SOUNDSCAVENGER: AN INTERACTIVE SOUNDWALK

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ABSTRACT
SoundScavenger is an open-form, networked soundwalk composition for iOS devices. Embedded GPS sensors are used to track user positions within a series of regions. Each region is associated with a different series of soundfiles. The application supports networked interactions, allowing multiple users to explore and communicate within a semi-shared soundscape.

INTRODUCTION
SoundScavenger divides a geographic region of approximately 200 square meters into 7 distinct zones (figure 1). Each zone is associated with a different soundscape. The GPS sensors embedded in the iOS devices allow the SoundScavenger application to play the correct soundfiles as the user wanders from one zone to another. Using Apple's Game Center, two users can collaborate in exploring a semi-shared soundscape. The users hear soundscapes associated with the GPS coordinates of both participating users, allowing them to explore many different combinations of sounds as they move between different physical locations. Users are also able to interact with one another by using the application interface to cue sounds from a collection of acousmatic gestures.

MOBILE-MUSIC
Existing mobile-music projects range from ensembles [1, 2], large-scale compositions [3], augmented reality [4] and digital controllers [5]. In “Updating the Classifications of Mobile-Music Projects”, David John identifies location and collaborative composition as two recurring themes in current mobile-music projects [6]. These categories are of primary importance to SoundScavenger. SoundScavenger aims to continue in the example set by projects such as AuRal and Net_Dérive [7, 8], and is particularly inspired by the soundwalks of Janet Cardiff [9].

David Kim-Boyle argues that networked projects “restitute the role of the composer to that of designer and transform the nature of performance to that of play.” [10] Listening to a composition becomes an act of engaged experimentation rather than a passive experience. Many mobile-music projects, such as Biophilia or Polyfauna, use this same approach of designing musical environments rather than composing strictly scored material [11, 12]. SoundScavenger also adopts this approach, aiming to provide the user with some amount of agency within the musical experience.

INTERACTION DESIGN
Upon starting the app, users are placed on a map separated into 7 zones, illustrating the locations of the 7 soundscapes. Through this map, the user is made aware of the existence of locational boundaries. In order to help the user understand the relationship between their physical position and the resulting soundscape, adjacent zones often contrast one another in terms of sound material. By using timbre to create a clear delineation between zones, the user can more quickly understand an available form of interaction. It is especially important to clarify this form of interaction if the user begins a multiplayer session. A multi-player session overlaps the audio of two zones at any given time. Transitions between zones may be somewhat obscured by the overlap.

Initial users of the system have actively explored the locational boundaries by to-ing and fro-ing between zones in order to test the correlation between the boundaries drawn on the map and the resulting change of sonic material. Several crossefade times between 10 milliseconds and 20 seconds were tested to smooth the transitions between zones. Shorter crossefades allowed the user interaction to be perceived more clearly while longer...
crossfades helped to smooth jitter in the GPS input. A 2-second crossfade was selected as a satisfying compromise.

The delineation between zones is also reinforced by the touch-based controls. Upon pressing any zone on the map, a short 1-5 second gesture will be performed (figure 2). The touch controls divide the material into families of sound objects. By experimenting with the touch controls, users will hopefully connect the families of gestures with the various sound objects used to compose the 7 soundscapes. By learning the individual gestures, the user will also hopefully learn to identify when a remote user cues a gesture.

![Figure 2](image2.png)

**Figure 2.** The user interface. The remote user is displayed as a green circle. Zone 7 is being pressed by the local user which will cause a short soundfile to play for both users.

### A SONIC FLASHLIGHT

While the moment to moment character of SoundScavenger is nonlinear and dependent on the decisions of the listener, the large-scale formal development of the composition is primarily linear. Each zone contains a soundscape of 10-14 minutes in length. While the user is able to switch between zones at any point in time, the zones are each composed with a parallel linear trajectory. Each individual zone could be experienced on its own as an autonomous, fixed composition. The zones continue forward in time linearly whether or not the user is presently listening to the zone at the time. I perceive this approach as a 3-dimensional musical form. While the first 2 dimensions are dependent on the user(s) input, the 3rd dimension, time, is fixed, resulting in a predetermined musical arc (figure 3). The role of the user in shaping the composition is similar to a person shining a flashlight on small fragments of a painting. While the painting as a whole possesses an overall coherence, the spectator is only able to experience a fraction of the painting at a time. By focusing on only a restricted section of SoundScavenger at a time, the listener is able to perceive details that may be lost when listening to the work in its entirety.

![Figure 3](image3.png)

**Figure 3.** Mapping the player movements over time. While the music progresses linearly in time, the performers help determine the moment to moment soundscape. In this example Player 1 begins in zone 2 and moves to zone 3, 5, and 6. Player 2 begins in zone 2, moves to zone 3, and returns to zone 2.

### SITE-SPECIFIC SOUND-DESIGN

Given the mobile nature of this composition, it is likely that the soundscapes associated with the listening locations will be noisier than a typical concert hall or recording studio. While this would generally be considered be an unfortunate quality for most pieces of electroacoustic music, (A “lo-fi” listening environment limits the audible dynamic range and may mask frequencies), prior knowledge of the listening environment allows the composer to choose sound materials for the location itself. Selecting sounds for a specific location can increase immersion by creating an ambiguous relationship between the sounds coming through the headphones and the external soundscape. This relationship is particularly effective when orchestrating for an active or busy soundscape such as a mall. For example, in a crowded mall, quickly approaching footsteps on tile may cause the listener to turn around to check whether the sound is within the composition itself or an actual person approaching. Yelling, laughing, or crying may also be more effective in environments where these sounds are natural occurrences. This effect is emphasized in SoundScavenger using binaural spatialization to place sounds outside of the visual field. Binaural spatialization was accomplished in Max using an FFT-based binaural panning tool by Jakob Andersen [13].

Rather than using sounds which are native to the listening environment, In his sound installation *Auditory Tactics*, Gauthier takes the opposite approach, using close vocal sounds to contrast the “public sphere” with sounds more generally associated with an intimate environment [14].
Adopting sounds which are perceived as close to the head or out of place within the context of the listening environment and contrasting these sounds with the soundscape of the listening environment creates a novel sonic experience. Janet Cardiff also uses this technique of contrasting the public and private spheres in many of her soundwalks, often pairing soft, close mic'd vocals with soundscapes of the surrounding environment [9].

SoundScavenger is originally designed for use on the University of Calgary campus. However, the application does not limit the user to a specific location. The GPS coordinates are instead based on the user's location at the moment the app is launched. Although the site-specific sound-design is compromised when used outside of the originally intended location, many of these techniques may still be translated to similar locations. For example, a work designed for use in a library would likely translate well to different libraries of a similar size. Selecting intimate sounds in order to contrast a public location with a private soundscape would likely remain effective in any sufficiently public setting.

Wrightson argues that many people try to avoid or ignore noisy soundscapes by using sound-proofing or adding “acoustic perfume-music”:

Music – the virtual soundscape – is, in this context, used as a means to control the sonic environment rather than as a natural expression of it [15].

Site-specific sound-design could be used not to control or ignore a soundscape, but instead to engage with it directly, integrating it as an element in the composition itself. Hopefully, this approach to composition could lead to a deeper appreciation of the external soundscape.

**FUTURE WORK**

Moving forward, SoundScavenger will be extended to improve both the depth of immersion and the range of interaction. By implementing tools for sound-analysis, the application could play specific gestures or soundfiles mimicking or contrasting a previously unknown soundscape (for example, performing traffic sounds in environments which feature high levels of continuous broadband noise). SoundScavenger could enhance the interaction and localization between players by implementing live spatialization, associating the remote player with both a specific soundscape and location. To be effective, the application would use the iOS device's built-in sensors to ascertain the user's orientation with regard to the remote player. The sounds associated with the remote player would emanate from the appropriate direction regardless of the local player's orientation. Finally, it may be effective to use live filtering to create a sense of distance associated with specific soundfiles, so that as a user nears a specific location, the sounds are perceived as gradually getting closer.

**CONCLUSION**

The software implementation of SoundScavenger functions as an interactive stage for the composition itself. Many different types of music can be performed on this stage. However, each GPS soundwalk will need to consider its use of acoustic environment, interaction design, and musical form.

SoundScavenger is freely available as an iOS app on the iTunes App Store. An exported, model version of SoundScavenger is also available at www.naithan.com/soundscavenger.

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**REFERENCES**


