Chapter 2.11
Designing a Ubiquitous Audio–Based Memory Aid

Shwetak N. Patel
Georgia Institute of Technology, USA

Khai N. Truong
University of Toronto, Canada

Gillian R. Hayes
Georgia Institute of Technology, USA

Giovanni Iachello
Georgia Institute of Technology, USA

Julie A. Kientz
Georgia Institute of Technology, USA

Gregory D. Abowd
Georgia Institute of Technology, USA

ABSTRACT

The ephemeral nature of sound can be problematic when people cannot recall something they heard. Motivated by everyday conversational break-downs, a continuous, near-term audio buffering application named the Personal Audio Loop was designed to recover audio content from the recent past using the mobile phone platform. The investi-gation of the potential usefulness in everyday life, the level of ubiquity and usability required of the service, and the social and legal considerations for long-term adoption is presented. The methods used include a controlled laboratory study, in-situ diary and event-contingent experience sampling studies, examination of legislation, and deploy-ment of the technology over several weeks.

INTRODUCTION

Everyday conversations fill our lives and we are all very familiar with the kinds of breakdowns suggested by these simple scenarios:

- You are in a conversation with a friend and one of you is interrupted. When the conversation resumes, neither of you remembers what you were talking about.
- You are at a social event and you are introduced to someone new. Minutes later, you have forgotten the person's name.

Current mobile phone technologies have the potential to preserve audio to enable people to recover needed information in many similar situations. Thus, the Personal Audio Loop (PAL) is the product of a multi-year design and research project focused on developing such capabilities. PAL is an automatic, audio-based memory aid that relies on audio capture technologies and the remarkable human ability to recover information quickly with only a few bursts of the audio from that memory.

PAL represents a significant case study for the design of new mobile and ubiquitous technologies. PAL is exceptional in its design and in its use because it required emerging technologies and unique usage models. Additionally, it is a personal technology that makes use of public information: the audio in the environment within earshot of an individual. In this chapter, the innovations required for this design case are explored. A mixed technological and human-centered approach was necessary to produce a near-term audio service that could survive research in the natural environment of people's everyday lives.

The design process addressed multiple questions of technical and human significance:

- **Usefulness:** Though motivated by observations from everyday life, how often and in what situations do people actually need a near-term audio memory aid?
- **Ubiquity:** What parameters of this service would make it available every place and every time it is needed?
- **Usability:** How should the service deliver functionality to maximize its benefit and minimize its distraction?
- **Social and legal considerations:** What aspects of society may influence the uses and cultural practices surrounding an audio recording application for everyday life?

PAL and technologies like it are becoming increasingly common, but at the time of its inception, the design was arguably outside the realm of a typical person's experience. Therefore, two essential requirements of the design process were to allow potential users to interact with a working prototype to have a sense of the capabilities and to answer engineering questions, including important architectural considerations.

From a technical perspective, there are several options for designing an audio-based memory aid to provide the required capabilities. All of the designs considered during this process reflected the same basic notion of replaying a buffer of recently recorded audio, but early prototypes varied in terms of the nature of recording and playback capabilities. A fully distributed system assumes an environment equipped with microphones, speakers, and interface controls to maximize opportunities for recording and playback wherever and whenever needed. A fully localized solution provides recording and playback in an all-in-one package carried wherever needed. A hybrid solution might delegate the recording in the environment and use a handheld device that receives streamed audio from a central repository for playback.

The complete design process for the Personal Audio Loop, a solution for an audio-based near term memory aid that addresses the technical concerns of an interesting capture and access application and answers questions from the four

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