., pre-purchase, purchase and post-purchase) (Lemon and Verhoef, 2016), AR services can be highly utilised in the pre-purchase phase, providing a platform for users to browse and try products. According to our research, the app "IKEA Place" was difficult to use due to 3D object flaws and usability problems. This can affect the customer journey since it might influence the pre-purchase stage, stopping users from entering the purchase and post-purchase phases.

Since this problem was exposed, other questions emerged: How can businesses optimise the user experience of AR services? What is the value that AR services might bring to businesses? Managers should account for issues AR services might bring, especially when consumers browse and try virtual products online. For example, in the browsing stage, AR services can be improved by providing more effective product classifications that users can understand. Other enhancements should include making the 3D object manipulation easier to understand and addressing technical aspects such as the plane detection process. If the AR try-on service is a tool that aims at helping customers, businesses need to address these problems first.

The majority of the participants mentioned that the idea of using AR try-on services is promising, but it can be useless to make a final product purchase. Participants did not know whether they needed to buy the product online or in the physical store while using "IKEA Place". This suggests that just the use of AR might not be enough to motivate customers to purchase a product. Based on this, organisations need to express their values and goals first and then extend this to the purchase stage. This shows that the customer experience in mobile AR try-on services has flaws and that each touchpoint needs to be more connected.

Theoretical implications

Our study reviewed the features of AR try-on services, which includes surface elements such as UI and product contents. The issues identified in each of these elements provided insights about what strategies AR try-on services should have in order improve the customer experience. However, if considering Garrett's (2010) UX layers, AR try-on services lack strategy and scope. This means that businesses willing to utilise this type of technology should include AR services within the business model. Thus, businesses should define the AR service's scope first and do more research on what strategy it represents.

Another implication is the alignment of consumer behaviour needs with the type of interactions the AR try-on services provide. Our study showed that the browsing process needs to be easy and quick since consumers would not use AR try-on retailing services just for entertainment. Thus, consumer's values need balance both hedonic and utilitarian consumer needs.

Our research indicated that AR services can have non-addressed usability issues. When a product is represented in the 3D world, users can feel disappointed when there is a lack of visual precision. Since users are more familiar with 2D digital environment gestures and manipulations, future research could study the process when the users manipulate devices in 2D and apply them into 3D to decrease cognitive overload.

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Businesses should also provide an aligned strategy. AR try-on services should offer design features that reflect the business model and consumer expectations. For instance, in our study participants mentioned they would not utilise "IKEA Place" before buying an IKEA product due to usability and lack of product information (e.g., texture and size). Those factors blocked the customer journey and prevented the business to build an effective omnichannel strategy. Thus, future research should look at the factors that businesses need to address in order to orchestrate the touchpoints influenced by AR try-on services.

CONCLUSION

This chapter revealed users' issues while manipulating AR try-on services through the lens of the flow theory. By doing so, the elements “perceived complexity” and “control” emerged as primary concerns. Our findings indicated that participants were not familiar with the mobile 3D environment due to UI and content placement problems. As a result, participants felt disappointed since they felt lost in the AR service. Based on that, we suggest that businesses define the core value they want to express by AR try-on services beforehand. Flavián et al. (2019) also mentioned that managers should define the AR design features first, in order to make the consumer journey more seamless, connecting both online and offline channels. Since Hilken et al. (2021) found that AR would positively impact purchase intentions, future research should look at improving problems found in UI and content placement in order to optimise positive feedback and purchase intention. AR technology is expected to flourish when 5G contributes to ease its technical problem. With huge business investments in AR and Virtual Reality (VR) technologies, boosted by 2021’s Facebook/Meta (2021) announcements concerning the metaverse, it is imperative that organisations understand the value that such technologies can bring. Although there is a trend in the market, many challenges still remain.

Limitations

This study was conducted during the pandemic of COVID-19 through an online-based research that requested participants to use the app remotely. This may result in the quality of observation when participants interacted with the “IKEA Place” app. Also, the quality of the experience could have been affected by network issues and potentially unsupported devices. For instance, the number of participants recruited was impacted as some of them did not have the required hardware. Hence, our future research would recruit more participants and add observation notes for bringing more insights into this topic.

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KEY TERMS AND DEFINITIONS

Augmented reality: Augmented reality (AR) is the interactive experience when people interact with the virtual object, AR experience integrates the real environment with a virtual object and performs in the device.

User experience (UX): User experience is about the user's needs and requirements, which approaches to enhance user totally experiences when the user is interacting with the product or service.

Flow experience: The state when an individual immerses in activity and loses self-consciousness but has a deep sense of control.

Customer behaviour: Customer behaviour is a study regarding a group of people, individuals and organisations, which links with purchase behaviours, and it further relates to customers' satisfaction, emotion and attitude toward their purchase experience.

E-retailing: E-retailing or electronic retailing is processed when people sell or buy goods through electronic media, normally via the internet.

Virtual fitting room: The virtual fitting room supports by the virtual product, which is generally made of 3-dimension objects and simulates those virtual objects to overlap on customer's body measurement.

Mobile augmented reality: Mobile augmented reality is the AR service that is designed for mobile devices, people could interact with virtual objects on the mobile screen, which is a mixture display with the real environment and virtual 3D objects.

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