Sound Cues in Geographic Representation

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Sound Categories

Several project types were proposed 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, all 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 swinging music. This category is influenced by the environment.

- **Signal**—includes sounds that draw attention. The distinction between "ambient" and "signal" cues is contextual and depends on 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-numeric data values through modulation of one or more physical properties such as pitch, volume, and timbre. For example, within a classified land use, 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 cartography. Many of the projects surveyed fall within the domain of cybercartography, which Caquard et al. (2003) confirms is one area of geography that is increasingly adopting sound for representation. Kryger (1994) draws an analogy between "visual variables", for example, color and textures, 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 on 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?

References Included in Classification


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.*