Designing Ludic Engagement in an Interactive Virtual Dressing Room System – A Comparative Study

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Abstract. The phenomenon of creating virtual dressing room (VDR) environments has currently been widely recognized. Most of the existing VDR systems are of a goal-oriented, rather than open-ended, nature. This study is comparative and investigated two VDR solutions: LazyLazy and a new VDR user interface (UI). The systems were tested by 426 participants. The study applies a qualitative approach including video observations, questionnaires and interviews. The comparison targeted an investigation of the users' experience and behaviour when interacting with the two VDR systems. The results showed that ludic activities can be enhanced without interfering with goal-oriented desires of the user.

Keywords: Ludic activities, motivation, goal oriented, ludic engagement, virtual dressing room.

1 Introduction

A Virtual Dressing Room (VDR) is a contemporary solution, which is changing users clothes shopping habits, preferences and experiences. This type of system enables the users to "try on" clothes virtually in the privacy of their home as well as in retail shops. The purpose of the system is to offer users an overview of available clothes, give an impression of how the clothes fit, and enabling users to make a final purchase decision. The motivation for shopping clothes has a strong impact on the users' performance and behaviour while using a VDR system. The expected shopping experience when using a VDR system, directly influences the customers intentions and final purchases, including both online and offline clothes shopping [1, 2, 3].

Users' motivation for shopping clothes online and/or offline can be divided into two categories of shoppers, namely the utilitarian shopper who has a specific goal in mind, and the hedonic shopper who is simply shopping clothes for the enjoyment of the activity [4]. Utilitarian shoppers are looking for the most efficient (easiest, fastest, safest, etc.) way to reach their goal of making a specific purchase decision. They are driven by motivations such as informativeness, convenience, product selection, and control of the shopping experience [5, 6]. Hedonic shoppers are also, to some extent, motivated by these factors, but it is not their primary purpose for shopping clothes. This type of shopper enjoys browsing websites and to be immersed in a product category, fuelled by their personal interests.

A. Marcus (Ed.): DUXU/HCII 2013, Part III, LNCS 8014, pp. 504–512, 2013.

Related work [7] has identified certain elements that are related to utilitarian and hedonic purchase intentions. These elements express user values which motivate such intended purchases and include utilitarian values as well as hedonic values. The hedonic value includes five key elements for shopping: (1) "Adventure/Explore", which means that the shopper is encouraged to follow their interest, and experience the enjoyment during the clothes shopping processes, as well as satisfy the needs of sensorial excitement in trying clothes; (2) "Social Interaction"which concerns the issue of being able to share the experience and this is, for some, the main joyful part of hedonic shopping; (3) "Idea" and (4) "Value" refers to what the shopper can learn about new trends in a pleasurable way; and finally (5) "Authority & Status" indicating that the shoppers can decide how they want to view the clothes and when and where to make the order [8].

Several existing VDR systems, such as FittingReality[1] and LazyLazy[2], share several similarities, for example their goal-oriented nature. The goal-oriented nature of most existing VDR solutions implies a clearly defined navigation where the user systematically can follow certain steps, for example, browsing the collection of clothes, selecting an item to try on, and finally examining the clothes on the body. On the other hand, satisfying experiences also include joyful interactions that captivates and holds the user's interest. In this regard, it can be useful to consider ludic engagement as a crucial design goal when targeting satisfying user experiences.

This paper is based on a comparison between two specific systems, the LazyLazy system (see footnote 2) and the new VDR UI. The latter is a beta version of a prototype developed within the Virtual Dressing Room[3] project. The focus of the paper addresses the question of how to advance the activity of online shopping by identifying affordances and constraints related to users' experiences and expectations on such virtual dressing room (VDR) systems. Particularly, the paper investigates how ludic engagement can be integrated in a goal-oriented system, and to explore in what way this might dissolve possible boundaries between shopping for clothes and having fun.

1.1 Ludic Engagement Designs

In order to create joyful experiences when interacting with a goal-oriented system, in this case a VDR system, include the questions of how the system processes information and, also, how the user engage with this specific system so that his/her expectations and actions correlate with computational expectations and actions [9]. This might elicit qualities in interaction through ludic engagement. The word "ludic" comes from the latin "ludus", which means "game" [10]. However, related work [11, 12, 13] has shown ludicity to be about far more than simply playing a game. It relates to the engagement of the body and mind, where a ludic activity is something that can create a good feeling for a person [13]. Rather than being useful, systems designed to support ludic values are rich, ambiguous and open-ended and differ in their

[1] http://fittingreality.com
[2] http://lazylazy.com
[3] Financed by the Danish National Advanced Technology Foundation.

assumptions, values, and techniques from those developed for the workplace [14]. This type of interaction is commonly referred to as "ludic engagement"; a term which was first described by Huizinga [15] who defined people as playful creatures. Thus, systems that promote ludic engagement should not be concerned with achieving clear goals, or be overly structured with defined tasks [16, 17, 18].

In the context of this paper, ludic engagement is related to the immersiveness offered by the system, which is dependent on the functionality and navigation possibilities of the system. Related work [19] investigated the intensity level of immersion and found that engagement is the basic level of immersion. Here, the affordances and constraints concern "access", "control" and "feedback", which have to be detailed and complete in order for the user to reach a higher level of immersion (engrossment). For example, the question of how fast the user can access the system, how the system can be controlled, and, finally, what kind of feedback the user will receive, constitute three fundamental points, which are crucial to captivate the user's interest. In this paper, this captivation of interest is related to having enjoyable and fun experiences. This means to being engaged and that the user is offered possible choices of action and exploration [17]. Overall, previous research has shown how a VDR system could enhance the user's exploration, social activities, self-recognition, and expression, which would provide increased hedonic value.

2 Method

In order to determine the affordances and constraints presented by current VDR solutions and investigate in what way ludic engagement can be utilised to enhance enjoyment in VDR activities, two different VDR systems were introduce in to the study.

The LazyLazy system "Webcam Social Shopper" (WSS) is a webcam-based VDR solution. The user steps in front of a camera within a certain distance. The camera tracks your position and the 2D image of a piece of clothes is applied to a real-time image of yourself on the screen. The clothes can be scaled in size to fit as close as possible to the size of the specific body measurements. The system tries to utilize the webcam similar to a mirror and "holds" a piece of clothes up in front of the user. The initial purpose of this system is to enable online users to immediately see if the style and/or colour of a piece of clothes is fitting. This to ultimately remove users' doubts about the clothes without physically trying it; benefitting sales by reducing the rate of returned items. The LazyLazy UI can be seen in figure 2.

The new VDR UI (developed by Commentor and Virtual Lab ApS) is also a camera based system. It uses the depth camera of a Microsoft Kinect to track the position of the user, and similarly to LazyLazy it placec a 3D scanned piece of clothes on them. The user interacts with the system mainly by relying on movements and gestures. The system uses two screens: One for displaying the full body image (like a mirror), and another for menu selection. This can be seen in figure 1. of the new VDR UI.

This comparative study relies on a qualitative research approach to determine the affordances and constraints for both systems. The study is based on a participatory

design (PD) approach, including video observation, questionnaire and interview. In line with a PD approach [20], participants took part in a short design session followed by an interview. A total of 14 people were involved in this design process. The task for the participants was to provide suggestions on improvements for the both above-mentioned VDR systems, particularly changes they would consider to make the experience more fun, i.e. enjoyable. The data was analysed using an interpretative approach [21], in which the researchers draw on the understanding, and shared perspective of the users, as well as the domain of their actions, to determine the reality of the VDR system.

2.1 Participants

The research took place at the TV2 Beep exhibition, where 426 participants were involved in the test. They were selected randomly at the location, where each participant could choose to try either of the two systems, or both depending on how long time and personal interest that the participants had. The sample had an age range from 2 to 69 years of age and covered both genders (66% were male and 34% were female).

Of the 426 participants, 103 filled out a questionnaire afterwards. Of the participants, only 8% have had experience with similar system (the remaining 92% had never tried it before). 43% of all the participants only tried the LazyLazy system, 18% only tried the new VDR system, and the remaining 39% tried both systems. For the comparative analysis as a whole, only these 39% were included. In relation to the questionnaires, this means that 22 of the 103 are included in this study. Comments from the groups that only tried one system will be brought in where it is relevant.

2.2 Procedure

The participants were briefly introduced to the systems and the test procedure. They were then told to freely interact with the system and to try on different pieces of clothes until they felt they were done. Afterwards the participants were asked to fill out a questionnaire. Those who were willing were also invited to take part in an informal semi-structured interview and a design session directed towards possible affordances, constraints and improvement suggestions related to the two systems. Due to the limited selection of VDR-capable clothes available in both systems, the clothes were selected for the user to avoid wasting too much time while the user searches for an item.

The video observation focused on the user's interaction with the two systems targeting affordances and constraints. From the facial expressions and behaviour of the participants during the interaction with the two systems, indications of enjoyable moments were identified. The 22 questionnaires focused on general participant background and experience-based information, as well as the preference between the two VDR systems in the domains self-recognition, system control, and general cognition. The interview process focused on determining the participants' perspectives on affordances and constrains and their design suggestions for a VDR system.

3 Result

The results are based on an analysis of video observations, questionnaires and interviews. Our findings presented the usefulness of this triangulation of methods. The findings are presented in the three following sections: System performance, user preference, and design suggestions.

Fig. 1. New VDR UI

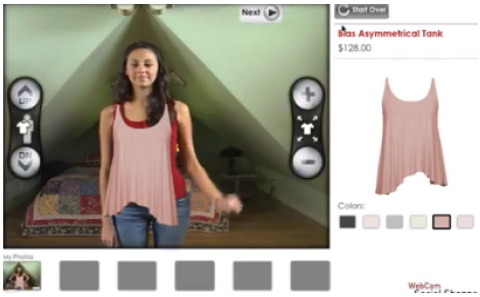

Fig. 2. LazyLazy UI

3.1 System Performance

When interacting with the LazyLazy system, users accidentally navigated to the second page (where colours can be adjusted, and pictures taken), and then became confused, as the controls are similar but not the same as the first page (where size is adjusted). Since the navigation was accidental, they also did not understand how to get back too the starting point. Some functionality has no undo or cancel option, for example, if the picture taking option is activated, there is no way to stop it, though it takes several seconds before it actually executes. The users did not immediately understand the function of the buttons, i.e. what to do with them. The system relies on the ability of the users to learn how the buttons work and where functionality is located, rather than presenting it in an easily recognizable way.

Error prevention is most clearly seen in the size adjustment, where the system will allow the user to move the clothes completely off the screen (by pressing "up" or "down" for a long time – maybe accidentally), or adjust the clothes to extreme scales.

Several interaction constraints appeared in the LazyLasy system such as the user using one hand for pointing at side buttons on opposite side of the screen. Users also had difficulty in judging distances the system does not support multiple users, and browsing the clothes collection. The clothes adjustments take time and effort.

In the new VDR system, the menu auto hides right after the user clicks on it. This confuses the users, complicating access to for example the clothes-browsing page. They may also accidentally jump to the detailed information page, leading to further confusion. However, the users can freely explore the system. They did not immediately understand what the images and icons on the menu do, and asked for assistance in understanding each function. Clothes is automatically scaled and positioned,

eliminating the possibility of mistakes, but also reducing the ability to make fine adjustments. The users were confused about button activation, which was evidenced by random pointing, clicking, flipping, and cycling with the buttons. When confused the users also occasionally accidently hit other buttons, complicating the navigation.

A common constraint in both systems was the fact that many users required help and advice from the observers during the tests, since this is not available through the systems as such. For example, if the user is confused about which buttons do what, there is no help immediately available on the screen. Furthermore, lag in tracking and system operation was also common.

Overall average performance time in the LazyLazy system was over 2 minutes, while in the new VDR system it was less than 2 minutes.

3.2 User Preference

The questionnaire inquired the preferred control method (using body movement) for each participant. The options where: Using a smartphone as a remote, voice control, foot touch (e.g. a dance pad), a touch screen, or regular body motion as in the systems tested. Of the people trying the LazyLazy system, 64% preferred body motion, compared to 72% of the ones trying the new VDR system. For comfortableness in using body movement for control, a 7-point Likert scale was used. In this, the most selected value was 5, which was at 26% for both systems. Overall, for the LazyLazy system, 71% selected 5 or higher, while in the new VDR system 68% selected 5 or higher.

In mirroring, 69% of the participants trying the LazyLazy system preferred a mirror image of themselves, compared to 72% in the new VDR system. The second most common choice was a self-like 3D model with the same figure as the user, which was wanted by 26% of the LazyLazy participants and 18% of the new VDR system participants.

When asked about intentions to purchase after using a system, the most common value on a 7-point Likert scale was 4 for both systems, meaning neither for nor against.

Overall, 58% of the participants that tried both systems preferred the LazyLazy system in favour of the new VDR UI.

3.3 Design Suggestion

The participants generally wanted more functionality in the LazyLazy system, such as recommendation of clothes size, and clothes collection browsing. In regards to the system performance, they wanted a friendlier user interface; the clothes should follow the body movements, the system should be more sensitive, and react faster. In the new VDR system, the participants wanted the image of the piece of clothes to be presented in a more realistic way. They would also like a bigger selection of clothes, and to be able to adjust the clothes size and colour. More detailed information about the clothes should be provided.

For both systems, the users would like to be able to view the clothes in 360 degrees (by being able to turn around).

4 Discussion

The five elements of hedonic shopping values [7] are used as a framework to discuss the results of the study, particularly focusing on the aspect of ludicity related to the VDR systems included in the study.

For access, the results showed that the participants use a longer time for the Lazy-Lazy system, and a step-by-step control process is required for the user to go through. The new UI provided the user with quicker access time, by simply requiring them to stand in front of camera, after which the clothes were somewhat auto-scaled and applied to the image of the user. Due to not having a clear navigation sequence, the system could provide the user with more hedonic adventure and exploration activities.

The LazyLazy system's distance judgement constraint meant that the user could not stand too close or too far away from camera. This limited the group of users that could access the system properly, such as people of shorter stature (e.g. young children, or a person in a wheel chair). By using the Microsoft Kinect, the new UI prevented the distance issues, which increased accessibility and provided more freedom to move back and forth.

Both systems provided movement based interaction. In general the users appeared to prefer using one hand to control the system. The button placement in the LazyLazy system meant that these users had to perform awkward movements to activate the buttons in the side opposite to whichever hand they preferred using. Furthermore operation errors continuously occurred when the user moved any part of their upper body and accidentally activated the buttons. The new UI menu was designed to be on one side of the system exclusively, and as a result the confusion regarding which hand to use was solved. Since the system was designed to only be activated by hand movements, this also allowed the user more freedom to move around in front of the camera.

In the new UI system, users showed their enjoyment by dancing a little in front of the system or turning to check the sides and back of the clothes. The LazyLazy system does not support either of these types of interaction. These results also show that the users consider that their body can be used to directly manipulate the system in a fun and interactive way.

Self-recognition and expression was facilitated mainly by both systems being camera based, which enables users to directly recognize themselves by the mirror image presented on the screen. A limitation in the LazyLazy system is the fact that it can only show half of the user's body, while the new UI shows a full body image. The users of both systems confirm that they could easy and immediately recognize themselves with the clothes on. The view of the entire body, in the new UI, encourages more movements from the users as they try to express themselves with different clothes. Interestingly, the second most popular choice for the users would be to see the clothes on an avatar made to look like them.

Social activity is one of the hedonic shopping experience activities [7]. LazyLazy does not support multiple users, which means that the user need to be alone and no one else can be even within a range of the camera's view. If so, the motion of the second person will interfere with the tracking.

The new VDR UI supports multiple users. For example, a mother brought her 3 years old son to try the new system. During the process the mother tried to pick up the virtual clothes, which were placed on her body, and pass it to her son. Both mother and child appeared to enjoy doing this. Two male participants did something similar. In this way, the system supports interaction not only between the user and the system itself, but also between users. It provided a shared social behaviour which enhanced the user's feeling of it being more fun to play with.

Overall, the new UI offers more ludic activities compared to the LazyLazy system. However, generally there is not a significant preference for the new UI.

In terms of authority, the main constraint of the LazyLazy system is the fact that it did not allow the user to browse different clothes, which is refers to one of the important hedonic clothes shopping experience: Browsing the clothes collection. The participants mentioned the inclusion of this affordance as something positive in the new UI. On the other hand, the main constraint for the new UI is in the lack of ability to control the choice of colour, shape, size, etc., on the part of the user.

5 Conclusion

This study focused on investigating how ludic engagement could be involved in a VDR system, by comparing user behaviour in two such systems, namely LazyLazy and the new VDR UI. The affordances and constraints that were determined for both systems had a strong impact on the system performance.

The performance differences between the systems in terms of constraints can be related to the five fundamental ludic activities: Access, movement based interaction, social activity, self-image recognition, and authority. These factors should be enhanced to provide a more hedonic shopping experience to the users. The freedom to freely move was a required affordance, which enabled expressions of self and fostered ludic engagement. However, since the navigation of the systems was not clear and the user, thereby, had difficulties to find the boundaries of the system, this constrained the ludicity and the qualities in the interaction.

The LazyLazy system only provides a 2D front image of the clothes, while the new UI provides a low quality 3D model of the clothes. Both systems have strong latency issues in the tracking (and positioning) of the clothes. The user experience of being involved with the product is reduced by these two limitations. Progress in image quality and tracking technology is required for future development. The location of the test, the TV2 Beep exhibition, was a limiting factor in the participant sample. A majority of the participants were male, and can be assumed to be familiar or interested in new technology (due to their presence at the exhibition). Future research should involve locations where a more broad range of interests can be found.

Acknowledgements. The Danish National Advanced Technology Foundation funds this work, as well as the entirety of the Virtual Dressing Room project. The authors would also like to thank Virtual Lab ApS and Commentor for the new VDR user interface developments

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