A Discovery on Creativity Delivery Tools–From the Needs of Hybrid–Using 3D Modeling Software

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ABSTRACT

Hybrid using 3D model-building software is a popular situation in product design to delivery creative ideas. Less research on challenges and expected functions in hybrid-use modeling software triggers this study which aims to gather an in-depth understanding of the hybrid-use modeling software user experience. Semi-structured interviews were used to report the using experience. The paper analyses the interview from intelligence, expected function, hybrid using experience, and expected software. It shows that participants expect automatically saving and recording process functions. Also, the traditional modeling building software has high developing potential on shortcut key plug-in. Suggestions were promoted to make more effective modeling software. This research is a former step to inspire thinking on how to improve the collaboration among different 3D modeling software.

Keywords: Creative idea, Product modeling, User behaviour

INTRODUCTION

Product design is important comportment that could make life better because it is the channel that transfers technology into application. During the design process, how to express creative ideas in mind will partly decide if the public or particular people could accept the transfer. There are various tools or method which could express the idea by visualizing like Computer-Aided Design (CAD), Solidworks, Rhino, Photoshop, Adobe Illustrator, and Sketch. Not only professional software, but some easy operation tools could also be accessed through the internet like Tinkercad. One thing interesting is that the tools could be classified based on the dimension they could express and thus divided into three groups: 2D software, 3D software, and 2D and 3D software. From the existing research, it could be found that compared with 2D software, the number of 3D software is limited. For product design, the main software is usually CAD, Solidworks, and Rhino.

However, 3D model building is an important idea-expression element in product design because the following reasons: Firstly, the 3D model could not be replaced by the 2D model because of a more direct expression of a product (Vlah & Roman, 2020) and provide more structure information (Zhang et al., 2020). In other words, the 3D model is a preview about the prototype, with the help of the 3D model, designers could have a more precise impression

about the prototype's outlook (Vah & Urbas, 2021). Secondly, the 3D model is the pre-step of mass productivity. In addition, the 3D model information is easier to be changed by changing some indexes.

Therefore, the importance of 3D modeling triggers more research on how to make the software express ideas more effectively. Some research has paid attention to developing new modeling software based on new technologies like Brain-controlled 3D modeling (Shankar & Rai, 2014) and VR 3D modeling (Gravity sketch). However, the software still meets some challenges. As for the Brain-controlled modeling, although it contributes to discovering the new modeling building approach, it has a low learning curve, lower users' adaptability to the interface, and hard to detect more than two commands more than once (Shankar & Rai, 2014). As for the Gravity Sketch, which is hand-controlled modeling and shows the results through VR, it also has some limitations. Although it allows people to draw what they like through VR, long-term VR usage will bring dizzy. VR needs people to use hand control, which easies for some people. However, some people still consider the keyboard and mouse as a tool to help them improve their poor drawing ability, which could not be achieved by hand control. Although there are some new 3D modeling ways mentioned, not all people could accept a new method even if they know the new method could improve their efficiency because people tend to use the method that they are familiar with.

Some people try to improve efficiency by improving the efficiency of existing software. However, although existing 3D modeling software has been improved, the target application of those improved 3D modeling software is on geography (Wu et al., 2005; Heo et al., 2013), and the improvement is more focused on algorithms (Han et al., 2021). Also, some improvement is focused on 3D printing - the outcome of the 3D modeling. There is limited 3D design modeling because although 3D modeling could visualize the 2D, the model has less design function in design than in other areas (Boeykens et al., 2008). Also, the 3D software in the design are always in a hybrid using (Boeykens et al., 2008), and it is hard to test one software.

Therefore, the present paper tends to detect the challenge in using hybrid 3D modeling software, the need for using the hybrid 3D modeling software. Therefore, through the study, developers could promote targeted interventions to improve the efficiency of the existing 3D modeling software and in this way, the creative ideas can be expressed effectively.

METHOD

To address these gaps from the literature and achieve the aim of our study, we used a semi-structured interview to collect information in the following aspects: the hybrid 3D modeling software using experience, challenge, and opportunities in using the software; expected functions and expected software.

Participants

The research recruited 25 participants (10 male and 15 females; age 19-29). The eligible participants need to have a product or industrial

design background; can use Solidworks and Rhino; have experienced in using both of the software more than two years; have experienced in designing more than 5 products with the help of the two software together; no more than one month since the last design task; be Chinese and fluent in Chinese; and be willing to complete the semi-structured interview.

In the 25 participants, 9 people with the background of industrial design while 16 people with the product design. However, both of the two kinds of background involve the same design; the selected two software using and software using experience. Therefore, the different background is not considered as a factor which could trigger difference. 1 participant has using the two software for more than 5 years; 2 people used it for 3 to 5 years; 22 participants have used the software for 2 years. As for the amount of the products they have designed; if they have designed more than 5 products with the co-help of two sorts of software and if they have done some design task during the last month, all of the participants admit that they obtain the requirement, but they could not promote the exact number of products they have designed.

The reason for taking Solidworks and Rhino as the example of hybrid 3D modeling software is that this is two sorts of software that are more easy and common to access and teach in the target people.

Method

In the study, semi-structured interviews were used to collect information in the following aspects: the hybrid 3D modeling software using experience, challenge, and opportunities in using the software, expected functions, and expected software. Interviews instead of observation were used because although the observation method could provide more real-time information, a 3D modeling process always needs long-term preparation. Also, the situation that a designer needs to use both of the software is usually in a complex design (like designing a car), which will also take a long time. Therefore, out of the time-consuming condition, we give up using observation. Instead, we use the semi-structured interview. However, the use of a semi-structured interview relies on the participants recalling, which will bring some memory bias.

Material

In terms of material, a computer that could run Solidworks and Rhino with a Windows system and a computer which could run Solidworks and Rhino with the IOS system was used to help people recall their memory. The recorder was used to record the interview.

Protocol

Before the study, participants filled a basic information collecting questionnaire to see if they satisfy the participants' requirements. Then, if they satisfied the requirement, the information sheet was given to participants, and participants signed the consent form. The semi-structured interview included five aspects: the hybrid 3D modeling software using experience; challenge

and opportunities in using the software, expected functions, and expected software to have a better understanding of the hybrid 3D modeling software using condition. The interview was recorded by recorder. Participants are voluntary in the research.

Analyzing

The 25 recorded were in Chinese as it was the participants' language and allowed them to express themselves better. These recordings are transcribed into Chinese. Thematic analysis was applied to the Chinese transcripts to ensure the capture of the interview. Then the themes were translated into English together with the quotes reported in this thesis. NVivo is used to code. The themes are summarized in deductive reasoning. There are 13 primary codes. Then, the 13 primary codes are summarized as 6 secondary themes. There are 4 general dimensions summarized: Intelligentialization, Expected function, Hybrid using experience, Expected software.

RESULTS

This research tries to summarize the results from the semi-structured interview. All analysis is trying to detect the experience, challenge, and expectation in using the hybrid 3D modeling software. In this section, the explanation will be expanded from 4 aspects: Intelligentialization, Expected function, Hybrid using experience, Expected software.

Intelligentialize

One challenge in using the hybrid 3D modeling software is that they are not so smart. One reason is the low error-tolerant rate. P27 (the letter "P" followed by a "number" to associate the reports with the study participants) mentioned that "I know Solidworks could show where you are wrong, but you know it is stupid. The common condition is that when I delete or change a step, then there is a sound 'Duang' and a lot of red cross apparent."P3 added that "Rhino also has some wrong suggestion, but it allows you to build whatever you want even it is a wrong face. It has a high error-tolerant rate. It is fine in the model building process, but if you want to make it into a real prototype, the model with the wrong face will face some difficulties. P18 suggested, "It is a better thing if the software could be smarter. To be specific, for example, I hope the software could refine the wrong structure and face automatically. Both of the software, I mean." P15 added that "Now the update of the software is mainly on update or add functions. But you know more function or new interface do not mean intelligence." Another correct function is mentioned by P5 "I hope the small gap between two faces could be connected (by Rhino) automatically. Sometimes the reason I could not build another face based on the existing building model is that the existing face is not connected. There is a very small gap that could not be seen by my eyes unless I enlarge more than 1000 times."

In conclusion, the reasons people think the hybrid software is not intelligentialize are in the following three aspects: low error-tolerant rate, automatically correct, function improvement not equal to intelligence.

Expected Functions

The expected functions are divided into two parts. One is about automatic functions, the other is about renderer. The former includes three kinds of automatic functions: saving, process memory, and explosive view. P9 mentioned that "When I use the software, it always generates crash. It is really an annoying thing especially for me. I always remember to save when there is some crash." P16 explained that "Rhino is better, because no matter if it could remember the step of my building process. It could automatically save. Solidworks is a horrible and only choice for me. It could not save automatically, and to make things worse, it has a higher crashing rate." P14 has a detailed explanation about Rhino "Rhino actually could automatically save, but it could not remember the step of the building. So, I just use Rhino to build some complex surface and transfer it into Solidworks. "P19, therefore, concluded that "I usually use Solidworks as the main modeling building software and use Rhino as an additional software which could help me build some surface. Save? Just remember to use control and S to save. I have no other choice."

Therefore, it could be seen that both of the software could not have the function in both the memory process and automatically saving. However, compared with automatically saving, the memory process is a more important thing for designers.

Another need for the automatic function is automatically generating an explosive view. However, this need is not as much as the former two automatically needs. P10 mentioned that "Most of my model will come into the industrial and thus I need explosive view. But in a big design, there are hundreds of parts. I could only make the explosive view one by one it is not a happy experience." But P23 refuted that "The explosive view is a problem, but I do not think it is a serious problem. As a student, I do not think we will have many chances to use the explosive view. But we need to make different parts of the model separate in a whole model. After all, the Keyshot (an external renderer) asked as to separate in a whole model to make the different parts have different colors." Based on the renderer, P2 added, "I use an external renderer to render the model. I know the software could do this kind of thing, but it does not work as well as external software. It is a controversial thing, I mean I know the separate renderer will have a better efficiency but I still hope the renderer could be involved and better works in the modeling software."

Hybrid Using Experience

There are two main challenges in hybrid using. The first one is no uniform keyboard shortcuts. P8 mentioned that "This is a common problem I think. I know most of my colleagues meet this problem. The two software has a different shortcut key." P11 added that "If the shortcut key is completely different, it will be easier, but in fact, they have some in common and some different." The implication to deal with the problem is mentioned by P20 "The only measure I know is remembering, and I think the condition will be better after practicing." P16 added another measure "Learn from wrong.

When you draw a line and use the wrong command to delete it, you will know you use the wrong command." However, P18 mentioned, "I do not think there is any measurement. I have used both of the software for two years, but I still could not familiar with the difference. Maybe I need more time. I hope time could solve the problem" Therefore, P25 suggested that "I hope the command could be same or there could have a plug-in to make it the same."

Another challenge is that the two software is complementation. This complementation is divided into the following two parts. Firstly, the complementation is in the surface building. Mainly, participants will select one kind of software as the main software and the other as an additional one. The ways to select could be divided into three: P 13 mentioned that "I will judge before I build a product. If it contains a lot of bend surface, I will choose Rhino as the main software, but if it is a regular shape, I will use Solidworks."P17 has a different way to select the main software "I always use Solidworks as the software to build the model and if there are some parts hard to be built in Solidworks, I will change to Rhino." P6 added that "As my teacher said, a smart designer needs to use multiple software together and use different software to do different things."The third method is a balance between the other two. P14 mentioned, "I mainly use Solidworks but you know, if the surface is really complex, I will use Rhino."

The secondary complementation is in 3D printing. P1 mentioned that "When a product needs to be printing, I will use Solidworks. Because it could make sure what you make could be print." P24 added, "Rhino will build face instead of a stereoscopic. If I forget to make a face to a stereoscopic, it could not be print. I do not want to have this problem. So directly use Solidworks." However, P17 promoted that "I like to use Rhino. If I need 3D printing, the printing software will tell me some parts could not print, then I could correct it. It is an easier way for me." P22 has another view that "I like to use Solidworks as a checking software."

Expected Software

What participants expected is one software that could combine the two existing software's functions. P4 mentioned that "I hope there could be a software that could record the model building process and build surface. Unfortunately, no software satisfy my expectations." P12 added, "Although it is fine for me to use two sorts of software, but you know one is better than two." P21 mentioned that "Maybe the two is because of the market needs? Or technology? I am not sure but if there is one software which could combine the benefit of the two software I would like to try it. Using two software together is not a comfortable experience."

DISCUSSION

In this study, participants complete a semi-structured interview to provide a depth understanding of their experience in using hybrid 3D modeling software. In this way, we summarize the challenges in using the hybrid 3D modeling

software and expected function. In this discussion, it first promotes some suggestion on hybrid 3D modeling software and then summarizes the research limitation.

The Suggestion of the Hybrid 3D Modeling Software

There are two main suggestions for the hybrid 3D modeling software. If the hybrid 3D modeling software could not be combined into one software, then the suggestion is that there is a shortcut key plug-in needed. The plug-in should adapt to both of the 3D modeling software and make the shortcut key same in the hybrid software as P4 mentioned, "I hope the shortcut key could be the same in two software. Maybe it could be achieved by a plug-in and seems like a mini-program. You know what I mean. It is not independent software."

On the other hand, the switcher between hybrid software needs to be considered and have a more convenient way. P13 mentioned that "Now, the Rhino and Solidworks could not transfer between and recognize each other. I use 'stp' format as the main way to transfer." P20 added another transfer format "I use 'igs' but I know most of my friends use 'stp'." Therefore, P7 promoted a suggestion that "I hope there is some plug-in in Rhino and Solidworks to open each other. Maybe the developer could see what Keyshot has done."

Another suggestion is independent, smart software. This smart software should combine the benefits of the hybrid 3D modeling software, which mainly involves automatically saving, building hook face easily, process record, and automatically refine wrong faces. However, this new software may be hard to be achieved like P19 mentioned "I hope this is smart software, but the thing is now technology is developing. More and more new methods have become an impact on traditional software. Just for me, I know there are VR used to build a model. It is better than the one we have." P25 added, "You spend much time on developing or maybe improving the existing software, and when you develop it, new technology has replaced the traditional technology. It is not a worthy thing."

Limitation and Future Research

The present paper still has some limitations which reduce the efficiency of the research. One of the limitations is representative. On the one hand, the samples are not representative. To simplify the research, the participants are all Chinese students. However, Chinese students are not the only user group. In the future, more positions and cultures need to be considered. In addition, the software we selected is Solidworks and Rhino. However, it is not the only software that people could use. Therefore, in the future, more hybrid software should be considered.

The other limitation is that the semi-structured interview answers are mainly about the user experience in separate use of modeling building software, and the challenges and expected functions are mainly based on the separate user experience. In the future, the interview should focus more on the user experience of a hybrid using. Also, some more research methods may be considered, like observation.

CONCLUSION

The paper identified some challenges and expected functions in hybrid using modeling building software through semi-structured interviews. In particular, (i) it shows that two main functions that participants want are automatically saving and recording process; (ii) the traditional modeling building software although was impacted by new technologies, it still has high developing potential on shortcut key plug-in and a smarter modeling building software; (iii) hybrid using modeling software is a normal operation on 3D building process and how to switch between hybrid software is worthy of detecting. Finally, the study proposed some software developing suggestions to make the modeling software more effective. This study is expected to be a former step to help creative ideas expressed more effectively.

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