

Sound Cues in Geographic Representation

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Sound Categories

Several project types were considered for their use of sound in presenting geographic information: online maps, desktop geographic information systems, personal navigational aids, and live demonstrations. The projects, while diverse, applied acoustic cues that can be classified under four main headings, according to their perception by the listener (Figure 1):

- **Ambient**—includes repetitive or monotonous sounds that comprise the “background” of the sonic environment. Ambient sounds can indicate general place in terms of physical environment, culture, region, time period, and mood. Examples include waves breaking on a beach, muted conversation in a particular language, vocalizations of endemic animal species, and a scratchy phonograph recording of swing music.
- **Signal**—includes sounds that draw attention. The distinction between “ambient” and “signal” cues is contextual and depends upon the listener’s perception. For example, gunfire functions as a “signal” cue when superimposed upon a background of crickets chirping, while the same sound might fall under the “ambient” category in the midst of other sounds of warfare.
- **Narrative**—a sub-category of “signal”; includes spoken language. Communication of literal content, verbalized in words, is the primary reason for using narrative cues, yet aspects such as language and accent may convey additional information. Examples include a news broadcast, a recited poem, and commentary on a soccer game.
- **Abstract**—includes non-realistic sound. Abstract sounds are often used to represent non-acoustic data values through modulation of one or more sound properties such as pitch, volume, and timbre. For example, within a map of classified land uses, a tone of varying volume might represent uncertainty, the tone growing louder as uncertainty increases.

Discussion

As the use of sound in geographic applications increases, theory developed in other disciplines may inform the design of these applications. Caquard et al. (2008) illustrates how ideas developed in film theory and video game design can inform uses of sound in cybercartography. Many of the projects surveyed fall within the domain of cybercartography, which Caquard et al. (2005) confirms is one area of geography that is increasingly adopting sound for representation. Krygier (1994) draws an analogy between “visual variables”, for example, color and texture, and “sound variables”, for example, pitch and timbre. Cognitive aspects of sound perception as well as cultural associations with different kinds of sounds are central to the design of any applications relying upon sound to convey information. The fields of music psychology, psychoacoustics, ethnomusicology, and acoustic ecology may provide additional theory to inform the use and design of sound in geographic applications.

Conclusion and Future Extension

This survey investigated how existing software, research, Internet projects, and live demonstrations use sound in the representation of geographic information. The projects considered here were necessarily biased towards those described in geography literature and not-for-profit Internet websites; commercial devices, such as in-car navigation systems, represent another large area of application to be explored. Questions to extend this research include:

- What types of geographic information can sound convey?
- How does information perception change based on the context in which the sound is presented?
- What cultural or individual characteristics influence how the sound is perceived?
- What limits an individual’s ability to detect information in sound, and how might training be designed to overcome limitations?
- In what applications might sound convey geographic information more effectively than imagery, alone?

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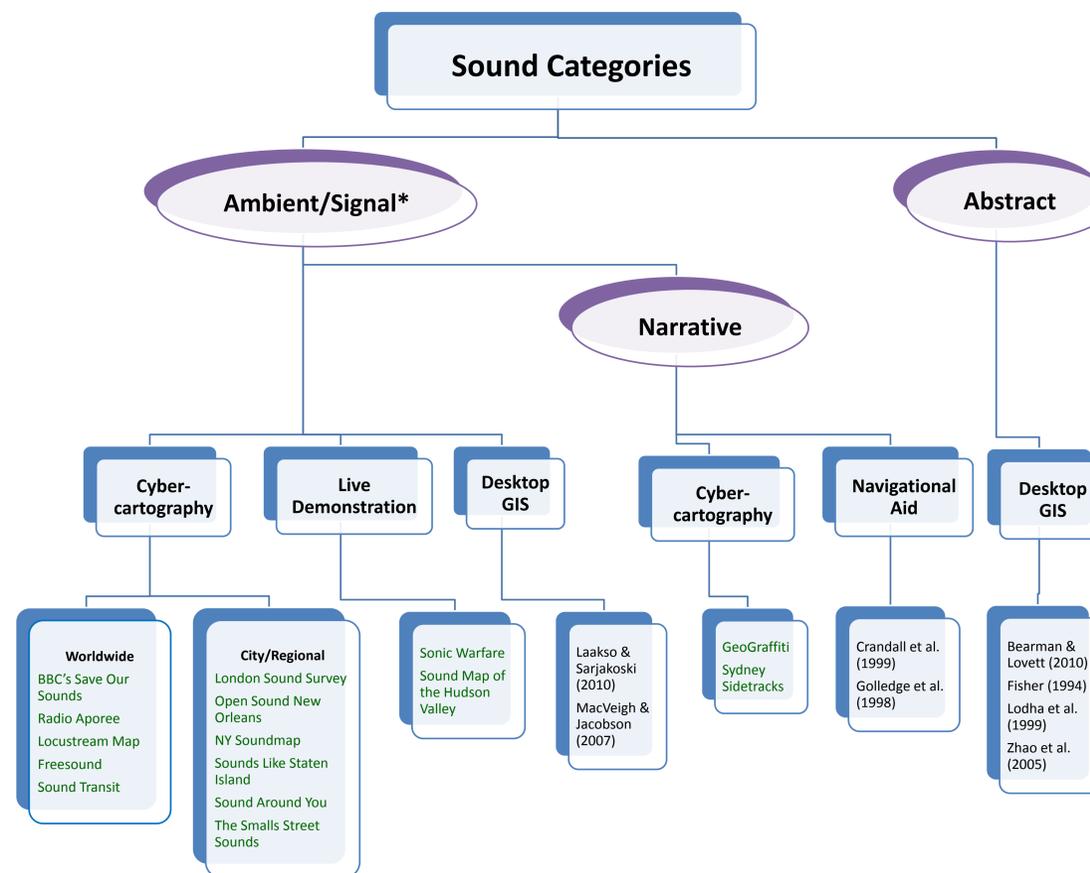


Figure 1. Classification of projects according to the sound cues used to represent geographic information. Internet resources are indicated in green.

*Distinction between “ambient” and “signal” depends upon context and listener’s perception.

Introduction

How is sound used in geographic representation? This question initiated the present research, a preliminary investigation into the broader topic of sound and its relationship to geography. Pocock (1989) contends that the dominance of vision over hearing has caused sound to be neglected in geographic study. The historic primacy of the map as the preferred geographic information product reflects this bias, though cultural reliance on visual maps is not universal (Chatwin 1987). By facilitating the creation, recording, playback and integration of sound with visual imagery, digital technology has expanded the possibilities for using sound to represent and carry geographic information through deliberately constructed products. Sound is integral to most individuals’ daily lives as a source of information, whether internalized consciously or unconsciously. In addition, visual means of gathering information are sometimes difficult or impossible due to physical impairment or the nature of a task that keeps vision otherwise occupied. The present study surveyed existing software, websites, research, and descriptions of live demonstrations that deliberately use sound to convey information in a geographic context. Four main categories are proposed to describe the nature of the sound used in each project: ambient, signal, narrative and abstract. Research questions and potential theoretical frameworks to extend this investigation are proposed and outlined.

Background

In his book, *The Songlines*, Chatwin (1987) investigates the indigenous Australian practice of recounting paths across the landscape through songs. This oral tradition is likely among the oldest formalized methods of conveying geographic information by acoustic means. Just as verbal descriptions of an environment evoke mental imagery, so, too, do characteristic sounds. In the late 1960s R. Murray Schafer founded the World Soundscape Project, which sought to study changing “soundscapes”—sounds heard in an environment—and what effects these changes had on people’s thinking and social activities (Pocock 1989, Wrightson 2000). Schafer laid the foundation for the field of acoustic ecology, which studies the relationship between nature and society, mediated through sound (Wrightson 2000). The presence of sound indicates an event: something must be happening to create the sound. In addition to revealing its source, sound as it is perceived reveals physical characteristics of the environment in which it is produced. A hand-clap in a cave sounds different from a hand-clap in the open.

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