New type of auditory progress bar: exploration, design and evaluation

In this paper, we focus on exploring new type of auditory progress bar and proposing new sound design model. We generate possible types of visual progress bar by recomposing their characteristics and then the context of auditory application is taken into consideration for the implementation of auditory progress bar.

<Method>

We explore the progress bar by analyzing its mode of usage; the visual progress bar can be analyzed by its external and internal characteristics: the form of the progress bar and the conveyed information. Three categories of form are classified: (1)The monotony and non-monotony bars (2)The continuous and discreet bars (3)The gradual and non-gradual bars; Besides, four kinds of information conveyed by progress bar are (1) the process (2) the value of the transmitted task (3)the change of status (4) the variation of the evolution. A cross table with these two characteristics of the progress bar is used to generate possible progress bar. To be noted, we found that the characteristic of non-monotone is an important factor in generating new types of progress bar. Unlike those conventional progress bars who act in a fixed direction to present the progress, the non-monotony progress bar whose status acts back and forth can be manipulated by user due to the characteristic of the task.

<Application>

To implement the auditory progress bar, six factors concerning the context of environment, the task type and the condition of vision are taken into consideration to choose prospective application. Different from the auditory progress bar in the study of Brewster, we aim to implement an auditory progress bar without visual feedback. In the categories of applications for non-monotony progress bar, the prospective application is found in the electronic compass. To be explained, in the electronic compass, it provides the forward/reverse mode of bearing to trace the orientation of the target; that is, we perceive the relative bearing between user and the target instead of knowing exact bearing of the current position. Thus, the process of finding the target in such specific scenario can be regarded as the non-monotony progress bar indicating the progress of searching. Moreover, the status of the progress in this task is manipulated by users according to the process of searching.

<Sound Design>

The sound design of the auditory progress bar focused on generating different progress sounds to express the function of scope in indicating the progress of the ongoing task. First, a formula is generated by the warm/cold metaphor to create the sense of progress. This formula is generated according to the relative bearing between the target and the user in the range of 360 degrees. The results of the formula are used as the duration to generate sound signals. Secondly, different durations of the silent pauses are joined with the sound signals to create four different series of progress sound. To feature the function of scope in the progress sound, we design a two-layer progress sound. The first layer of progress sound is the continuous sound composed by 4 music notes to express the wide range of progress. The second layer of the progress sound is the discontinuous sound generated by the formula to indicate the progress in details. The property of polarity (increasing/decreasing) in volume is also used to augment the auditory effect on the progress in each layer. Moreover, we use the stereo sound to express the variation of the progress especially when the progress decreases.

<Pilot Study& results>

A prototype of the interface of electronic compass is simulated in Macromedia Flash 8. Tasks of finding targets were executed via the headset on the portable computer with four versions of auditory progress bar; a pilot study was done with 14 subjects.

Form the results of the executed tasks and opinions of subjects, we found that the performance of auditory progress bars with increasing volume and duration is better than those with decreasing ones, which people are used to the warm/cold metaphor. While subjects can finish tasks by perceiving the progress sound, the performance of the two-layer progress sound is not as well as expected when expressing two auditory messages in parallel. This is because of their personal preferences in the priority of detecting and ignoring auditory stimuli. Thus, it caused that subjects choose one dominating factors to perceive the progress and screen those redundant auditory messages. In the process of finding targets, the increasing volume and continuous sound convey more clear messages of progress when users act in a monotony way; the increasing duration and discontinuous sound help users easier to detect the variation of the progress during the non-monotony operating behavior.