Iconographical Virtual Polyhedrons for Constructing Graphical User Interface

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Abstract

There are many applic ations that require a large number of icons on their user interface. Such applications share the same problem: the icons use up too much screen space. As a solution to this problem, we propose a new concept: the use of Iconographical Virtual Polyhedrons (in short we refer to them as "IV-polyhedron(s)"), which are polyhedrons created in 3D virtual space, with the usual 2D icons being mapped onto their polygonal faces. Users are enabled to rotate the IV-polyhedron in virtual space and select one of the icons mapped on it. Such IV-polyhedrons have proved to be efficient for saving screen space and increasing the enjoyment of using the graphical user interface.

1.Introduction

We have worked on developing an application to help Japanese students learn Chinese pronunciation [1]. We used 2D illustrations of sections of the human head showing relative positions of the tongue, lips, and teeth [3]. Here, we encountered large numbers of icons. There are six vowels and 21 consonants in Chinese. Usually one begins learning Chinese by learning these basic vowels and consonants first and then learning the pronunciation of each individual syllable. Each syllable has a sound that is a combination of the basic vowels and consonants. There are over 400 different phonetic syllables (pronunciations) in Chinese.

In the beginning, we designed an interface like the one in Fig.1. There were six icons for the vowels and 21 icons for the consonants. To input a syllable (pronunciation) like "jia (home)", the user has to select three icons, first the icon "j" then the icon "i", and finally the icon "a". There are 15 percent of Chinese syllables that can be inputted by selecting a single icon. In the other 85 percent, the users have to select icons multiple times. Such an interface is cluttered and makes the users confused. It is also much easier to make mistakes

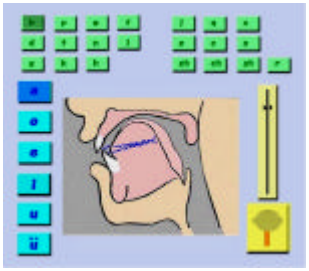

Fig.1

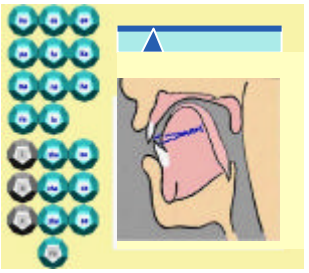

Fig.2

Fig.1 An interface with traditionally used icons
Fig.2 An interface with IV-polyhedrons

Consequently, we tried to represent the most frequently used pronunciations with icons, so that 50% of the Chinese pronunciations could be realized by selecting a single icon. The resulting out comes a screen filled up with many tiny icons and no space is left to display graphical illustrators. Raskin in his book "The Humane Interface [2]" described an icon as follows: From many studies, we can conclude that icons are most effective when at most a dozen of them are seen at one time. In addition, it is essential that they are visually distinct, doing a good job of representing the appropriate concept, and are presented in a reasonably large size, typically larger than a text label would be.

In the event of having to use dozens of icons as well as displaying these icons in a large size, the main

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problem with existing techniques becomes evident. To solve this problem, we propose the use of Iconographical Virtual Polyhedrons (IV-polyhedrons in short). As shown in Fig. 3, the IV-polyhedrons are made using 3D computer graphics techniques. An IV-polyhedron is a 3D object in the form of a Platonic solid or semi-regular polyhedron, and has the commonly used 2D icons (patterns or commands) mapped on its polygonal faces.

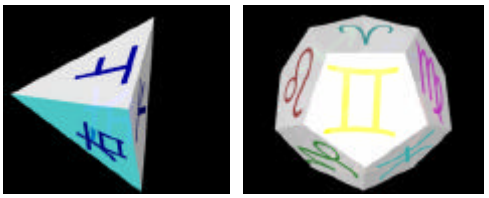

Fig.3 Examples of iconographical virtual polyhedrons

Users are able to turn the IV-polyhedron around in 3D virtual space to see every icon mapped on it, and to select one of them. When using a graphical inputting device such as a mouse, the users can click on an IV-polyhedron with the left button on the mouse. To rotate the polyhedron, hold down the left button while dragging the IV-polyhedron. Then the user can select one of the icons mapped on the polyhedron with the right button. If the user double clicks on an IV-polyhedron, the polyhedron will unfold an animation that shows all the icons mapped on the polyhedron simultaneously.

By using IV-polyhedrons, the user interface for the application teaching Chinese pronunciation was changed to the new design shown in Fig. 2. The same numbers of icons in our second plan are mapped on 21 IV-polyhedrons in the form of a dodecahedron. By using IV-polyhedrons, in the space one icon would occupy, we can set multiple icons.

2. Application with using IV-polyhedrons

As an application of IV-polyhedrons' use in human interface, we developed software for teaching math to children of ages 3 to 4 years old. The prototype of the software was written in C and OpenGL. It runs on Dell Power PC with Windows XP. The software is going to provide a way for children to learn simple addition and subtraction equations while having fun. It includes two games: one with an interface as shown in Fig. 4-(left), used for kids learning the order of numbers, and another with an interface as shown Fig.4-(right), which is for kids learning simple equations.

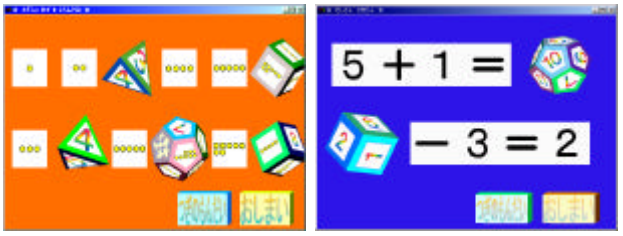

Fig.4 Applications with using iconographical virtual polyhedrons

3. Conclusion

Obviously, IV-polyhedrons are significant for saving screen space when the user interface contains a lot of icons. Furthermore, In terms of making it possible to show icons in a large size, IV-polyhedrons are remarkable. When using a display (screen) limited in size, such as a pocket PC, IV-polyhedrons provide a solution to the problem of limited space for a user interface. When using IV-polyhedrons, interface designers are able to classify icons into groups according to the functions or meanings behind the icons.

Reference

1. Y.Hoshino, Q.Guo, K.Takayuki, S.Yumiko,K.Kazumasa, Teaching Chinese Pronunciation through Applying Computer Graphics, in the Proceedings of 5th World Multi-conference on Systems, Cybernetics and Informatics (SCI2001), Vol. XVI, pp. 18-22, July 22-25, Orlando, 2001.
2. J. Raskin, The Human Interface-New Directions for Designing Interactive Systems, Addison Wesley, 2000.
3. E. Ueno, New Chinese, NHK, 2001 (in Japanese).