Interact with Show-Window at Stores: Exploratory Study and Design Solution for Physical Retailers' Product Demonstration

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Abstract. Facing the rapidly shrinking trend of in-store shopping, this study aims at developing an interactive environmental prototype that provides the in-store customer with a more intuitive and enjoyable experience. Based on an intensive market research and evaluation process, we suggest that it is necessary to establish a new type of connection among customers, products, and retailers. Therefore, it is vital to provide stores with a better solution which could integrate an advanced product displaying method with object tracking and recognition and user behaviour interaction approaches. The designed solution proposes an interactive show-window, which emphasizes customized product visualization and direct interactivity to reinforce the connection, during physical shopping, between goods and consumers. We explore the possible feedback when people interact with the interactive show-window using a qualitative study, which has also been facilitated through an interactive show-window installation. The results demonstrated a meaningful outcome for this designed solution.

Keywords: Interactivity · Tangible interaction design · User experience
Shopping behaviour · Physical shopping experience
Physical product demonstration · Transparent screen · Object recognition
Object tracking

1 Introduction

With the booming trend of online shopping in the recent two decades, there is a significantly negative impact on the physical retail stores which can be seen as a miniature of the many domains of human interaction already affected dramatically in

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the twenty-first century. Such trends have also already established new conventions in how people share information, and it creates an entirely new business model and consumer behaviour. As the number of Internet users continues to increase, the opportunities for online shopping will unavoidably continue to expand as well [1]. However, consumers also seem willing to go further to a mall with more comfortable shopping environment and with more diversified and cheaper products [2].

The tangible (physical) shopping experience is one of the primary attributes that drives most consumers to physical stores. Compared with the rapid development of online shopping, physical shopping urgently requires integration with innovative technologies to enhance shopping experiences in the physical store context. Keeping technology up-to-date is an important way to satisfy the ever-changing shopping habits [3]. However, there is a gap between customers' in-store shopping expectations with current retailer stores' environment and available services.

There is an enormous opportunity when implementing potential technologies in physical retail stores. The success heavily relies on a good understanding of (a) what are the key factors affecting customer shopping behaviours; (b) what is the established way for physical retailers to catch consumers' curiosity; (c) how to demonstrate their product; and (d) what they focus on to improve the physical shopping experience.

The following issues are the main focus:

1. Curiosity in shopping - Market research and analysis on the advantages and disadvantages of how physical retailers currently integrate new technologies to showcase product and arouse consumer's curiosity
2. Factors for satisfaction - What are the most important aspects being focused on to increase customer shopping satisfaction
3. Intuitive interactions - Design and evaluate possibilities for altered shopping process and product presentation by using object recognition and tracking technology
4. Overlapping/combined displays - Further develop the potentials for an 'interactive front store window' concept using transparent-screen technology

2 Market Research and Analysis

In a world flooded with visual stimulation, visual aspects of branding have become the central factor affecting shopping behaviours [4], even as branding itself has become ever more crucial to bringing significant market value to a business [5]. Thus, shopping malls and individual physical retailers are aiming to establish their unique brand image and maximize their features on either efficiency or entertainment [6]. Moreover, recreational shopping behaviour, which focuses on the shopping activity and the experience itself [7] is also a good way to keep potential customers engaged. Retailers should focus on customer satisfaction, trust and commitment through the implementation of customer-oriented selling, thus leading to a long-term relationship [8]. There are many examples of retailers re-building their shopping environment to satisfy the customer's expectation for in-store shopping, but the results are still limited. Here market research was used to evaluate several ways of product presentation in the current market. Based on usability, flexibility, price, and functionality enabled a deeper

understanding the in-store consumers' expectations, and the core factors affecting in-store (physical) purchase satisfaction.

The physical static decoration is the most common method for re-building the in-store shopping environment, but the shortcomings are also evident (Table 1). Dynamic decoration as an upgraded version of physical decoration which increases the effect attract people's attention, but still, neglects the information connection and connection between the customer and actual products. In most cases, customers expect to give their feedback in their own words on evaluating items [9], which is a great potential connection that can be established between consumers and products. Moreover, considering shopping as a *process*, composed of a set of distinct components linked together in a particular sequence [10], an effective way implant technology to shopping processes might alter the shopping process, making it more efficient and joyful. For instance, *Interactive WayFinder* and the *Interactive Mirror* both offer shopping-related information to the customer, such as location, opening hours, inventory availability and digital fit-on effect. Those designs are focusing on data interactivity using gestures as the main input method. Bettman in 1979 highlighted that situational variables affect in store decision making in various ways [11]. With the advanced technology available, people should not be restricted to gesture, hands or fingers as the input method. Human interactivity has a tremendous potential for any kind of tangible objects rather than screen-based display or a smart phone. Physical and digital space penetrate one another, to achieve an enhanced shopping experience [12]. All those possible input methods can be considered as situational variables affecting in-store decision-making during shopping (Fig. 1).

Table 1. Evaluation on wayfinding solutions in the current market

Current solutions	Advantage	Disadvantage
Static physical decoration	1. Most common way to improve the shopping atmosphere in a physical shop	1. Long construction time 2. High cost 3. Environmental impact by waste material
Interactive WayFinder	1. Save labour 2. Low cost 3. Interactive communication	1. Limited information support 2. Limited interaction
Dynamic showcase	1. Better visual effect 2. Build luxurious & distinctive brand images	1. High cost of maintenance and construction
Interactive mirror	1. Modifiable user interface 2. Convenient to customer browse items and check inventory 3. Enrich customer shopping experience through virtually fit-on	1. Unnatural fit effect 2. Relatively low usability
Interactive gaming machine (claw gaming machine)	1. Increase amusement interactivity	1. As an accessorial machine cannot directly facilitate final purchase

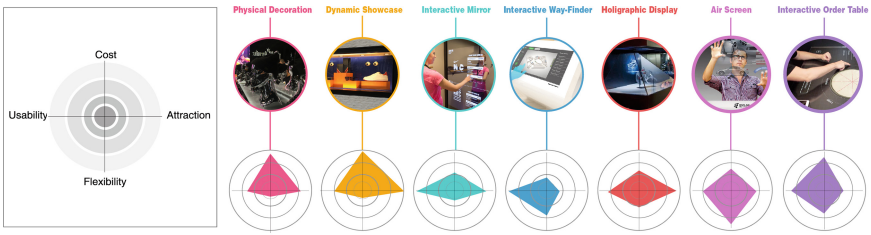

Fig. 1. Products marketing usability evaluation

3 Exploratory Technology Practicability

Concerning the study and evaluation of the current approach that physical retailers demonstrate their products, *interactivity*, *customization,* and *visualization* are three key factors affecting customer's shopping satisfaction and shopping behaviour. In this section, based on shopper's needs and latest technology, the design will first come up with the innovative concept, then test, evaluate, redesign it to get closer to the core of consumer needs.

3.1 Concept One: Trackable Overlay Augmented Reality

In this concept (Fig. 2), the physical product is situated behind the transparent screen, using overlay effect through transparent display rendering the actual product. The overlay effects appear on display which can be modified by the user; meanwhile, it will follow the user's position to ensure the overlay effects align with the actual product.

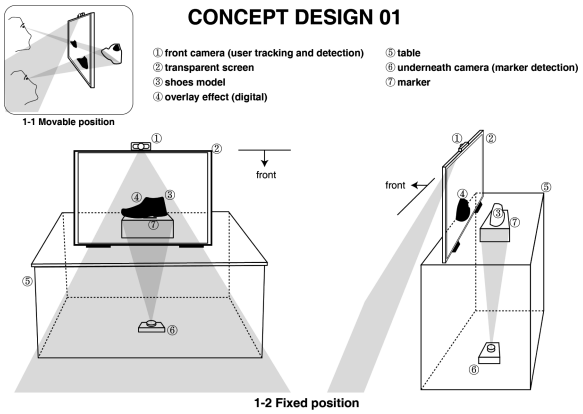

Fig. 2. Explorative concept design 1

However, as Fig. 3 shows, the outcome cannot satisfy the design goals, even though the layer can be matched with eyes perfectly, it still cannot achieve the ideal

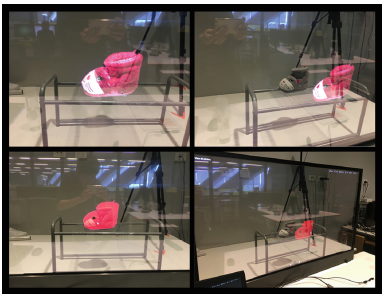

Fig. 3. Explorative concept design test 1

composite rendering effect. The transparent screen is also affected by the lighting, overlaying effect on the actual product, the colour aberration should be considered.

3.2 Concept Two: Trackable Overlay Augmented Reality Rendered by a Mirror Reflection

To achieve a better rendering effect by using transparency, we present the secondary concept as shown in Fig. 4, which put the transparent screen toward to a mirror. The user was able to modify the rendering effect appear on the screen through smart devices. The final rendered effects can be seen from the reflection on the mirror (Fig. 4). The advantage of this concept is that it allows the customer to actually wear the actual product, and to track the position of user's feet through front camera detection. Most interestingly, it is also possible to apply it to a several users with multi-object moving setting and render the augmented images at the same time.

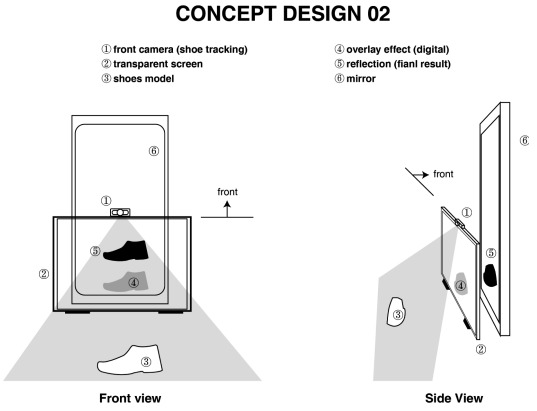

Fig. 4. Explorative concept design 02

After the test, the outcome is a rendering effect as natural as the design expectations (Fig. 5). Several people tested this prototype; they said that when they look at the

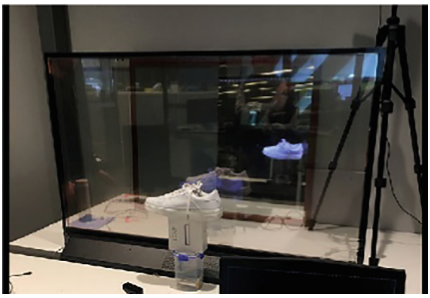

Fig. 5. Explorative concept design test 2

reflection in the mirror, they feel uncomfortable, because they will automatically look at their shoes rather than only observe the reflection in a mirror. Some of the testers also suggested that the augmented imaging effects were not natural enough, it looks like they are wearing a digital shoe, even though they can modify the colour or pattern and view it in a mirror. Mostly they will not go to complete their purchase if they cannot see the actual customized shoes.

3.3 Concept Three: Interactive Showcase

Whereas a forward overlay effect will not match with the real object, a reversed overlay effect through a mirror fails to offer a natural result. To overcome these issues, we imagined concept design three (Fig. 6), an interactive showcase which puts several products on a moving track behind the transparent screen, depending on the timing when certain products come to the centre position to load different items or products information on the screen. The transparent screen is simply and only used to add annotation explaining key information or specifications of the items.

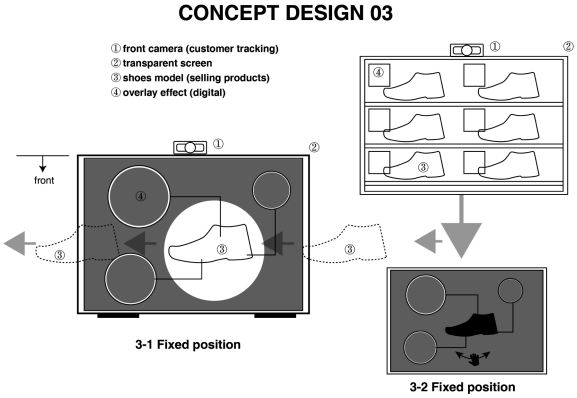

Fig. 6. Explorative concept design 3

In this concept, the physical product remains the focus of the consumer, and the technology is simply being used to engage the consumer via a 'Want to know more?' paradigm. The test result is reasonably positive; most of the testers suggested that the effect is natural and if the item is close enough to the transparent screen, the position of the annotation is not a big issue. However, it needs to be built with useful interactivity which can create the linkage between customer, product, and retailer. Significantly, the designer needs to figure out a way to attract customers' attention and deliver useful/valuable information to them. Examples could include, asking for product evaluation or feedback, and keeping the customer engaged with product demonstrations.

4 Executable Concept and Design Rationale

After various potential concept designs and tests, the most feasible solution was the interactive store-front window. The possibility of implementing transparent display and object tracking technology to enhance physical interaction between the shopper, and visualization of, the product, has been emphasized through all the tests. To rationalize functionality of this design, the designer went through market research and evaluation of the current methods that physical retailers use to present their products. With the feature of visual interactivity, the interactive window was able to stimulate potential customers' curiosity and dynamically schedule selectable advertisements. The feature of transparent display integrated with infrared multi-touch input, satisfied those people who were: willing to make a quick purchase; queuing outside a store; or anyone interested in new arrival products. Finally, physical object recognition and tracking technology enrich the method of input instruction.

4.1 Visual Interactivity

The visual effect is one of the most critical factors to be considered when building a physical in-store shopping environment. There are some cases in the current market or shopping mall with strong visual effect. However, it is still rare to integrate the visual effect and human interactivity with useful information exchange, which could provide interesting interactive experience. Since visual or audio feedback is crucial for guiding the user's interactive behaviour [13], the system provides sensitive visual and audio feedback to users when they stand in front of the camera detection area. Visible target product information is displayed to the customer behind the transparent screen. An interactive dynamic visual effect will respond to passing individuals' positions, and entice those people who walk in front of the interactive window. The benefits of using the virtual reality simulation technique may enable participants to show their preferences simply through different viewing perspectives [14].

4.2 Physical Object Recognition and Tracking

Interactivity between a human and an object is a crucial factor for retailers to focus on. With a variety of advanced technology released, customer behaviour should not be merely restricted to static physical objects and/or smart phones. Physical object

recognition and tracking technology is the key to opening a new linkage between customers and products which enables users to interact with a machine with the real-time positions of their head/face rather than limited gesture such as swap, click, scale etc.

In this concept, the transparency and the infrared multi-touch input are the two main features used to facilitate interactive shopping behaviours. Traditionally, the store-front window emphasises its own attribute as a physical barrier that demarcates the shopping area from the street/mall. This concept unleashes the potential of transparent show-window including overlay effects and product annotations, associated directly with the actual product. Importantly, it could monitor the user's interactive behaviours (including both touch and gestural) which enables the retailer to obtain first-hand information leading to a better understanding of individual customer's needs [15]. Moreover, it could potentially provide a fast shopping solution. The customers could have a chance to review an item and complete their purchase even outside the store.

Regarding to the above-mentioned visual effects, a big potential advantage for physical retailers in implementing such technology is the ability to build linkages through user's eyes, arms, legs even entire body movements as an information input. Furthermore, designers can build up visual effects corresponding to the position of a human face. It provides an active feedback to draw potential customers' interest and give a focus and real-time response to keep customers engaged. Such experiences could provide better support to facilitate the completion of trade (Fig. 7).

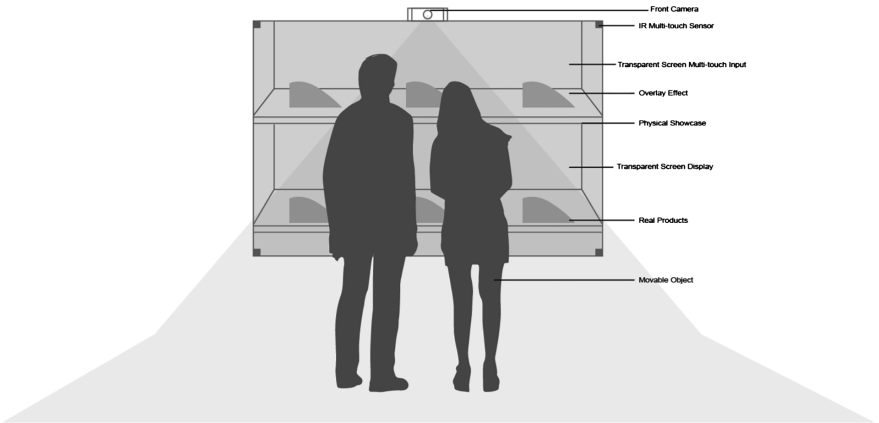

Fig. 7. Explorative concept design 4

5 Technology

Using the well-known tools Unity3D and OpenCV, we developed a functional prototype based on our interactive store-front window concept (Fig. 8). This prototype includes three main modes: (a) screen protection mode (default mode), (b) attracting mode, and (c) discovery mode.

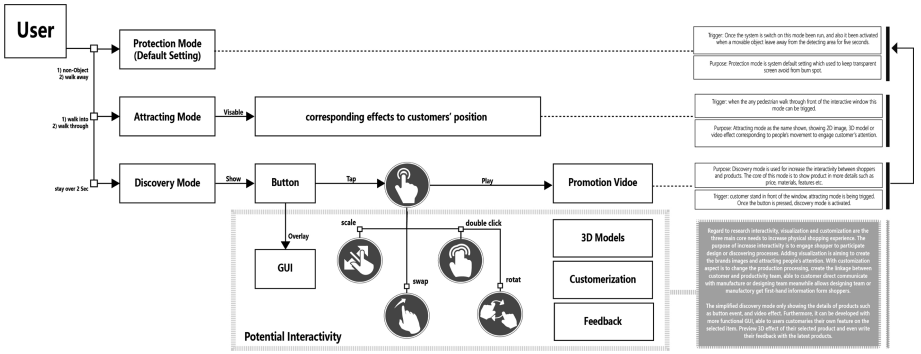

Fig. 8. Interactive store-front-window system structure diagram

The screen protection mode is the system default mode, which is used for energy-saving and to prevent burn-in on the transparent screen. This mode is activated once the customer moves away from the front camera detection area for longer than five seconds. When anyone walks into or goes through the front camera detection area it will automatically switch to attracting mode.

Attracting mode is designed to attract people's attention and arouse their curiosity. In this prototype, the application of Adobe After Effect was used to build a multi-group video effect which can play on the screen in a position corresponding to the location of the person's face.

When a customer stays for more than two seconds, a simplified menu will show up containing brief information about the actual product. Once the customer clicks the button, a video advertisement will play. Retailers are able to present key information to showcase the features of the product in the video. In this prototype, we created a video to highlight the technological and material features of a shoe product. The video advertisement as an overlay corresponding to the actual product behind the transparent screen. This augmented visualization provides an attractive and unique visualised information layer overlay to the real product.

The customer was able to switch on or off the overlay video by tapping the button on the right-side top of the screen. Importantly, the customer also could click the feedback button to switch on the feedback dialog, then evaluate and give a score on that product such as appearance, technology, comfortability and price, as shown in Fig. 9. Finally, when the user moves away from the detection area (when the front camera cannot detect any movable object or human face for longer than five seconds), the system goes back to the default screen protection mode.

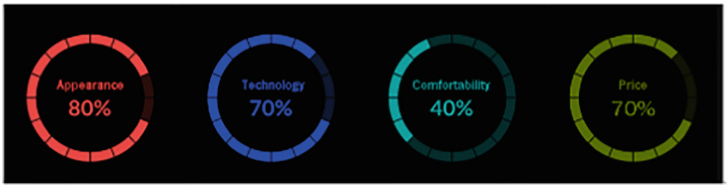

Fig. 9. System feedback menu

6 Discussion and Future Work

This study provides an overview of using transparent display technology, object recognition and tracking technology, to augment the physical product presentation in a physical in-store shopping context. We started with market research concerning current modes of physical product presentation in a shopping mall and an analysis of their limitations, then went through design concept development, discussion and rebuilding to come up with the final executable solution - interactive shop-front window. During this overall development process, we have taken a user-centred approach, with a specific focus on creating innovative solutions to satisfy the consumer's needs during in-store shopping, utilising the above mentioned technical features [9].

After building a low-fidelity prototype for the interactive window concept, we tested it with 5 university lecturers, 5 potential shoe buyers, and 5 researchers. Through the observation and conversation with them, useful feedback was obtained. *For example:*

- *"the visual effect is indeed impressive and draw a significant attention from them";*
- *"it achieves the goal to give a focus to customer allowing them to look at specific item in front of them";*
- *"people are trying to move their body, hand or head even rotate their body to check out what will happen next".*

Those comments inspired the designer to increase the use of various facets of human behaviour as input, instead of monotonic position of face or body detection.

Furthermore, to solve the lightless area around the actual product, LED lights can be attached on the top of the showcase to light up the products behind the transparent screen. However, the 'customization' function takes the primary consideration during the testing. The main functionality of this design is to arouse potential customer's interests, attract them to go into the store to discover more on what they could be potentially interested in exploring further. On the other hand, responders proposed that the customization possibility through the outside interactive window could be an advantage for customers who want to make a quick purchase, and also enable them to purchase products out of opening hours. To further develop this concept, more user research is required, such as consumer psychology and behaviour to optimize the shopping experience.

Our prototype is different from other existing tools in the current market. The functionality of an interactive window not only focuses on human's multi-touch as an input method but also captures human behaviours, extending the possibility of interactivity between human and machine, such as eye tracking, body movement, facial recognition and so on. A responsive visual effect which matches with the pedestrian's movement can be an effective way to attract people attention, and emphasize or promote a specific product.

The next step for polishing up the concept will focus on enhancing visual attraction including a graphic user interface and a refined visual effect. For example, providing a pull-down menu will enable customers to modify the user interface to achieve a flexible user experience. For a more energy-saving solution, the visual effect could be triggered by people passing nearby through a body movement detection system.

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References

1. Overby, J.W., Lee, E.J.: The effects of utilitarian and hedonic online shopping value on consumer preference and intentions. J. Bus. Res. **59**, 1160–1166 (2006)
2. Gould, J., Golob, T.F.: Shopping without travel or travel without shopping? An investigation of electronic home shopping. J. Transp. Rev. **17**, 355–376 (1997)
3. Eroglu, E.: The changing shopping culture: internet consumer behavior. Rev. Bus. Inf. Syst. **18**, 35 (2014)
4. Da Silveira, C., Lages, C., Simões, C.: Reconceptualizing brand identity in a dynamic environment. J. Bus. Res. **66**, 28 (2013)
5. Phillips, B.J., Mcquarrie, E.F., Griffin, G.W.: How visual brand identity shapes consumer response. Psychol. Mark. **31**, 225–236 (2014)
6. Lewison, D.M.: Retailing. Prentice Hall, Upper Saddle River (1996)
7. Jack, E.P., Powers, T.L.: Shopping behaviour and satisfaction outcomes. J. Mark. Manag. **29**, 1609–1630 (2013)
8. Williams, M.R.: The influence of salespersons' customer orientation on buyer-seller relationship development. J. Bus. Ind. Mark. **13**, 271–287 (1998)
9. Burke, R.R.: Technology and the customer interface: what consumers want in the physical and virtual store. J. Acad. Mark. Sci. **30**, 411–432 (2002)
10. Peterson, R.A., Balasubramanian, S., Bronnenberg, B.J.: Exploring the implications of the internet for consumer marketing. J. Acad. Mark. Sci. **25**, 329–346 (1997)
11. Bettman, J.R.: Memory factors in consumer choice: a review. J. Mark. **43**, 37 (1979)
12. Valentina, C., Mark, G.: Futuristic retail spaces. Archit. Des. 138–141 (2009)
13. Wang, J.S.: Fields Interaction Design (FID): The Answer to Ubiquitous Computing Supported Environments in the Post-information Age. Homa & Sekey Books, Paramus (2013)
14. Berneburg, A.: Interactive 3D simulations in measuring consumer preferences: friend or foe to test results? J. Interact. Advert. **8**, 1–13 (2007)
15. Dewan, R., Jing, B., Seidmann, A.: Product customization and price competition on the internet. Manag. Sci. **49**, 1055–1070 (2003)