ON THE PRIMARY EVALUATION OF AR COMPUTER INTERFACE DESIGN FOR THE ELDERS

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Abstract - The related research about how the senior interact with the AR 3D portrait interface system was few, it is critical to analyse what type of interface is the best for the senior user group. In this study, three types of interface, namely linear, mix, and network, of paper models were proposed and tested. There were twelve senior people invited to participate the interactive simulation individually. As the study result indicated, 11 people favoured the mix-type interface that possesses the vantages of linear and network designs. Moreover, linear design scored the worst point. It was also noted from the interview, most senior people consider that linear display too little while network too much information, caused frustration and misunderstanding during the interactions. This study provides an example on AR 3D interface design testing for the senior citizens that will benefit the research on related AR 3D computer interface design in the future.

Keywords - Augmented Reality (AR), Interface Evaluation, the Elders

I. INTRODUCTION

In addition to the issues of living care, distant medical care, movement assistant device, robot or health related product, other matters such as dignity, leisure, amusement, and joy are eagerly wanted by aged people but overlooked by the younger generation. As the market tendency indicated almost 90% products, especially the leisure or amusement related goods, for aged people are still overlooked (MOEA, 2011). Consequently, the issues of usability, security, amusement design for aged people are in demanding urgently.

An AR 3D portrait identifying technology is more precise than the 2D based technology. To applied AR 3D portrait identifying technology into a VR try-on interface is not new, but only little can be found for the aged population. With the AR 3D portrait try-on system, the aged people can try the products such as hat, glasses, necklace, or ear-ring by computer and video camera at home. Through design proposals, expert meeting, and user experience investigation, the most favored AR 3D portrait try-on interface system will be presented, and related design suggestion provided. The study result will benefit the interface design and research for the aged group.

II. LITERATURE REVIEW

A. AR 3D Portrait System

The development of 3D portrait cognitive system is considered matured and wildly applied in security or emotion identifying (Terzis, et.al., 2010 ; Stanley, et. al., 2013; Wijk, et.al., 2012), yet only little researched can be found related to AR try-on system. Since there was no previous study can be referred, we proposed a fundamental interface layout (Fig 1) and discussed with the experts to decide the needed functions and structures. After the expert meeting two main design principles were approved as the basic framework for interface design: 1. Interface layout was divided by four main areas, namely portrait display, mode, product menu, and control panel; 2. the fundamental AR 3D portrait try-on system functions are camera, rotate, try-on, colour, size, and texture. In this study, three re-designed interfaces with different structure based on the topological theory will be presented to the aged group for evaluation to find the most suitable design for targeted users. the body text. This is the body text. This is the body text. This is the body text. This is the body text. This is the body text. This is the body text. This is the body text. This is the body text.

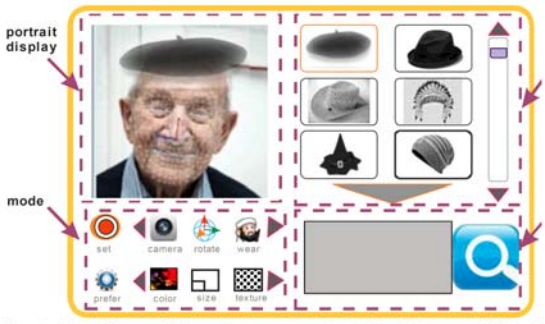


Fig. 1 A fundamental interface proposal of AR 3D portrait interface design (proposed by the authors)

B. Interface Design for the Elders

As the Taiwan government report indicated, the aged group will reach 22.55% of population by year 2028; aged people become the main stream of the family members. The good designed interface and product for the aged people are severally lacked (BOFT , 2011). Because the physical and psychological conduction of the aged grouped are gradually retarded, that will not function as good as the normal adult group. Aged people may feel frustration and pressure when deal with the information processing, inexperienced advanced technology, or 3C product (Freudenthal,

2001). It can be predicted, aged group would have worse task performance than the normal adult when operate the interface without special considered design (Evans & Rowlands, 2004).

C. Topology of the Interface

2.3 Topology of the Interface

A linear topology is based on a rigid linear links structure design, resulting in less disorientation, nevertheless, the linear design results in potentially tedious back-and-forth and backtracking navigation. In contrary, a network structure visualizes all of interface functional links in a whole picture; users can "jump" to different functions or units using displayed icons or buttons. However, too much displayed information may cause overloaded cognition as users got lost while confronted with the complex visible choices. A mixed topology possesses the merits of both linear and network, that folds the linear functions under a cluster or layer and displays parallel function modes in one picture to inform the user needed clue for operations (Chen, Chang, & Chang, 2008). Previous study claimed the senior user group performed better in the linear than the network topological structure, thanks to the simpler displayed function design (Lin, 2004). It was noted that only few studies have tested mixed type of topology with the other structure. Thus, more design proposals with aged people is important to clarify the target user's needs and related issues.

III. METHOD

There are three main methods, design proposals, expert meeting, and user experience investigation applied in this research. The most favored and un-favored AR 3D portrait try-on interface among the design proposals will be investigated and discussed, and related suggestions summarized.

A. Participants

Twelve elder people (6 male and 6 female) were invited to participate the questionnaire interview and usability test. All the participants were aged between 60~71 year old, and above high school educated with more than 2 year smart phone user experience.

B. Experimental design

There are three main research steps in this study. Firstly the participants were introduced with the AR 3D portrait try-on conceptual models. Secondly, the participants were required to experience the interface based on the pre-set mission procedures. Finally, the questionnaires investigation will be processed by the researchers. All participants were paid US $7 per hour for their participation.

C. Computer Interface Design

As previous sections mentioned, there are four main parts of the computer interface layout, portrait display, mode, product menu, and control panel. On the alternative product for related to AR 3D portrait try-on system, glasses and hat product items considered not cause gender effect were taken for demonstration at this study, while other product such as necklace or earring possibly differentiated by gender effect for try-on test were avoided at this stage. Additionally, design principles such as text size (12 point), icon size (above 15mm), and portrait size (220 X 220 mm) were also discussed, pre-tested and modified before the design proposals were generated.

D. Topological Structure

On the interface design proposal, after successive modify and re-design three topological proposals were designed and presented to the expert meetings. They are linear (Table 1-1), mixed (Table 1-2) and network (Table 1-3) topological designs. There were 42 links in each design of the three proposals. The feature of linear design is controlled by backward and forward icon with linear linking structure. The feature of mixed design is structured by two networked main product group, hat and glasses icons with 21 links on each. The feature of network design is structured by 42 network links at one display.

TABLE 1-1. LINEAR TOPOLOGICAL INTERFACE

	Linear topological structure

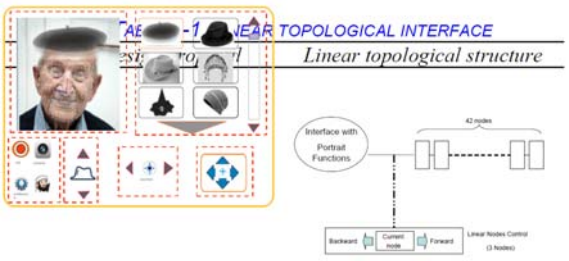


TABLE 1-2. MIXED TOPOLOGICAL INTERFACE

Mixed design proposal	*Mixed topological structure*

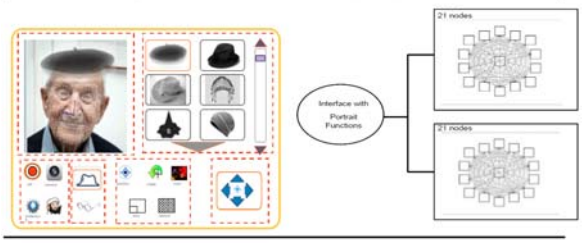
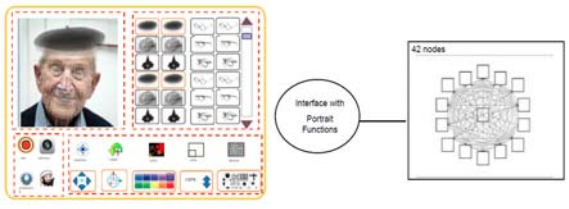


TABLE 1-3. NETWORK TOPOLOGICAL INTERFACE

Network design proposal	*Network topological structure*



E. Interview questionnaire

There are two main parts of interview questionnaire. The first part is about fundamental data of the

participant on the issues of age, sex, previous touchpad experience. The second is about the interface design proposal on the issues of preference and usability. There are three topological designs (linear, mixed, and network) and three display size scale (1:1; 4:3; 16:9 by height 220mm) printed paper models. Video camera was used to record the interview.

IV. RESULT AND DISCUSSION

A. Fundamental data

Among the 12 participants, all of them owned smart phone and familiar with touchpad function, and willing to experience the AR 3D portrait try-on system. Most participants claimed the AR 3D portrait try-on system can avoid the embarrassment and time pressure in the real world.

B. Usability evaluation

As Table2 displayed, the second part of the interview, 11 persons favored the mixed topological structure thanks to its layout and quantity of the presented information, 0 person preferred linear by its' simplest function layout, while only 1 person like network because of all visible function modes. On the function mode priority, the order is (1) color; (2) size; (3) texture. Finally, the size scale of 4:3 was favored by 10 votes, 1:1 1vote, and 16:9, 1 vote, suggesting 4:3 scale to be the most confortable scale among the three scales. On the sex effect, the former 6 participants are female, the latter 6, male, and no significant sex differentiation was found in this investigation.

As the interview result indicated, mixed topological design was the most favoured choice, this is consistent with the previous study that claimed mixed is superior to the other topological designs if successfully integrating the merits of linear and network structure (Chang & Chen 2011,). It is important to note that this study have not exam these interface design through task performance experiment. As previous study claimed that the elder people have better task performance on linear topological structure than the network (Lin, 2004) remained untested in this study. It is also worth to note, some researches (Coluccia, Iosue, & Brandimonte, 2007; Chang, et.al., 2015) argued that task complexity may interact with the effect of topological structure shall be tested in the future stage.

CONCLUSION

This study adopted topological structures in the practice of computer interface design of AR 3D portrait try-on system. The research results indicate that, mixed topological structure is superior to the linear and network designs, thanks to its proper integration of the other topological structure's merits. In the near future, further effectiveness evaluation experiments will be processed based on the comparison of the proposed topological structure designs.

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REFERENCE

[1] BOFT (2011). Population forecast between 2010 to 2060 of Taiwan, Bureau of Foreign Trade (BOFT), (In Chinese language), Retrieved date: Dec., 2015, http://www.cepd.gov.tw/m1.aspx?sNo=0000455

[2] Chang, W.-T. & Chen, C.-H. (2011). The effects of topology and task complexity on digital-speech-desktop interface design and evaluation, Journal of the Society for Information Display, 19(10) 700-705

[3] Chang, W.-T., Lin, C.-L., & Chuang, C.-C. (2015). On the Influencing Factors of Dictionary App Interface Design for the Elders, 6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) (in Digit file), 26 – 30 July, Las Vegas, USA, 6p.

[4] Chen, C.-H., Chang, W.-C., & Chang, W.-T. (2008). The efficiency, usability, and preference of user interface with regard to topological structure and task type. Journal of Engineering and Applied Sciences. 3(7), 538–544

[5] Coluccia,E. Iosue, G.& Brandimonte, M. A. (2007). The relationship between map drawing and spatial orientation abilities: A study of gender differences. Journal of Environmental Psychology, 27, 135-244.

[6] Evans, B. J. W. & Rowlands, G. (2004). Review article. Correctable visual impairment in older people: a major unmet need. Ophthal. Physiol. Opt. 24, 161–180.

[7] Freudenthal, D. (2001). Age differences in the performance of information retrieval tasks. Behaviour & Information Technology, 20(1), 9-22

[8] MOEA (2011). The opportunity of international medical device for the aged people, Ministry of Economic Affairs of the Republic of China (MOEA), (In Chinese language), Retrieved date: Dec., 2015, http://www.sencare.com.tw/zh_TW/news/info.html?id=E12B3CB6DBE83ADB

[9] Stanley, J., T., Zhang, X. F., Helene, H. Isaacowitz, D. M. (2013). Cultural differences in gaze and emotion recognition: Americans contrast more than Chinese. Emotion, 13(1), 36-46.

[10] Terzis, V., Moridis, C.N., and Economides, A.A. (2010). Measuring Instant Emotions During a Self-Assessment Test: The Use of FaceReader. Proceedings of Measuring Behavior 2010, Eindhoven, The Netherlands, August 24-27, (pp. 192-195).

[11] Wijk, de, R.A., Kooijman, V., Verhoeven, R., Holthuyzen, N., and Graaf, de, C. (2012). Autonomic nervous system responses on and facial expressions ot the sight, smell, and taste of liked and disliked foods. Food Quality and Preference, 26, 196-209

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