ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research, volume 40
3rd International Conference on Education, Language, Art and Inter-cultural Communication (ICELAIC 2016)

Interactive Interface Design Based on Memory Thinking

Chong Lan
Lanzhou Jiaotong University
Lanzhou, China 730070

***Abstract*—Objective: To study the interaction design experience in the form of the memory interface and the use of innovative methods in the design task. Methods: First, the method of the basic framework and extraction using the analysis of the memory of thinking, provide a theoretical basis for the design frame of mind; Second, according to interface design task and design elements feature will remember thinking applied to the design process which formed the design scheme provide practical application support; and finally, to watch intelligent car interface design as an example, the case presents specific design process of the design method. Conclusion: Examples prove that the method can simplify the extraction process of effectively design experience, and planned innovation based on design tasks.**

Keywords—memory thinking; interface; design experience; innovative methods

I. INTRODUCTION

Memory plays an important role in human's perception and innovation of things. Designers' accumulation of design experience can improve their ability solve design tasks. These experience and knowledge are stored in the brain in the form of memory. In the study of relevant design experience, JS Gero proposes that design memory can be formed into new scheme by way of reconstruction.[1] Liao Yi and others propose that knowledge activity elements can analyze design-based cognitive working process, which is beneficial to improve the design-based knowledge working efficiency [3]. However, wiswanathan VK and others point out that excessive reliance on experience could lead to design thinking curing [2]. Based on the existing memory thinking research, this study puts forward the a clearer and more effective extraction and innovation strategy of interactive interface design experience, plan the innovative task in the interactive interface design on the premise of experience, to improve the efficiency of interactive interface design.

II. FRAME FACTORS OF MEMORY THINKING

A. Basic Model of Memory Thinking

Psychologist Athinson - Shiffrin proposes the memory model made up of three storages ("Fig. 1"). In this model, the memory system consists of sensory memory, working memory and long-term memory [4], and the three types of memory storages play a different role in the process of memory respectively. There exist different forms of external information in the environment, such as text, images, sounds, smells and material and so on, which is the source of memory. Once the information is noted or received, it will enter into the sensory memory within the storage system. Sensory memory only maintains for 0.25-1 second, playing the effect of preliminary judgment in memory storage, and forming the basic properties and sensory of information through the five senses (i.e., eyes, ears, nose, taste and touch).These information will then enter into the short-term memory, which will enter into long-term memory if it can be repeated, otherwise it will be forgotten. Long-term memory is the key part and main extraction source of memory storage, of which the capacity is not restricted with a long duration, and it can be divided into semantic coding and graphic coding [5].Semantic encoding classifies the memory properties by way of words or language, while graphic coding connects and differentiates information through graphic elements characteristics. The extracted information is stored in short-term memory temporarily (also referred to as working memory), enabling the planning of information to realize the operation procedure and method during that process.

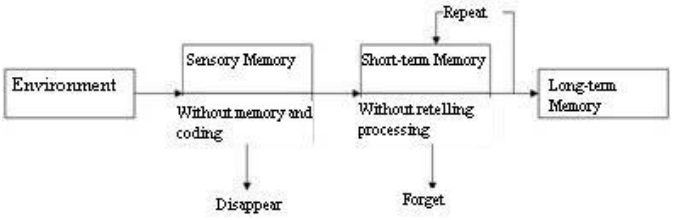


Fig. 1. Athinson-Shiffrin's memory model

B. Extraction Stractory of Memory Thinking

Memory is often disturbed by forgetting and irrelevant information in the process of extraction. Different strategies can be adopted to assist memory extraction in order to improve extraction efficiency and accuracy.

During the extraction process, the first is to expand extraction scope, wake up the relevant content in the memory, which content may be stored in the form of image or text. The second is to screen content, and improve the correlation of extracted content. It can be matched through comparison, error practice, decomposition and other forms in large memory system. Chen Chaocui divides the memory extraction process

Fund Project: Youth science fund research project of Lanzhou Jiaotong University (2014060).

into contract-to-contract, group set -to - group set, and within the group set [6], which can be summarized as large concept, similar concept and content matching. Large concept is the huge concept classification network in the memory, and the positioning extraction in the whole network structure; similar concept is to wake up related concepts upon confirmation of the large concept; final decision and matching use the concepts in the memory, and transfer to the working memory.

C. Application and Innovation of Memory Thinking

The innovation and application of memory is mainly conducted in the memory zone, to form new action plan. As for the formation of new scheme, there are mainly three factors, namely situational information, visual memory and semantic memory. In the innovation without factor dominance, different innovative forms will be generated, as shown in "Fig. 2".

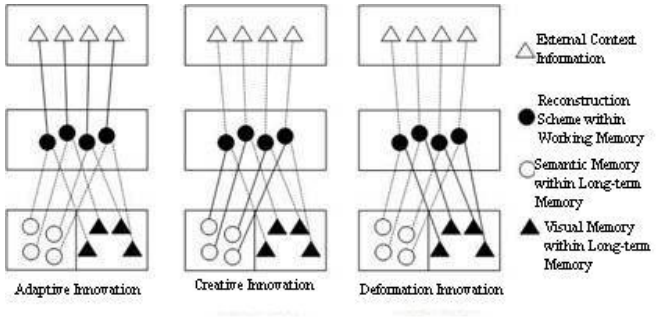


Fig. 2. Innovative forms of memory thinking

Adaptive innovation is dominated by situational information, taking the task characteristics and environmental factors in situation as the premise, forming the design scheme meeting conditions after extracting relevant knowledge from long-term memory and the experience combination. Creative innovation is dominated by semantics. Semantic memory has a large capacity and wide range, and the new feasible solution can be obtained by analyzing the concepts of different classifications. Deformation innovation is guided by visual memory, which is replaced, deformed into a new scheme by analyzing other similar or interlinked visual or spatial memory.

III. INTERACTIVE INTERFACE DESIGN METHOD BASED ON MEMORY THINKING

A. Interactive Interface Design Task Characteristics

Interactive interface design task is to solve the problem of communication with technology products stand on users' position. Acting as the starting point of design tasks, users are also the ultimate goal of design program. Therefore, user-related research is the primary feature of the design task. In the design, it mainly reflects in that user memory is used as the basis for understanding new design scheme, to improve the operational efficiency via latent memory [7]; secondly, in design tasks, as a kind of behavior process expressed by meaning, interaction needs the limited visual interface to understand and operate. This makes the visual information in interactive interface be able to express the corresponding behavior semantic information, as shown in "Fig. 3"; finally, the interface design task is to interact the interface based on the continuously emerging new functional architecture. Therefore, it is necessary to show the new operation mode through the design and innovation, and cultivate the operation habit of new function. But at the same time, the usual operation mode can not be completely broken away, resulting difficulties in learning operation. Design is an iterative process of innovation, to constantly update and improve the expression mode of new function.

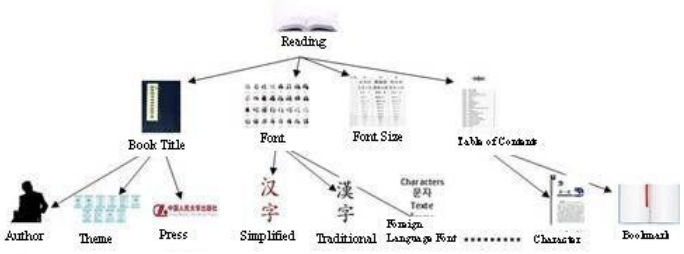


Fig. 3. The visual and semantic encoding

B. Interactive Interface Design Element Characteristics

The design elements of interactive interface can be decomposed into various parts related to the interactive interface that can be understood and described [8]. The process of interacting with the interface consists of graphic information elements, graphical interactive elements, and graphical feedback elements. Graphical information element is the characteristic rule of interface information display, such as the information expressed by the combination of shape, size, color and so on, which makes the interface language symbols beautiful and recognizable; graphic interactive elements include the dynamic interactive effort in the interaction process, such as the setting of time, distance, path, deformation, and speed of the interactive effect, which can show the more obvious visual attractiveness and functional explanatory power in the process of interface interaction, undertaking the interpretation role of function under limited interface; interactive feedback element is the prediction of changing state or changing trend after interaction. The interaction is no longer limited to the conventional visual channel. It is gradually extended to the non-conventional interactive channels such as eye movement recognition, body feeling control, consciousness control and other aspects. [9] Therefore, the interaction of multi-sensory channels needs to feedback on the interface, such as the sound curve, button status, operation page continuous convergence state and so on after language interaction. Through feedback on the operated behavior in interaction process, the user can have access to result information about this operation behavior [10].

C. Design Process Based on Memory Thinking

The interface design method based on memory thinking is the method to build optimization and innovate design scheme based on the design experience. The cycle design process from user situational analysis to program matching target situation is mainly divided into six design steps, as shown in "Fig. 4".

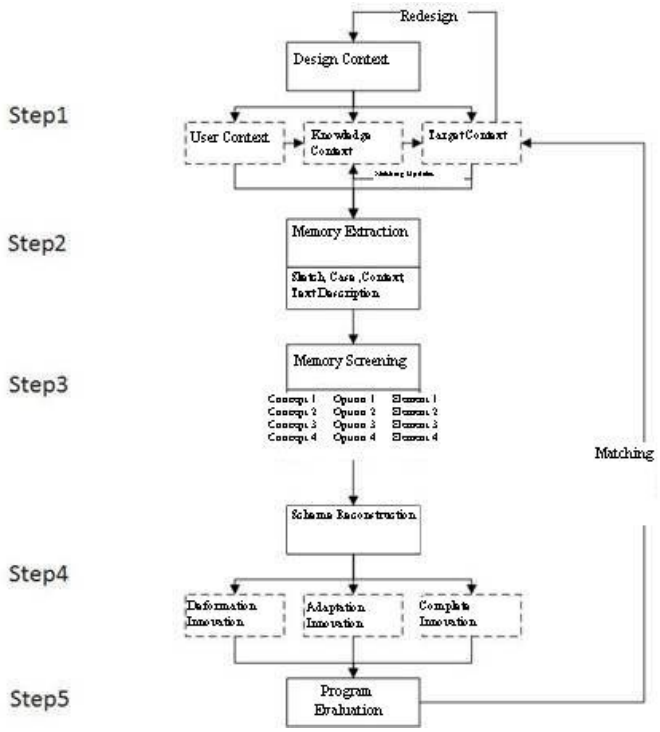


Fig. 4. The design process based on the memory thinking

Step1, Situational Analysis: Analyze the user needs, experiences and environment in the user context and summarizes the design task focus as well as the situational constraint conditions; combine with the design experience in knowledge context, such as the design skills, scheme and design tools to form the target situation. In the design process, make clear the design goals and the design elements contained in the objectives, to reduce the interference of irrelevant design elements and optimize the planning of design action.

Step2, Memory Extraction: Arouse the relevant sketches, similar cases in the visual memory, and the similar operational experience and behavior rules in semantic memory, to extract the similar design experience and cases as much as possible in accordance with design focus in the target context.

Step3, Memory Screening: Decompose the recalled memory content into interactive interface design elements step by step, determine the available reference elements by way of analyzing and comparing the elements or error test.

Step 4, Memory Reconstruction: Conduct the innovative application of the design elements taking one innovative way as the core or combining several innovative methods to form a new design scheme.

Step 5, Scheme Evaluation: Match the scheme with target, if it is in the expected matching range, then the scheme will be passed and update the design memory situation, if it does not match totally or in part, then design process shall be entered again, till it reaches the target context state and complete the design iteration.

IV. SMART WATCHES INTERFACE DESIGN PRACTICE BASED ON MEMORY THINKING

As the development of science and technology, intelligent equipment has gradually formed a huge system. New functions have been added to the smart watches on the basis of traditional watches, but at the same time, the wearing forms of traditional watches have been inherited, having the advantages of portable, compact and timely feedback. Apply smart watches into automobile interaction will improve user and automobile interaction integrity, to achieve real-time interactive control and traffic management. Taking the automobile networking function of smart watches as an example, design the interactive interface based on thinking memory design process.

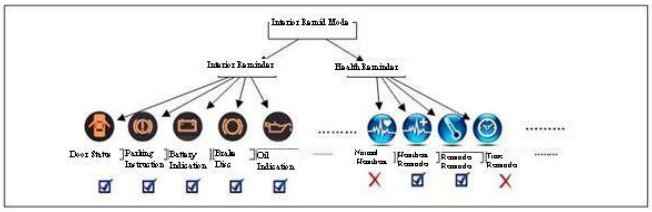
A. Design Context Analysis

First of all, analyze the user context in design context. The current automobile information interaction requirements in user context mainly reflect in such aspects as fuel consumption, in-car settings, navigation and positioning, and vehicle performance, with automotive display screen meeting these interactive needs; while smart watch is a portable interactive interface, so when interacting with new functions with the cars, it has such functions as body condition monitoring, remote interface operation, timely information reminder, remote vehicle positioning and so on. These functions did not appear in the user experience, so the new interactive functions of smart watches become the design focus. In the process of using, driving accounts for a lot of attention. Therefore, as for the in-car interactive interface design, the unnecessary information harassment needs to be reduced as much as possible.

In the designer's knowledge context, give priority to the interactive design tools and information presentation features of the smart watch, at the same time, combine the characteristics of in-car interaction cases. Finally, analyze and conclude that there are mainly two modes of interior and exterior car with target context as the interface. The functions of interior car mode includes abnormal situation reminding, personal driving conditions; exterior car mode refers to the automatic switching within a certain range from the car, including safety lock, interior temperature preset, parking point positioning.

B. Memory Thinking Application

In the stage of memory extraction and screening, form the extraction clue based on the interior and exterior modes in design context. The interface element extraction under interior car mode include relevant case sketch decomposition of car alerts and health alerts, as shown in “Fig. 5”; the interactive memory extracts the remind interaction memory under different contexts. The exterior mode extracts the relevant case experience in the same way.



Take the Similar Situation	Interaction Behavior	Behavioral Decomposition (Appearance)	Behavioral Decomposition (Feedback)	Match or not Target Context
Mobile Phone Prompt Interaction	Interface Reminder	Interface Information Pop Up	Click to Confirm	×
	Vibration Alert	Mobile Phone Vibration	Click the Screen / Button	×
	Voice Prompt	Voice Prompt	Click the Screen / Button	×
Interior Prompt Interaction	Interface Prompt	Interface Information	Reading...Troubleshooting	×
	Voice Prompt	Fault Voice	Troubleshooting	×
.....	.....	.....	.....	.....

Fig. 5. The visual and interactive elements in the car model

Analyze the extracted content in form of analytical contrast and error text, confirm that the interior available reference element is the abnormal prompt icon and the interactive mode is not applicable due to occupying large amount of attention. As for the interaction mode of security lock in interior mode, refer to the anti-theft security interaction measures such as the car key, the safe deposit box and the unlocking mode of mobile phone, and it does not match the target context after analyzing; the visual elements are similar in each situation interface, and suitable for the temperature preset and parking location, which have been widely used in various using contexts.

C. Scheme Formation

Conduct the scheme reconstruction on the basis of target context in accordance with reference elements after extraction and screening of memory thinking. Interior reminder mode is based on the deformative innovation, combining with either the adaptive innovation or creative innovation, apply the visual elements in the reminder, and conduct adaptive deformation design; it appears in the form of vibration reminder in the interactive design, and user feedback using gesture, with the design scheme reconstruction process as shown in "Fig. 6".

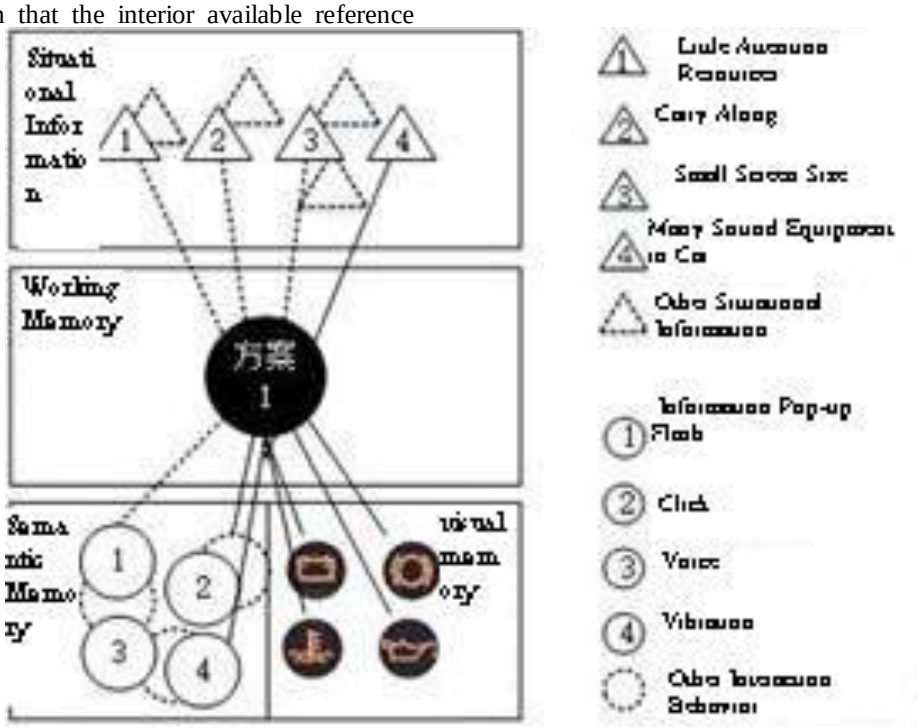


Fig. 6. The innovative application of reminding interface

The innovative design scheme reflects the interactive interface design prototype via the design software, as shown in "Fig. 7". The design elements and interactive methods of interior mode present in the most concise way, focusing on interactive feedback to achieve the purpose of reminder; the security lock under interior mode interacts through voice, with the screen specifying the security lock words, watch recognition voice completing security lock task, and conduct innovation according to the implicit interaction in the semantic memory, to design the interaction methods of applicable target; temperature setting conducts practice deformation innovation design on interactive behavior, improving interface operability; position interface extracts the design element of automobile interface, and conducts adaptive innovative design on watch interface shape, enabling the navigation information meaning to be received and recognized. Match the program prototype with the target context, and enter into the design process again if the interactive interface prototype does not reach the target context.

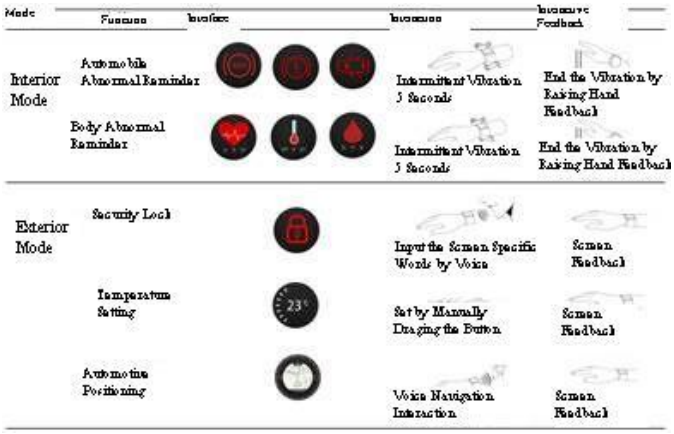


Fig. 7. The car interactive interface design prototype in smart Watch

V. CONCLUSION

The essence of memory thinking is the process of cognitive thinking to reuse the past experience. Experience is the key factor that affects the design work efficiency in the interaction interface design task. Form the good way for searching for the design experience using the storage rules of design experience, which can not only improve the efficiency of design experience extraction, but also can conduct the design innovation based on memory thinking reusing. This interactive interface design method has improved the design efficiency, which can also accelerate the enhancement of design ability after mastery of the design experience application law. However, this design method lacks the basis for judging the design elements, and the details of interface design task planning, which is the follow-up research direction of this method.

REFERENCES

[1] John S. Gero，Udo Kannengiesser.The situated function–behaviour–structure framework[J].Design Studies, 2004, 25: 373–391.

[2] VISWANATHAN V K, LINSEY J S .Physical models and design thinking: a study of functionality, novelty and variety of ideas [J]. Journal of Mechanical Design, 2012, 134(9): 091004-1-091004-13.

[3] Liao Yi,Yi Shuping, Li Faquan.Investigation onthe Cognitive Process of Design-type Knowledge Work Based on Knowledge Activity Ⅰ Elements[J].Science & Technology Progress and Policy .2014,31(15):133-138.

[4] Atkinson, R.C,& Shiffrin, R.M. Human memory: A proposed system and its control processes. The Psychology of Learning and Motivation: Advances in Research and Theory[M]. New York: Academic Pres. 1968 .

[5] Galotti, K.M. Cognitive Psychology: In and Out of the Laboratory (5th Edition) [M].Beijing: China Machine Press, 2016.

[6] Chen-Chaocui.Design Cognition -- Cognitive Science in design[M]. Beijing: Chinese Building Industry Press, 2008.

[7] LIU Bai-song, XIN Xiang-yang, LIU Yuan. Subconscious Interaction Design Methods Based on Theory of Neuropsychology [J] .Packging Engineering, 2016, 5 (37): 70-74.

[8] TAN Hao, LI Wei, Wu Yong-meng. Research and application of Interaction Features in Design [J]. Journal of Hunan University (Social Sciences), 2015, 3 (29):156-159.

[9] LI Tie-meng, HOU Wen-jun, CHEN Dong-qing. Control Sense in Interaction Design of Mobile Internet Product [J]. Journal of Beijing University of Posts and Telecommunications (Social Sciences Edition), 2014, 6 (16): 7-11.

[10] YANG Mao-lin.Interaction Design Process Based on Intelligence Solution [J]. Packging Engineering, 2015, 6 (36): 83-86.