

Overview of Auditory Representations in Human-Machine Interfaces

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In recent years, a large number of research projects have focused on the use of auditory representations in a broadened scope of application scenarios. Results in such projects have shown that auditory elements can effectively complement other modalities not only in the traditional desktop computer environment, but also in virtual and augmented reality, mobile platforms, and other kinds of novel computing environments. The successful use of auditory representations in this growing number of application scenarios has in turn prompted researchers to rediscover the more basic auditory representations and extend them in various directions. The goal of this paper is to survey both classical auditory representations (e.g., auditory icons and earcons) and those auditory representations that have been created as extensions to earlier approaches, including speech-based sounds (e.g., spearcons and spindex representations) emotionally grounded sounds (e.g., auditory emoticons and spemoticons) and various other sound types used to provide sonifications in practical scenarios. The paper concludes by outlining the latest trends in auditory interface design, and providing examples of these trends.

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1. INTRODUCTION

Recently, a large number of research projects have focused on the use of auditory representations in a broadened scope of application scenarios. This is in part due to the fact that modern technological developments are creating applications in which the use of sound is expected to have a more central role than before. However, the novelty of many application scenarios is also forcing researchers and developers to take into consideration theoretical aspects which had not previously formed an integral part of auditory interface design theory.

For example, the growing prevalence of virtual reality environments – which were much less accessible when the theoretical foundations of auditory interfaces were

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