Positive and Negative Attributes Assigned to Soundscapes on a University Campus in Relation to Demographic Information and Participant Comfort

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Introduction & Literature Review

A soundscape is an acoustic environment made up of a combination of sounds that exists by human perception. Originally, the term soundscape was coined by Murray Schafer for a project aimed to educate individuals about the effect of noise pollution (as cited by Engle et al., 2018). Since Schafer, scientists have adapted and expanded the term soundscape in a range of studies that consider how sound environments affect human perception and health. The evolution of soundscape research also includes the recent standardization of study methods in the ISO/ TS 12913-2:2018 standards. The research question and factors considered in soundscape research will all influence the study design. In this literature review I address soundscape research in terms of why people are interested in soundscapes, how people study soundscapes, the environmental conditions (time/place) that scientists select, and who investigators in the soundscape studies. The focus of this thesis is to study soundscapes on the University of Colorado Boulder (CU) campus using the soundwalk methodology. Similar to Manzano et al. (2021) and Kogan et al. (2017), I am interested in exploring how different settings on a college campus are perceived by listeners, and how both time of day and listener factors may relate to this perception.

The "why" of researching soundscapes is an important factor in understanding the rationale and motivations for soundscape studies. Several soundscape studies address the questions about the extent to which different soundscapes provide perceptual restoration. Perceptual restoration investigates the way that mental fatigue can be bettered by the

soundscapes due to the perceived restorative characteristics. Restorative characteristics may include natural sounds or green spaces and lower sound level (Evensen et al., 2016; Kogan et al., 2021; Payne 2012; Qiu et al., 2020; Uebel et al., 2020). Other research questions addressed by soundscape studies include the following: Is the soundscape harmful to one's health? (de la Prida et al., 2019; Mancini et al., 2021); How is the soundscape different before and after the COVID19 pandemic? (Alías & Alsina-Pagés 2022; Bartalucci et al., 2021; Mitchell et al., 2021); What are the positive and negative attributes assigned to soundscapes? (Aletta et al., 2019; Mancini et al., 2021); What are the difference in responses to the soundscape across different socioeconomic groups? (Erfanian et al., 2021; Kogan et al., 2017; Yildirim, 2014); How does soundscapes perception change across different times? (Huang & Kang, 2015; Kang & Zhang, 2010; Manzano et al., 2021). These examples of research question illustrate the range of lenses that scientists use when investigating soundscapes.

In addition to the "why" of researching soundscapes, there is also the question of how people study soundscapes. Standardized methods for measuring soundscapes are outlined in the ISO/ TS 12913-2:2018 and include questionnaires, guided interviews, sound source taxonomy, analysis of binaural sound recordings, and soundwalks. Questionnaires address the participants perception of the soundscape (Aletta et al., 2019; Erfanian et al., 2021; Kang & Zhang, 2010; Kogan et al., 2021; Kogan et al., 2017; Mancini et al., 2021; Mitchell et al., 2021; Yildirim, 2014). Guided interviewers are a tool that probes specific types of responses from participants (Kang & Zhang, 2010). Sound source taxonomy is used to identify the sound sources that are apparent in soundscapes (Huang & Kang, 2015; Yildirim, 2014). Acoustic analysis of binaural sound recordings are used as an objective measurement of soundscapes (Alías & Alsina-Pagés 2022; Manzano et al., 2021; Mancini et al., 2021; Yildirim, 2014). The focus here is on soundwalks. According to ISO/ TS 12913-2:2018, soundwalks are defined as listening walks

through an environment to obtain human sensations, responses, and outcomes. Soundwalks collect data about multiple soundscapes in an area through group walks. This method is carried out in participatory groups. The standards state that soundwalks are important for analyzing ecologically valid acoustic and perceptual data. The ISO standards provide guidance for the soundwalks including surveys, data collection methods, and data analysis methods.

Whitin the soundwalk methodology, a moderator leads the soundwalk participants along a route that is within a predefined area. The group of participants is asked to stop at a location to listen to the acoustic environment for a minimum of three minutes. After listening attentively to the surrounding acoustic environment, the participants are then prompted to report their perception of the area. The ISO/TS 12913-2:2018 standards outline several data collection methods which include the Method A questionnaire, the Method B questionnaire, and the Method C interview. The Method A questionnaire will be the tool utilized in this study. The Method A questionnaire asks questions such as sound source identification, perceived affective quality, assessment of the surrounding sound environment, and the appropriateness of surrounding sound environment. The method utilizes a five-point response scale in assessment of each question which provides data on how individuals perceive an acoustic environment (ISO/TS 12913-2:2018).

Engle et al. (2018) summarize thirteen studies that implement soundwalk methodology. Many of these soundwalk studies were completed in Europe or Asia and aimed to characterize outdoor areas, typically in public squares, markets, or park areas, through questionnaires that provide quantitative data. As an example, Aletta et al. (2019) characterized spaces with positive or negative attributes around a university campus in Rome, Italy. The questionnaires included in Methods A and B of the ISO/TS 12913-2:2018 standard were used to identify positive and negative attributes of the different campus settings. Positive attributes were supportive and

related to the perception of the soundscape as pleasant and calm. Individuals who assigned positive attributes to soundscapes were reported to be likely to visit the site again (Aletta et al., 2019). Negative attributes were typically disruptive and correlated to the soundscapes characterized as unpleasant, loud, chaotic, annoying, and associated with traffic noise (Aletta et al., 2019). Aletta et al. (2019) suggests that locations with positive attributes are correlated to individuals wanting to return to those locations. In addition to Aletta et al. (2019), Mancini et al. (2021) also considered positive and negative attributes on a university campus in Fisciano, Italy following the ISO standards for soundwalks to gather information about noise pollution and health outcomes in the area. The research highlighted areas on campus that were perceived positive and those that were perceived as negative. Here, areas that were perceived as positive were associated with the terms vibrant and pleasant. Areas that were perceived as negative were associated with the terms annoying, chaotic, and monotonous. Spaces that were recognized as negative were noted as areas that required intervention (Mancini et al., 2021). Like Aletta et al. (2019) and Mancini et al. (2021), the use of positive and negative attributes will be important for characterizing participant responses to the areas on the CU campus. Both Aletta et al. (2019) and Mancini et al. (2021) use data collection methodology outlined by ISO ISO/TS 12913-2:2018 standards. To expand on positive and negative attributes, a comfort scale may be important for characterizing locations. Kang and Zhang (2010) used a survey that included a question about the comfort scale of the location. The research by Kang and Zhang (2010) predates the release of the ISO standards and so the researchers use a sematic differential scale in their analysis. However, the scale is like those used in the ISO/TS 12913-2:2018, where there is five-point scale ranging from “comfortable” to "discomfortable". Areas that are “comfortable” are perceived positively while areas that are “discomfortable” are perceived negatively.

Many different factors influence the "when" and "where" of soundscapes studies. These factors include location use, weather, visual influence, time or day, and lighting (Engle et al., 2018). Locations include urban (Alías & Alsina-Pagés 2022; Manzano et al., 2021), rural, natural (Qiu et al., 2020), city (Huang & Kang, 2015; Mitchell et al., 2021), college or university campuses (Aletta et al., 2019; Mancini et al., 2021; Yildirim, 2014), and green spaces (Evensen et al., 2016). I will be focusing on location and time when investigating how these factors influence participant response. Research on soundwalks by Manzano et al. (2021) suggest that the time of day is an important factor when characterizing participant responses. In their research, two soundwalks were completed along a route with eight locations. The soundwalks were repeated once in the morning and once in the afternoon. The result suggest that time influences the soundscape assessment due to a change in the sound sources. For example, pleasantness was positively correlated with birds, vegetation movement, and sounds from trees during the morning soundwalk and sounds were negatively correlated with motorcycles and other traffic noise in the evening soundwalk. Thus, sound source occurrence varies based on time of day. Furthermore, Huang & Kang (2015) also suggest that time of day is important in relation to perception of soundscapes. Here, the research investigates a historic city center that has multiple cultural and religious influences and conduct soundwalks at three different times of day. The researchers found that as the time of day changed, the soundwalk was perceived differently due to the change in the sound sources. For example, in the morning there were sounds including religious sounds, ambient sounds, and natural sounds but in the evening, there was fewer religious sounds and no natural sounds present. Kang and Zhang (2010) compared soundscapes in different seasons and found that between autumn/ winter and spring/ summer, the perception of the soundscapes changed due to changes in sound sources at the different locations.

For example, the “Peace Gardens” location was rated higher by average scores in comfort, pleasantness, and socialness than the other location “Bakers Pool” which has lower average scores for comfort, pleasantness, and socialness. Yildirim (2014) analyzes how the difference in the perception of soundscapes on a university campus at different locations and the sound types of each location. For example, at the location “Sanderson Center”, traffic was a sound that was disliked the most and wind was liked. At another location “Bell Tower”, traffic noise was present and disliked by more participants than in the “Sanderson Center” location. Church bells and water were the sounds liked the most and had overall more liked sound sources than “Sanderson Center”. The result from this research demonstrates that as location differs, sound type changes and perception of the spaces change as a result.

Lastly, who participates in the research is an important factor that may influence the soundscape perception. Some research aims to use “experts” or individuals familiar with soundscapes when conducting research. Here individuals from a class or a group may be asked to join the research (Kang & Zhang, 2010). Another way that participants are gathered is through random advertising. Individuals may be asked to participate in an interview randomly in a study or the study may be advertised in general, not targeting a specific group, such as using participants from the university community that have voluntarily joined (Aletta et al.,2019). In addition to background knowledge of the study, personal factors such as demographic information or socio-economic information are important influences on the perception of the soundscape. In a study completed by Erfanian et al. (2021) the correlation between the perception of a soundscape (pleasantness and eventfulness) and demographic information was investigated. The researchers asked demographic information which included, age, gender, education level, occupation status, and ethnicity. With the demographic information that was provided the researchers found that eventfulness was perceived negatively by males and those

who did not report occupation. In addition, occupation status (primarily retirement), age, and gender, were related to positive perception of the pleasantness and eventfulness of the soundscapes. Therefore, this research suggests that there is a connection between demographic factors and the perception of soundscapes. Additionally, Kogan et al. (2017) investigated the multiple factors that may influence data collection of a soundscape. Here the demographic information includes age, gender, kind of current home, occupation, place where grew up, and current mood. The socio-demographic information found to influence the participants' perception and preferences for soundscapes and therefore, Kogan et al. (2017) suggest a methodology for cross-cultural analysis of soundscapes. Because individuals' identity may impact the way that they perceive spaces, it is important when characterizing spaces based on human perception to consider how different identities may influence perception. In summary, current research supports the idea that demographic information can influence participants' responses based on their personal characteristics. Therefore, including demographic information as a part of a survey of soundscapes is an important factor when considering participants' responses to the spaces that they occupy. However, only limited research has considered soundscapes on US college campus. Yildirim (2014) is an example of research that has been conducted on a US college campus. The research includes socio-demographic information as an important consideration of the perception of soundscapes. For example, the younger participants favored the wind, tree sounds, and birds and more tolerant of footsteps. The older participants favored the sounds of insects, water, and church bells, and were also more tolerant of construction noise, speech, and chatting and shouting. The results from the research show that age may have an impact on the preferred sounds and the perception of soundscapes and therefore should be considered in research.

Objective

The purpose of my research is to apply the soundwalk methodology to characterizing soundscapes on the CU campus. I am particularly interested in characterizing responses from each location and how each location differs in relation to each other. And investigating the relationship between demographic information and participant response to the location. I also seek to identify locations that are comfortable. My specific aims are as follows: 1) to characterize differences in responses across the five locations on the CU campus 2) to identify the locations that participants find comfortable and 3) consider how demographic information may relate to individual response. To address these aims, I use an expanded version of Method A for the ISO/ TS 12913-2:2018. Because I sought to consider participants comfort and likelihood to return to specific locations, I expanded the Method A questions to include a question about the extent the participant finds each location comfortable.

Methods

In my research, I aimed to characterize spaces around the CU campus through soundwalks. The ISO/ TS 12913-2:2018 standards suggest taking input from local experts when selecting locations of interest for a soundscape study. Locations on campus were chosen in consultation with the campus architect and community input from individuals such as faculty and students. The campus architect identified areas on campus that were in the master plan for renovation in the coming years. Student and faculty input was also considered when identifying spaces that were of interest for further investigation. The goal was to provide information on locations on the CU campus that are assigned positive attributes. After considering input from these campus experts, five locations were chosen as the predefined areas for the soundwalk route.

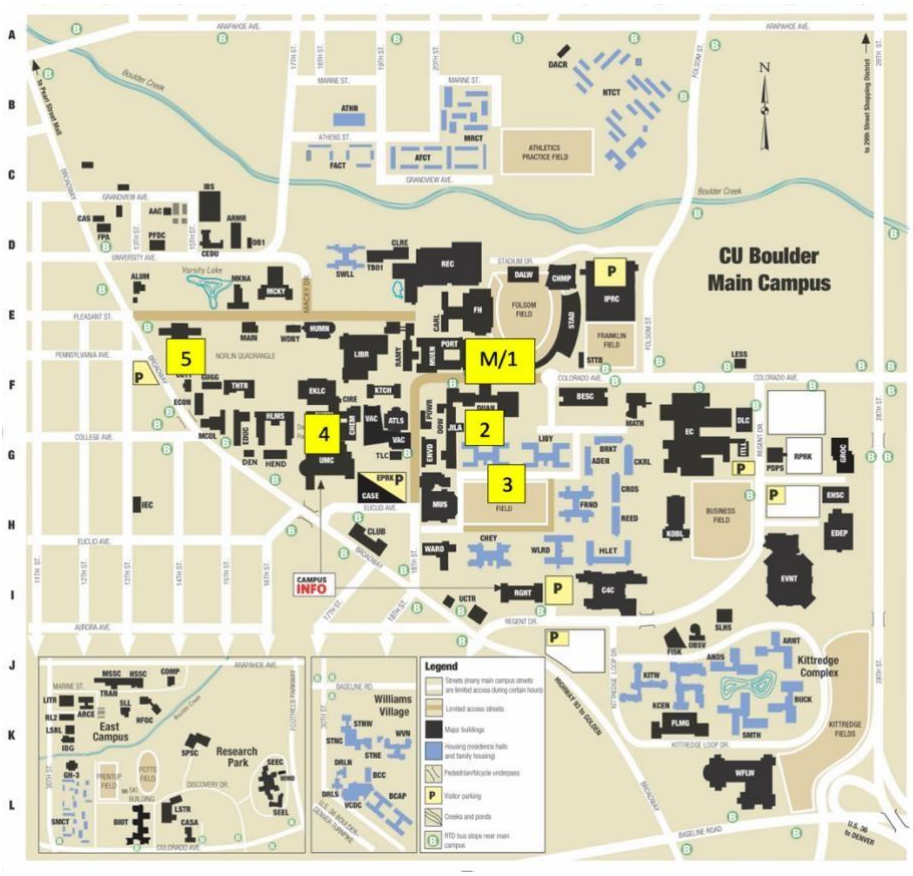


Figure 1. Soundwalk Route

Location 1 – Plaza outside Folsom field L1 (Folsom)	
Location 2 – Courtyard Near Duane Physics L2 (Duane)	
Location 3 – Farrand Field Near the Stage L3 (Farrand)	
Location 4 – Courtyard by UMC entrance L4 (UMC Court)	
Location 5 – West End of Norlin L5 (Norlin)	

Table 1. Location names and images

Recordings of the soundscapes in each soundwalk were used as an objective measurement that allowed for the identification of specific sounds at each location. During each soundwalk, an operator recorded binaural audio recordings of each location. The recordings were completed in accordance with Annex D of ISO ISO/TS 12913-2:2018. The operator used Roland CS-10em In-Ear Binaural headset connected to the Zoom H1n Handy Recorder. The recording time was three-minute intervals and recorded during the time that participants listened to the sound environment at each location. The recordings were then downloaded to a computer and analyzed using the Raven Lite software.

Furthermore, I focused on characterizing spaces around the CU campus at different locations. In my research I aim to compare the responses of each location that are collected in soundwalks. Three soundwalk events were included in this study on three different days in the winter to collect enough data in accordance with the ISO ISO/TS 12913-2:2018. The ISO ISO/TS 12913-2:2018 recommend a minimum of 20 individual responses for the soundwalk method. In the results, each dataset is analyzed separately, then analyzed together and represented in a combined dataset of all 3 soundwalks. The first set of data was collected in the fall semester on December 1st at 3 p.m. and had a total of 12 participants. The second set of data was collected in the spring semester on February 21st at 11 a.m. and had a total of 7 participants. The third set of data was collected in the spring semester on March 1st at 12 p.m. and had a total of 5 participants. Thus, my dataset includes a total of 24 soundwalk responses.

Soundwalk Event	Date	Day of Week	Time of Day	Number of Participants
E1-Dec	12/01/22	Friday	3 p.m.	12
E2-Feb	02/21/22	Tuesday	11 a.m.	7
E3-Mar	03/01/22	Wednesday	12 p.m.	5

Table 2. Breakdown of Soundwalk dates, times, and participants

The data collection method that I used was Method A from the ISO ISO/TS 129132:2018 standards. In analysis of the questionnaire provided by Method A from the standards I correlated responses from the questionnaire to positive or negative attributes. In addition to the ISO ISO/TS 12913-2:2018 standards Method A questionnaire that is used to identify the positive and negative attributes associated with soundscapes; I have included a question about the perceived

comfort of the location. I added this question to my survey because of the importance of understanding the CU community's perceived comfort of the spaces that they occupy. Specifically, I added to the Method A questionnaire the following question: “To what extent do you agree or disagree that the present surrounding sound environment is comfortable?”. The survey responses range from strongly agree to strongly disagree.

Question Type	Questions	Scale rating

Question 1: To what extent do you hear the four following types of sounds	- Traffic noise ((e.g., cars, buses, trains, airplanes) - Other noise (e.g., sirens, construction, industry, loading of goods). - Sounds from human beings (e.g., conversation, laughter, children at play, footsteps) - Natural sounds (e.g., singing birds, flowing water, wind in vegetation)	(1) Not at all, (2) A little, (3) Moderately, (4) A lot, (5) Dominates completely
Question 2: For each of the 8 scales below, to what extent do you agree or disagree that the present surrounding sound environment is…	· Pleasant · Chaotic · Vibrant · Uneventful · Calm · Annoying · Eventful · Monotonous	(5) Strongly agree, (4) Agree, (3) Neither agree, nor disagree, (2) Disagree, (1) Strongly agree
Question 3: Overall Sound Quality	Overall, how would you describe the present surrounding sound environment?	(5) Very good, (4) Good, (3) Neither good nor bad, (2) Bad, (1) Very bad
Question 4: Overall Sound Quality	Overall, to what extent is the present surrounding sound environment appropriate to the present place?	(1) Not at all, (2) Slightly, (3) Moderately, (4) Very, (5) perfectly
Question 5: Overall Sound Quality	How loud is it here?	(1) Not at all, (2) Slightly, (3) Moderately, (4) Very, (5) Extremely.
Question 6: Overall Sound Quality	How often would you like to visit this place again?	(1) Never, (2) Rarely, (3) Sometimes, (4) Often, (5) Very Often
Question 7: How does this soundscape make you feel?	To what extent do you agree or disagree that the surrounding sound environment is comfortable?	(5) Strongly agree, (4) Agree, (3) Neither agree, nor disagree, (2) Disagree, (1) Strongly disagree

Table 3. Method A survey questions with additional question about comfort.

The survey also included demographic information. When advertising to participants for the CU Soundwalk research, the goal was to advertise the research to anyone who was a part of the CU community to obtain a diverse group of people. The CU community includes students, staff, faculty, retired professors, and alumni. The demographic information on the survey included questions about gender, age, role at CU, ethnicity, race, language fluency, and mood. The goal with this information was to compare participants demographic information to the response to the soundwalk survey.

DEMOGRAPHIC QUESTIONS	**ANSWER OPTIONS**	
How would you describe your gender?	· Male · Female · Genderqueer · Agender	· Transgender · Cisgender · A gender not listed. · Prefer not to say
Age	Open answer	
Role at CU Boulder	· Student Undergraduate (first year) · Student Undergraduate (sophomore) · Student Undergraduate (Junior)	· Student Undergraduate (Senior) · Graduate Student · Staff · Faculty · Alumni · Retired faculty or staff
Are you of Spanish, Hispanic, or Latino origin?	· Yes · No	
Choose one or more races you consider yourself to be	· White or Caucasian that · Black or African American · American Indian/ Native American or Alaskan Native	· Asian · Native Hawaiian or Other Pacific Islander · Other · Prefer not to say
Please list any languages that you are fluent in	Open answer	
What mood are you in today?	· Stressed · Sad · Worried	· Excited · Happy · Relaxed

Table 4. Demographic survey questions

Participant advertising was done in several ways to gain as many participants as possible. Flyers for the research opportunity were posted around campus in buildings and online, as well as passed out to individuals. The flyer was also posted and advertised on social media platforms including Instagram, Reddit, and Next Door. Clubs and department were also advertised to.

Alumni and retired professors were included in the participant group and were therefore advertised to through rec centers and email. I also advertised to campus departments including Speech Language and Hearing Science, Environmental Design, and Women and Gender Studies.

Results

Demographic Information

Age: Twenty of the 24 participants reported their age. The participants ranged in age between 19 – 64. Of the participants, 50% were between 19-24, 8% of the participants were between ages 25-29, 4% of the participants were between ages 40-44, 21% of the participants were between ages 50-54, 55-59, and 60-64.

Role on campus: Of the participants, 70% were students of CU, both undergraduate and graduate, 30% of the participants were staff, faculty, or alumni.

Gender identity: Of the participants, 83% identified as female, 8% identified as male, 8% identified as genderqueer.

Hispanic or Latino Origin: Of the participants, 100% responds "no".

Race: Of the participants, 86% identified as white, 8% identified as Asian, and 1 participant did not respond to this question.

Languages Fluency: All participants responded English, except for one that responded they were fluent in Gujarati and Hindi, in addition to English.

Mood: Of the participants, 12% responded that they were stressed, 8% responded that they were worried, 8% reported that they were excited, 38% reported feeling happy, 29% reported feeling relaxed.

The participants who were students at CU and between the ages 19 – 24 and 25 – 30 typically found the locations on campus more pleasant and comfortable than the participants who identified as staff, faculty or alumni, whose ages ranged from 40-44, 50-54, 55-59, and 60-64.

The difference in responses were most apparent at L2 (Duane) across all datasets. Of the participants that were between ages 19-24 and 25-30, 10 of 17 responded to Question 7, either that they "agree" that surrounding sound environment was comfortable or that they "neither agree, nor disagree" that the sound environment was comfortable. Of these participants, 6 of 10 responded to Question 3, characterizing the sound environment as "good". Of these participants, 4 out of 10 responded to Question 5 reporting the location was either "very" or "moderately" loud, but in Question 6, then reported that they would "sometimes" return to this location. All 10 participants reported on Question 1 that at L2 (Duane) there was "moderate" to "a lot" of other noise. Of the participants, 8 reported on Question 2, that they either "disagree" or "neither agree nor disagree" that the sound at L2 (Duane) is annoying and may be the reason why those participants felt comfortable in the location.

The responses from this age group are interesting in comparison to the other age groups that are 40 - 44, 50 - 54, 55- 59, and 60 – 64 and identify as staff, faculty, or alumni. Of these participants, 6 of 7 "disagree" that the surrounding sound environment was comfortable on Question 7. All 6 responded to Question 6, that they would "rarely" or "never" like to visit the location again. Of the participants, 5 reported that they location was "very" or "moderately" loud. Responses to Question 4, how appropriate the sound environment is to the location, ranged from "slightly" to "moderately". On Question 3, 3 of the participants reported that the surrounding sound environment was "neither good, nor bad" and the other 3 reported that the location was "bad". From Question 1, the 6 participants felt that the other noise was "a lot" or "dominating completely". In Question 2, 4 of the 6 participants "agree" that the sound environment was annoying and the other 2 of the 6, "neither agree, nor disagree" that the sound environment was annoying.

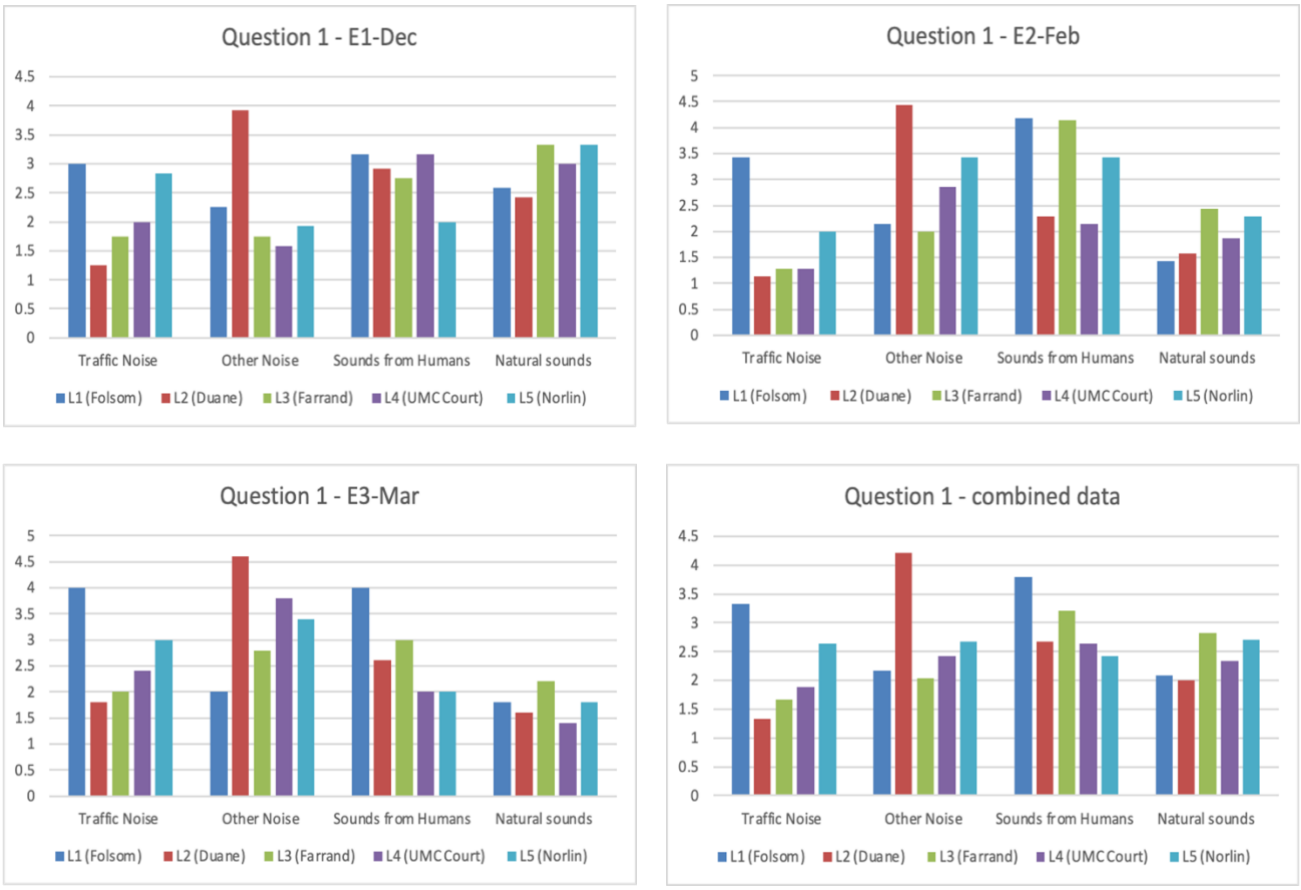


Figure 2. Question 1 – Sound Sources, averages for all datasets

Sound Sources, Question 1

Question 1 addressed "To what extent do you hear the four following types of sounds" where the participant rates on a five-point scale the extent to which one can hear traffic noise, other noise, sounds from human beings, and natural sounds. Five being "dominating completely" and one being "not at all". Following this code (rating the sound source 1,2,3,4,5), the averages for traffic noise, other noise, sounds from humans, and natural sounds were computed for each location using Qualtrics. A higher average represents a higher agreement with the sound source in that location. The graphs shown in Figure 2, represents the average responses from the participants for the perceived sound sources at each location across the three

different datasets and then lastly, all data combined. The purpose of these data is to show that at each location there are different sound sources that are perceived by the participants.

From E1-Dec, traffic noise at L1 (Folsom) had the highest average response with 75% of the participants had reporting that there was moderate to a lot of traffic noise, 66% responded that there was "little" to "no" other noise, 83% found that there was "moderate" to "a lot" of sounds from human beings, and 50% found that there was "little" to "no" natural sounds. At L2 (Duane), the type of sound that was most present was the "other noise". This result follows with what would have been expected of the location because of the HVAC unit that creates a dominating sound in the courtyard. Of the participants, 83% reported that the other noise was "a lot" to dominated completely and the other 17% reported "moderate" other noise. Traffic noise was the lowest here as 100% of the participants reported little to no traffic noise. Sounds from human beings was divided across the responses but 50% reported "little" to "no" sounds from human beings. Additionally, 58% of the group responded that there was little to no natural sounds. At L3 (Farrand), of the participants, 92% responded "little" to "no" traffic noise, 92% responded that there is "little" to "no" other noise, 58% percent responded that there was "moderate" to "a lot" of sounds from human beings, and 75% of the group responded that there was "moderate" to "dominating" natural sounds. At L4 (UMC Court), of the participants, 75% responded that there was "little" to "no" traffic noise, 92% reported "little" to "no" other noise, 83% reported "moderate" to "a lot" of sounds from human begins, and 58% reported "moderate" to "dominating" natural sounds. At L5 (Norlin), of the participants, 66% reported "moderate" to "a lot" of traffic noise, 75% found that there was "little" to "no" other noise, 83% responded that there was "little" to "no" sounds from human beings, and 75% responded that there was "moderate" to "dominating" natural sounds.

From E2-Feb, L1 (Folsom) 100% of the group found that there was “moderate” to “a lot” of traffic noise, 86% found “little” to “no” other noise, 100% responded that there was “a lot” to “dominating” sound from human beings, and 100% found “little” to “no” natural sounds. The traffic noise for this location is again explained by the road next to L1 (Folsom). At the time of the soundwalk, a tour group had stopped next to the first location and therefore caused an increase in the response to sounds from humans. At L2 (Duane), 100% reported “little” to “no” traffic noise, 71% found that the other noise “dominated completely” while the rest of the group reported the noise as “moderate”, 86% found that there was “little” noise from humans, and 100% reported “little” to “no” natural sounds. At L3 (Farrand), 100% of the group reported “little” to “no” traffic noise, 86% reported “little” to “no” other noise, 71% reported that sounds from human beings was “a lot” to “dominating completely”, while the rest of the group reported the sounds from human beings as “moderate”, and 71% of the groups reported that there was “a little” to “moderate” noise from natural sounds. At L4 (UMC Court), 100% of the group reported “little” to “no” traffic noise. Other noise was varying in responses as 57% reported “little” to “no” other noise while the other part of the group reported “a lot” to “dominating” other noise. For sounds from human begins, 71% found that there was “little” to “no” sounds and 71% reported “little” to “no” natural sounds. At L5 (Norlin), 100% of the groups responded that there was “a little” traffic noise, 71% reported “moderate” to “a lot” of other noise, 86% reported “moderate” to “a lot” of sounds from human beings, and 71% reported “little” to “no” natural sounds.

From E3-Mar, L1 (Folsom), 80% of the participants reported there was “a lot” to “dominating” traffic noise, 80% reported “little” to “no” other noise, 80% reported “a lot” to “dominating” sounds from human beings, and 80% reported “little” to “no” natural sounds. At L2 (Duane), 100% of the participants reported “little” to “no” traffic noise, 100% reported “a lot”

to “dominating completely” other noise, 60% reported “moderate” sounds from human beings, and 80% reported “little” to “no” natural sounds. At L3 (Farrand), 100% agreed that there was “a little” traffic noise, 80% reported “moderate” to “a little” other noise, 100% agreed that there were “moderate” sounds from human beings, and 80% reported “moderate” to “a little” natural sound. At L4 (UMC Court), 100% found “moderate” to “a little” traffic noise., 60% reported “a lot” to “dominating” other noise, 100% reported “a little” sound from human beings, and 100% found “little” to “no” natural sounds. At L5 (Norlin), 100% agreed that there was “moderate” traffic noise, 100% found that there was “moderate” to “a lot” of other noise, 100% agreed that there was “a little” sound from human beings, and 80% reported “a little” natural sound.

In the combined dataset, at L1 (Folsom), 75% of the participants found that there was “moderate” to “a lot” of traffic noise, 66% reported “moderate” to “a little” other noise, 92% reported that there was “moderate” to “dominating completely” sounds from human beings, and 71% reported “little” to “no” natural sounds. At L2 (Duane), 100% found that there was “little” to “no” traffic noise, 83% reported “a lot” to “dominating” other noise, while the remaining participants reported moderated other noise. For sounds from human beings, 58% reported “a little” to “no” sounds, and 75% reported “little” to “no” natural sounds. At L3 (Farrand), 96% of participants reported “little” to “no” traffic noise, 80% reported “little” to “no” other noise, 83% reported “moderate” to “dominating” sounds from human beings. Responses to natural sounds in L3 (Farrand) varied when combined likely because when collecting data from E1-Dec there was a lot of wind. Most of the participants, 70%, reported that this location ranged from “a little” to “a lot” of natural sounds. At L4 (UMC Court), 80% reported “little” to “no” traffic noise, 67% reported “little” to “no” other noise, 80% reported “a little” to “moderate” sounds from human beings, and 62% reported “little” to “no” natural sounds. At L5 (Norlin), 83% reported “a little” to “moderate” traffic noise. The responses to other noise at L5 (Norlin) varied likely because on

the days E2-Feb and E3-Mar data were collected, construction work was going on at Norlin Quad. For other noise, 58% reported “moderate” to “dominating” and 67% reported “a little” to “moderate” sounds from human beings. Responses to natural sounds varied likely again to wind on the day E1-Dec was collected. Of the participants, 54% reported there was “little” to “no” natural sounds while the other 46% reported “moderate” to “dominating” natural sounds.

In analysis of Question 1, one of most dominating sounds at L1 (Folsom) across all datasets was the traffic noise. The other dominating sound at L1 (Folsom) was the sounds from humans. Both sounds that were prevalent at L1 (Folsom), can be attributed to the road that is right next to the area. The road is one of the busiest roads on campus and many buses and cars drive through the area. The sound from human beings was another source prevalent here because the location is a common pedestrian area that is extremely populated during times in between classes. One of the most dominating sounds at L2 (Duane) across all datasets was the other noise. The other noise from L2 (Duane) can be attributed to the HVAC unit that is on a building surrounding the courtyard. At L3 (Farrand) sounds from human beings was a dominating sound in this location because it is a popular location for skateboarders or for individuals to sit on the field. There are also many walking paths that surround the field and therefore, there is a lot of pedestrian traffic. Another sound rated highly in this area were natural sounds and that can be attributed to the location being an open green space on campus. At L4 (UMC Court) sounds from human beings and other noise were two sounds that are reported. L4 (UMC Court) is in front of the UMC and there is pedestrian sitting areas and walkways, making it a popular pedestrian area. The other noise rated highest in E3-Mar and likely be attributed to the HVAC unit that is on a building nearby. For L5 (Norlin), traffic noise was consistent across all datasets and can be attributed to the road near the end of the Norlin Quad. Other noise was also rated highly on E2-Feb and E3-Mar and can be attributed to the construction on Norlin Quad

that was running at the time of the soundwalks. Natural sounds in E1-Dec were the dominating sound and can be attributed to the wind on the day of that soundwalk.

Location Characteristics, Question 2

Question 2 asks "for each of the 8 scales below, to what extent do you agree or disagree that the present surrounding sound environment is… "Pleasant, Chaotic, Vibrant, Uneventful, Calm, Annoying, Eventful, Monotonous". For each characteristic, the participants responded using a 5-point rating scale ranging from strongly agree (5) to strongly disagree (1). The mean of these responses was computed for each dataset using Qualtrics. The higher the mean is the higher agreement the participants found with the characteristic. In Table 5, each dataset has a table with the mean of the participants responses for every characteristic at each location.

E1-Dec	L1	L2	L3	L4	L5
Pleasant	3.58	2.67	4.33	3.92	4.25
Chaotic	2.33	2.83	2.83	2.08	1.92
Vibrant	2.67	2.67	3.25	2.58	3.0
Uneventful	2.83	2.75	4.08	3.42	3.67
Calm	3.17	2.58	4.5	3.75	4.25
Annoying	2.42	3.5	3.75	1.83	1.92
Eventful	2.83	2.75	3.33	2.33	2.17
Monotonous	2.75	3.33	3.42	3.08	3.0

E2- Feb	L1	L2	L3	L4	L5
Pleasant	3.57	3.29	4.43	4.0	4.14
Chaotic	3.28	1.86	2.14	1.57	2.14
Vibrant	3.71	2.57	3.29	2.57	3.0
Uneventful	2.28	3.86	2.86	4.0	2.71
Calm	2.57	4.0	3.86	4.43	3.43
Annoying	2.0	2.86	2.29	1.71	2.71
Eventful	3.14	1.57	2.71	1.86	3.29
Monotonous	2.14	3.71	2.71	3.71	2.57

E3-Mar	L1	L2	L3	L4	L5
Pleasant	2.6	2.2	4.0	2.6	2.6
Chaotic	3.4	2.6	1.8	2.0	2.8
Vibrant	2.8	1.8	3.0	1.6	2.4
Uneventful	1.0	3.2	3.2	3.0	2.6
Calm	2.4	2.4	3.8	2.6	2.4
Annoying	3.2	3.4	2.2	2.8	2.8
Eventful	4.2	2.8	2.8	3.0	3.4
Monotonous	2.0	4.2	2.6	3.2	2.2

Combined	L1	L2	L3	L4	L5
Pleasant	3.38	2.75	4.29	3.67	3.88
Chaotic	2.83	2.5	1.92	1.92	2.17
Vibrant	3.0	2.46	3.04	2.38	2.88
Uneventful	2.29	3.17	3.54	3.5	3.17
Calm	2.83	2.96	4.17	3.71	3.63
Annoying	2.46	3.29	1.83	2.0	2.33
Eventful	3.21	2.42	2.83	2.33	2.75
Monotonous	2.42	3.63	2.88	3.29	2.71

Table 5. Mean data for Question 2 – Soundscape characteristics, all datasets.

The data were analyzed further according to the methods and tools that are provided by ISO/TS 12913-3. The average responses from Question 2 can be computed into coordinates that are then plotted on a two-dimensional plane. The equations for pleasantness and eventfulness:

$$P = (p\text{-}a) + \cos 45 \bullet (ca - ch) + \cos 45 \bullet (v\text{-}m)$$

$$E = (e\text{-}u) + \cos 45 \bullet (ch - ca) + \cos 45 \bullet (v\text{-}m)$$

All the mean scores for each of these characteristics were then input to these two equations that once solved, provide coordinates for the graphs shown in Figure 3. The planes on the graph are related to the perceived pleasantness (x-axis) and perceived eventfulness (y-axis). The graphs in Figure 3, are 2D circumplex plots that are provided by ISO/TS 12913-3. In Figure 3, E2-Feb, the plot for L4 (UMC Court) was absent from the graph due to the data being an outlier from the other data. For all graphs, L1 (Folsom), tends be the most event and falls between "vibrant" and "chaotic". L2 (Duane), across all datasets falls in the quadrant "annoying" and "uneventful". L3 (Farrand) was perceived as "pleasant" and "calm" across all datasets except for E1-Dec. L3 (Farrand) in E1-Dec falls towards "annoying". This characteristic may be attributed to the wind the day of that data collection. L4 (UMC Court), across all datasets, was perceived as "annoying" and "monotonous". Even though the coordinates for L4 (UMC Court), E2-Feb were excluded from the graph because it was an outlier the coordinates suggested the location would be plotted between "annoying" and "monotonous". For L5 (Norlin), across all datasets the location can be described mostly as "pleasant".

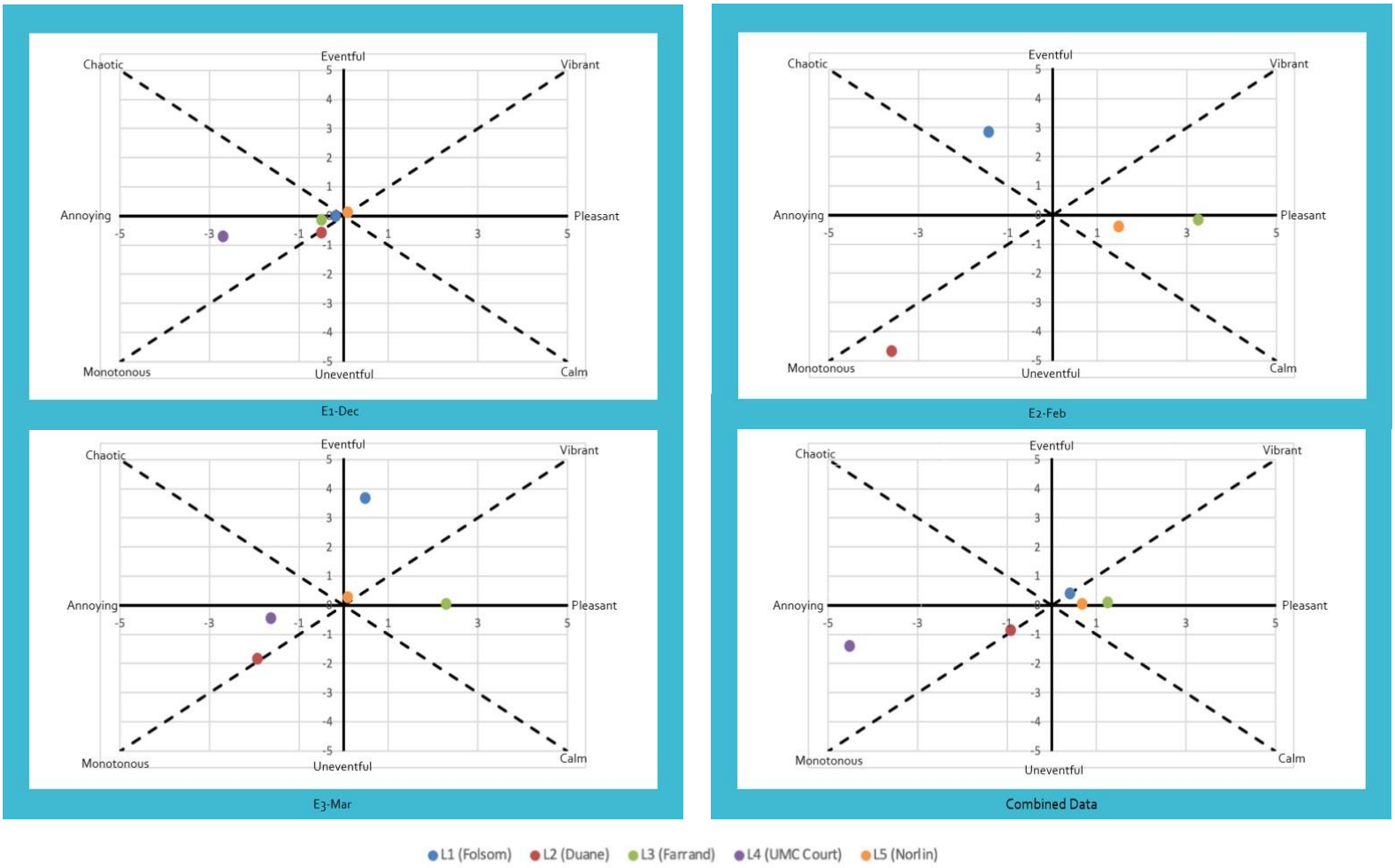


Figure 3. Question 2 – soundscape characteristics, 2D Circumplex plots for means of all datasets and a key for all graphs.

For Question 2, Figure 3 was good for representing a visual comparison of the characteristic of each sound environment. L1 (Folsom) was generally the most "eventful" with a mean score of 3.21 in the combined dataset. L2 (Duane) across all datasets was characterized as "annoying" and "monotonous". In the combined dataset at L2 (Duane), the mean score for "annoying" was the highest at 2.29 and the mean score was also highest for "monotonous" at 3.63. L3 (Farrand) was generally the most "pleasant" except for E1-Dec. The responses from E1-Dec can likely be attributed to the high winds that were present on that day. In the combined dataset, L3 (Farrand) had the highest mean score for "pleasant" at 4.29. L3 (Farrand) also had the highest mean score for "calm" at 4.17. L4 (UMC Court), was generally characterized on

Figure 3 as “annoying” and “monotonous”. The caveat with this location is that in the mean for the combined dataset, L4 (UMC Court) was given a mean score of 3.67 for “pleasant” but a mean score of “3.29” for monotonous. When the mean data was entered into the equation for the coordinates in the graphs of Figure 3, the high “monotonous” score, pulled the coordinates into the negative values. Lastly, at L5 (Norlin), was characterized on Figure 3 as “pleasant” and was plotted between “vibrant” and “calm”. On Table 5, L5 (Norlin) received a mean score of 3.88 for “pleasant” and received its second highest mean score for “calm” at 3.63.

Overall Sound Quality, Question 3 – 7

The responses for Questions 3 through 7 were averaged across the three datasets and summarized in Figure 4. Question 3 asks “overall, how would you describe the present surrounding sound environment?”, participants responses range from (5) very good to (1) very bad. The higher the mean is the more favorable the response is for how good the surrounding environment is. For E1-Dec, the mean of L1 (Folsom) was 3.58, L2 (Duane) was 2.67, L3 (Farrand) was 4.08, L4 (UMC Court) was 4.0, and for L5 (Norlin) was 4.33. For E2-Feb, the mean of L1 (Folsom) was 3.57, L2 (Duane) was 3.29, L3 (Farrand) was 4.14, L4 (UMC Court) was 4.14 and. L5 (Norlin) was 3.29. For E3-Mar, the mean of L1 (Folsom) was 3.20, L2 (Duane) was 2.60, L3 (Farrand) was 3.80, L4 (UMC Court) was 3.0, and L5 (Norlin) was 2.6. For the combined dataset the mean of L1 (Folsom) was 3.5, L2 (Duane) was 2.83, L3 (Farrand) was 4.04, L4 (UMC Court) was 3.83, and L5 (Norlin) was 3.67.

Question 4 asks “overall, to what extent is the preset surrounding sound environment appropriate to the present place?”, participants responses range from (5) perfectly to (1) not at all. For this question, the mean of each location from all datasets are provided in Qualtrics. The mean responses for all locations and datasets are reported in Figure 4. The higher the mean score

represents that the participants find the location fits with the surrounding sounds. The mean for E1-Dec, L1 (Folsom) was 3.75, L2 (Duane) was 3.08, L3 (Farrand) was 3.92, L4 (UMC Court) was 3.42, and L5 (Norlin) was 3.67. The mean for E2-Feb, L1 (Folsom) was, L2 (Duane) was 4.0, L3 (Farrand) was 4.14, L4 (UMC Court) was 3.29, and L5 (Norlin) was 3.43. The mean for E3-Mar, L1 (Folsom) was 3.8, L2 (Duane) was 2.8, L3 (Farrand) was 3.6, L4 (UMC Court) was 3.0, L5 (Norlin) was 2.8. The mean for the combined dataset, L1 (Folsom) was 3.83, L2 (Duane) was 3.04, L3 (Farrand) was 3.92, L4 (UMC Court) was 3.29, and L5 (Norlin) was 3.42.

Questions 5 asks "how loud is it here" referring to how loud each location is. The participants responses range from (5) extremely to (1) not at all. The mean of each location from all datasets are provided in Qualtrics. The mean responses for all locations and datasets are reported in Figure 4. The higher the mean score is the louder the perceived sound environment is. The mean for E1-Dec, L1 (Folsom) was 2.25, L2 (Duane) was 3.42, L3 (Farrand) was 1.75, L4 (UMC Court) was 2.0, and L5 (Norlin) was 2.0. The mean for E2-Feb, L1 (Folsom) was 3.14, L2 (Duane) was 2.14, L3 (Farrand) was 2.0, L4 (UMC Court) was 1.43, and L5 (Norlin) was 2.86. The mean for E3-Mar, L1 (Folsom) was 3.2, L2 (Duane) was 3.0, L3 (Farrand) was 2.2, L4 (UMC Court) was 2.6, and L5 (Norlin) was 2.8. The mean for the combined dataset, L1 (Folsom) was 2.71, L2 (Duane) was 2.96, L3 (Farrand) was 1.92, L4 (UMC Court) was 1.92, and L5 (Norlin) was 2.42.

Question 6 asks "how often would you like to visit this place again?" and participant responses range from (5) very often to (1) never. The mean of each location from all datasets are provided by Qualtrics. The mean responses to Question 6 are reported in Figure 4. The higher mean score represents the location as more favorable or the participant wanting to return often to the area. The mean for E1-Dec, L1 (Folsom)) was 3.08, L2 (Duane) was 2.42, L3 (Farrand) was 4.0, L4 (UMC Court) was 3.58, and L5 (Norlin) was 3.83. The mean for E2-Feb, L1 (Folsom)

was 2.86, L2 (Duane) was 2.71, L3 (Farrand) was 4.43, L4 (UMC Court) was 4.0, and L5 (Norlin) was 3.57. The mean for E3-Mar, L1 (Folsom) was 3.0, L2 (Duane) was 2.4, L3 (Farrand) was 3.6, L4 (UMC Court) was 2.8, and L5 (Norlin) was 3.0. The mean for the combined dataset, L1 (Folsom) was 3.0, L2 (Duane) was 2.5, L3 (Farrand) was 4.04, L4 (UMC Court) was 3.54, and L5 (Norlin) was 3.58.

Question 7 asks "To what extent do you agree or disagree that the surrounding sound environment is comfortable?" participants responses range from (5) strongly agree to (1) strongly disagree. The mean of each location from all datasets are provided by Qualtrics. The mean responses to Question 7 are reported in Figure 4. Figure 4 represents how responses to Question 7 vary at each location and how the responses vary or relate across each dataset. The higher the mean score the more favorable the location is rated and represents a higher sense of comfort in the location. The mean for E1-Dec, L1 (Folsom) was 3.75, l L2 (Duane) was 2.83, L3 (Farrand) was 4.5, L4 (UMC Court) was 4.08, and L5 (Norlin) was 4.17. The mean for E2-Feb, L1 (Folsom) was 3.43, L2 (Duane) was 2.71, L3 (Farrand) was 4.43, L4 (UMC Court) was 4.29, and L5 (Norlin) was 3.43. The mean for E3-Mar, L1 (Folsom) was 3.2, L2 (Duane) was 2.4, L3 (Farrand) was 4.2, L4 (UMC Court) was 3.6, and L5 (Norlin) was 3.0. The mean for the combined dataset, L1 (Folsom) was 3.54, L2 (Duane) was 2.71, L3 (Farrand) was 4.42, L4 (UMC Court) was 4.04, and L5 (Norlin) was 3.71.

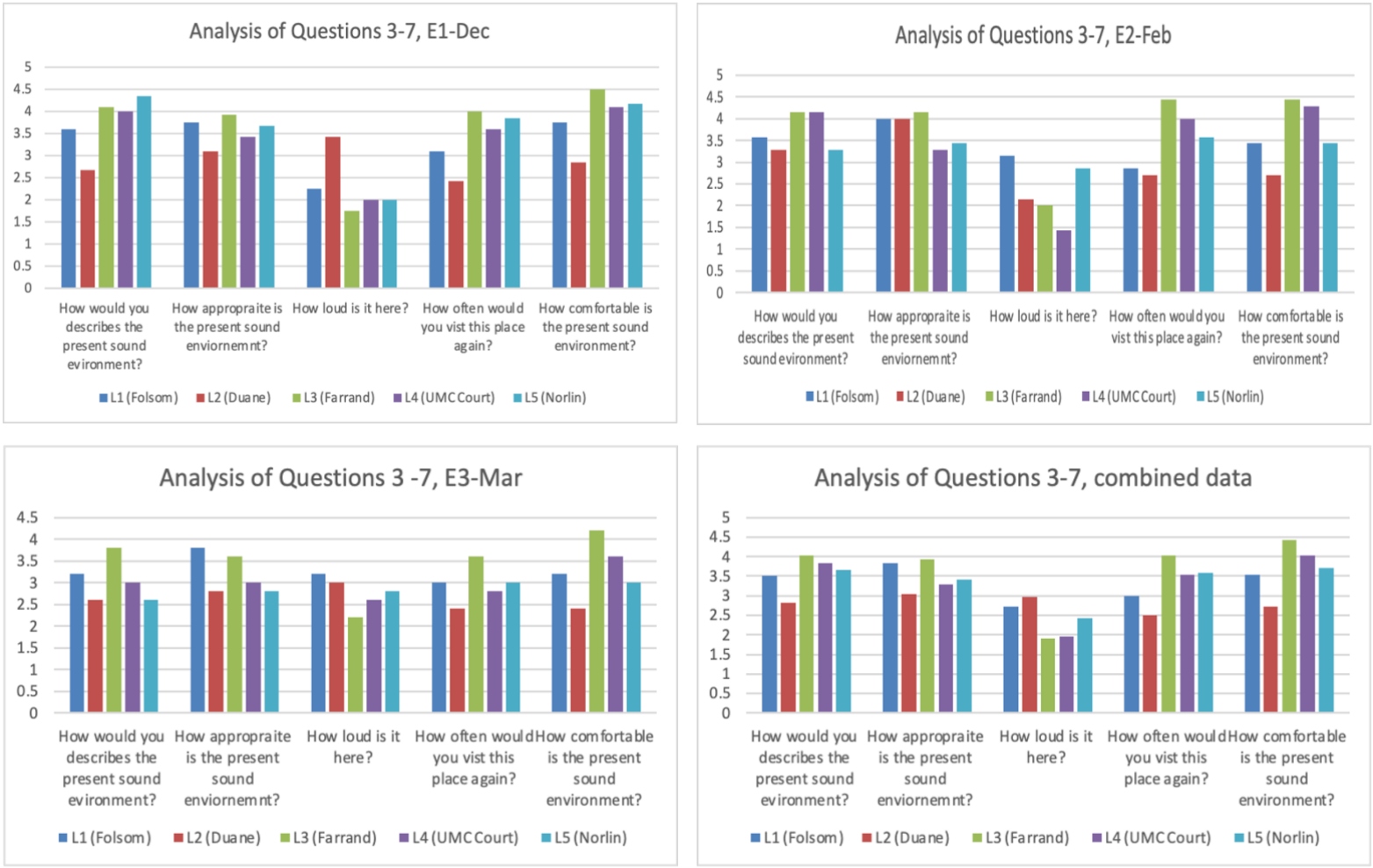


Figure 4. Averages of Questions 3-7 across all datasets

Acoustic Analysis

The spectrograms are attached in the appendix of this document. The spectrograms and waveform are an objective measurement of the soundscapes at each location across all datasets.

The waveform is representative of the amplitude of the present sounds over time. The spectrogram represents the three dimensions of acoustics including frequency (y-axis), time (xaxis), and amplitude (color). In this section, I highlight the acoustics in two specific locations which were identified as the most positive location (L3-Farrand) and the most negative location (L2-Duane).

L2 (Duane)	Spectrograms, Time Waveform, and Descritpions

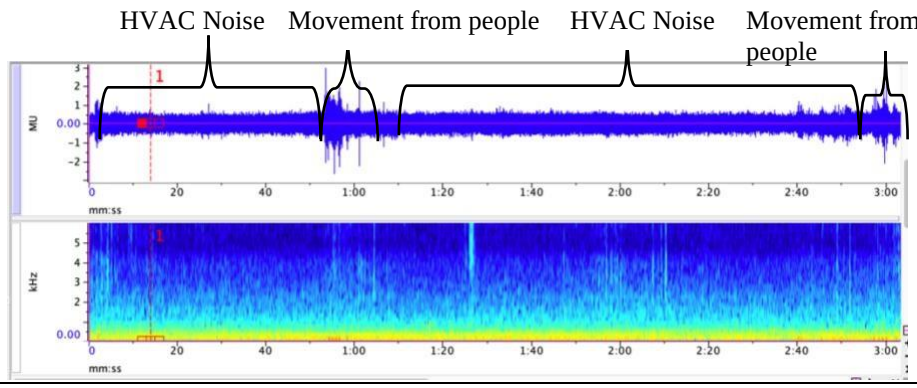
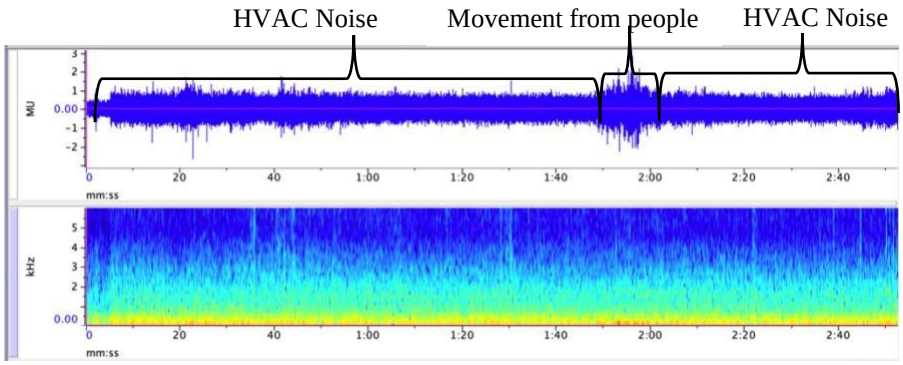
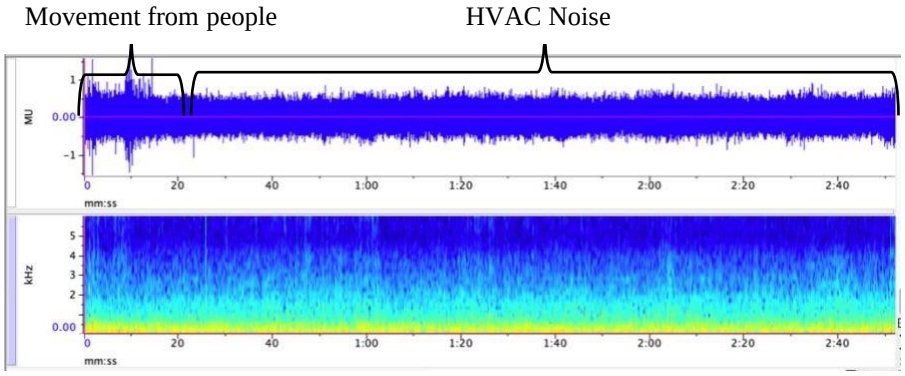
E1-Dec	
E2-Feb	
E3-Mar	

Table 6. Spectrograms, time waveform and sound descriptions from the three soundwalks at L2 (Duane).

L3 (Farrand)	Spectrograms, Time Waveform, and Description

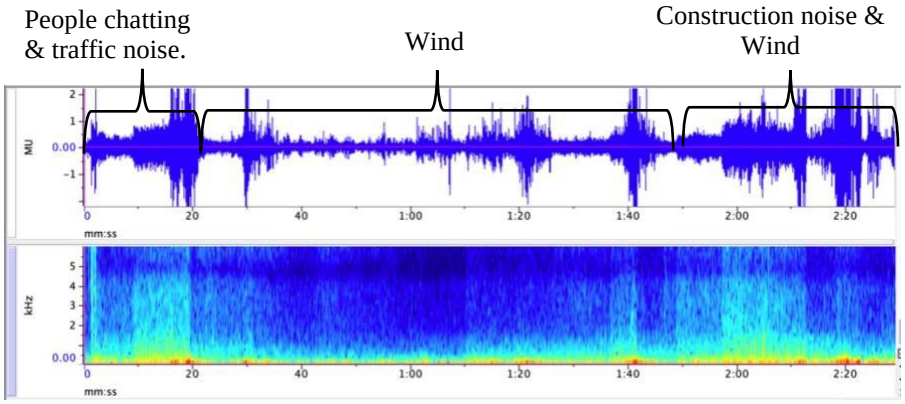
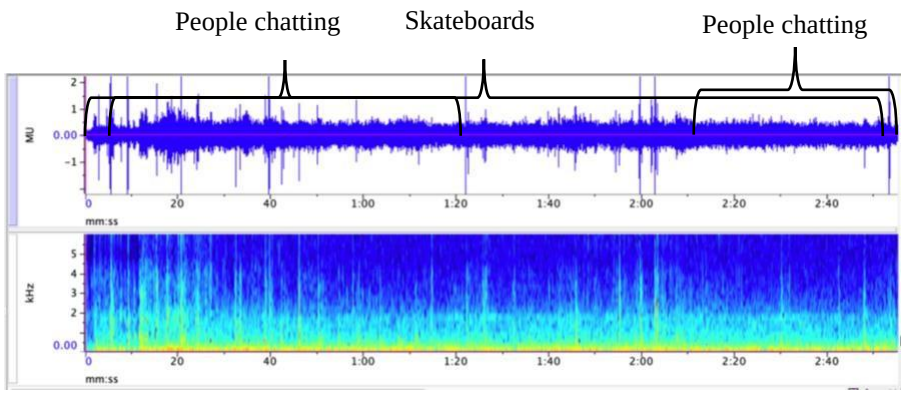
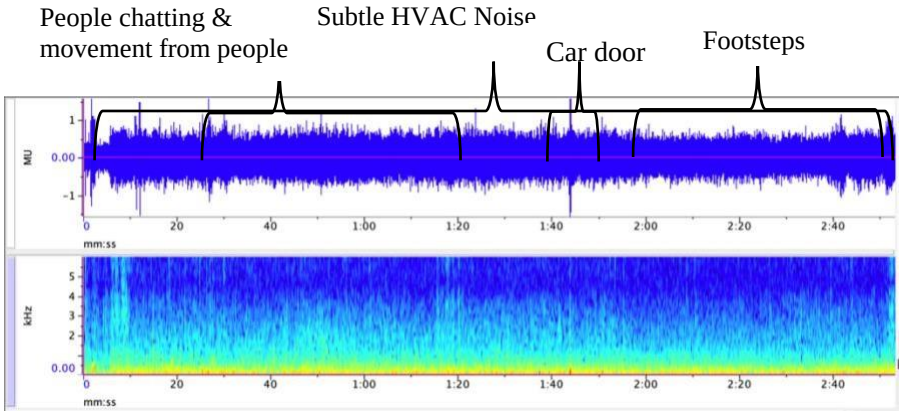
E1-Dec	
E2-Feb	
E3-Mar	

Table 7. Spectrograms, Time Waveform, and sound descriptions from the three soundwalks at L3 (Farrand).

Discussion

Negative and Positive Locations

For the Questions 3 – 7, the most favorable location based on mean score is L3 (Farrand). Within the combined dataset represented Figure 4, L3 (Farrand) has the highest mean scores for Questions 3, 4, 6, and 7. A high mean score for Questions 3,4,6, and 7, characterizes the space

as favorable. For Question 5, the mean score for L3 (Farrand) is the lowest and characterizes the space as quiet. Overall, the responses to L3 (Farrand) would present that location as the most positively perceived sound environment in relation to the other locations. L1 (Folsom), L4 (UMC Court), and L5 (Norlin) were similar in response to L3 (Farrand) as the mean score for those location is close to the mean scores for L3 (Farrand) on Questions 3,4,6, and 7. For Question 5, L4 (UMC Court) is similar to the mean score for L3 (Farrand). L1 (Folsom) and L5 (Norlin) has higher mean scores for mean loudness. For L1 (Folsom), this can be attributed to the pedestrian and traffic noise. For L5 (Norlin), this can be attributed to the construction noise. Overall, L1 (Folsom), L4 (UMC Court), and L5 (Norlin) are characterized as positive sound environments due to the high mean scores. The least favorable based on mean score is L2 (Duane) On the combined dataset in Figure 4, L2 (Duane) has the lowest mean scores for Questions 3,4,6, and 7 of any of the locations. For Question 5, L2 (Duane), had the highest mean score for loudness, meaning that the area was perceived as loud. Therefore, because of these low mean scores, L2 (Duane) is characterized as a negative sound environment.

The locations that are most relevant in the discussion of this research are L2 (Duane) and L3 (Farrand) because L2 (Duane) is perceived as the most negative soundscape and L3 (Duane) is perceived as the most positive soundscape. The results for L2 (Duane) Question 1 suggested that the noise most present was other noise. For Question 2, L2 (Duane) is perceived as negative with the characteristics “annoying” and “uneventful”. L2 (Duane) has the lowest scores for how good the sound environment is, how appropriate the sound environment is, how often participants would like to revisit the location, and how comfortable the sound environment is. L2 (Duane) also has the highest rating for loudness out of all the locations. My results suggest that there may be a connection with loud soundscapes and negative attributions. With the

combination of these responses, L2 (Duane) is characterized as the most negative soundscape. The results shown in my research are similar to the results from Mancini et al. (2021). Mancini et al. (2021) results show that one location (location 5) in the study was characterized as negative. Location 5 had the highest rating for other noise on Question 1. On Question 2, the location was characterized as both annoying and monotonous. Location 5 was also reported to be the loudest location and least likely for participants to return. The overall result for location five suggested that the sound environment was bad. Thus, the similar findings in Mancini et al. (2021), support my results that suggest there is a connection between the soundscape perceived as negative and high scores for other noise, characteristics such as annoying, high scores for loudness, and low scores for interest in returning to the location.

In contrast to L2 (Duane), L3 (Farrand) is perceived as the most positive location. At L3 (Farrand), sounds from humans was the most apparent sound source, followed by natural sounds. For Question 2, it was characterized as "pleasant" and "eventful". L3 (Farrand) also had the highest scores for how good the sound environment is, how appropriate the sound environment is, how often participants would like to revisit the location, and how comfortable the sound environment is. It also had the lowest scores for loudness out of all locations. With the combination of these responses, L3 (Farrand) is characterized as the most positive location. L3 (Farrand) is likely perceived as a positive soundscape because it is a green scape and used as a recreation area. The results from my research are supported by Mancini et al. (2021). Their results suggest that locations 2 and 3 are perceived as positive as positive because they are surrounded by green space. Location 2 and 3 had low scores for loudness and unpleasantness, and the highest scores for all locations for how appropriate the sound environment is and how often would the participants visit the location again. Location 2 and 3 from Mancini et al. (2021)

were also characterized as pleasant and calm. The results from Mancini et al. (2021) suggest that there is a connection between green spaces and positive perception of soundscapes. Furthermore, Aletta et al. (2019) also states that green spaces are related to "calmness" and "pleasantness" and is perceived as a more positive soundscape. Thus, the results form Mancini et al. (2021) and Aletta et al. (2019) support my results finding a connection between the soundscape being perceived as positive and sound sources like sounds from humans and natural sounds, characteristics such as "pleasant", high scores how appropriate the sound environment is and how often the participants would like to visit again. There is also a link between low loudness and the perceived pleasantness of the environment.

Demographic Information

The demographics of the 24 participants included a range of ages. My results suggest that there may be a connection between age and perception of sounds. My results suggest that age and role at CU has an influence on the perception of sounds at the locations. The comparison between the age groups/relation to CU is interesting to characterize in terms of responses because of the contrasting attributes assigned to L2 (Duane) by the students from CU and the staff, faculty, and alumni. For example, most of the participants who identified as staff, faculty, or alumni, found L2 (Duane) "annoying" and "uncomfortable". In contrast to this response from the staff, faculty, and alumni, some participants that identified as students found L2 (Duane) comfortable or felt neutral about their comfort in the location. Therefore, the results suggest that age may have an influence on the perception of comfort in the locations. The potential trend, that age may influence the perception of sound, is supported in Yildirim (2014). The results from Yildirim (2014) suggested a connection between age and preferred sound sources. Yildirim (2014) asked demographic questions including age. The results suggest that

younger participant favored birds, wind in the trees, and footsteps. And the older participants were more tolerant of construction sounds, surrounding speech, chatting, and shouting. Together these results support the idea that age is an important factor when considering how participants perceive locations.

Acoustic Analysis

The soundscape that is most consistent when analyzing the waveforms and the spectrograms is L2 (Duane). The prominent sound at L2 (Duane) was noise from the HVAC unit. The noise from the HVAC unit is a low frequency sound that can be seen on the bottom of the spectrogram as the red, yellow, and green colors. In some areas shown on the waveform at all locations, the amplitude spikes and represents sounds from people who are talking. The consistent amplitude shown on the waveform is the sound from the HVAC unit. L2 (Duane) is also characterized as the loudest soundscape and perceived as the most negative soundscape in relation to the other locations included in the soundwalk.

In comparison to L2 (Duane), characterized as the most negative soundscape, L3 (Farrand) is perceived as the most positive soundscape. L3 (Farrand) is an area where people from CU walk around to get to classes, skateboard, or sit on the field, there is also a parking lot next to field. There are many activities going on around Farrand field that create different sound sources. In E1-Dec, the prominent sounds included wind, people talking and some subtle construction noise. In E2-Feb, the prominent sounds included people talking and skateboards. In E3-Mar, the prominent sounds included, wind, subtle sounds from a HVAC unit, people talking, and a car. The sound sources vary in each dataset because the location is utilized in different ways depending on weather. For example, in E2-Feb, the sound sources prominent were people talking and skateboarding because the weather on that day was warm and sunny. L3

(Farrand) is a common area for recreation use for many in the CU community and may contribute to the reason why it is perceived as the most positive soundscape.

Limitations

Limitations that should be considered with this study is the small sample that was collected, and therefore the responses to the survey may not be representative of the general opinion of the sound environments on campus. Another limitation that may have affected the small sample size, was the season and weather. The soundwalks were conducted during the winter months and may have been attributed to low participant turn out. Many soundwalk dates had to be rescheduled due to the weather. Rescheduling the sound walks effected participant turn out due to conflicting schedules. In addition to the other limitations, the time and day may have been another restriction for participants wanting to sign up due to do other commitments. The original objective of the research was to compare soundwalks at different times of day, however, due to the restrictions such as weather and low participant outcome, my ability to the factor of time of day was constrained. Within limitations for demographic information, the majority of the participants identify as white and for that reason the study was not as culturally or racially diverse as it was initially intended to be.

Conclusion

In this research, the use of the soundwalk methodology was utilized in the analysis of the soundscapes on the CU campus. The soundwalk, surveys, and data analysis were completed following the ISO standards. The objectives of the study were to 1) characterize the difference in responses across all five of the locations on the CU campus, 2) identify the locations that participants find comfortable and 3) consider how demographic information impacts participants

perception of the locations. Overall, the analysis of these objectives was used to identify locations on the CU campus that are associated with positive or negative attributions.

The data obtained in this study by use of the participant survey and binaural audio recordings were analyzed and results were compared. L2 (Duane) evoked the most negative perceptions compared to the other locations. Specifically in contrast, to L3 (Farrand), is perceived as the most comfortable. L2 (Duane) is also perceived as the least comfortable location for participants and may be a result of the negative attributes. L3 (Farrand) is perceived as the most positive soundscape in relation to the other locations. L3 (Farrand) is also perceived as the most comfortable location for participants and may be a result of the positive attributes. The results from this survey represent how perception of soundscapes and positive and negative attributes assigned to the soundscapes will change in relation to the sound sources present and further how comfortable the participants feel at the location as a result of the present sound sources.

Another potential trend that is presented in the data are the demographic results. Age may have an impact on the way that soundscapes are perceived. The most noticeable result from age of the participants in relation to the perception of the soundscapes is that the students of CU were more likely to find locations on campus comfortable and return to these locations than the participants who identified as staff, faculty, and alumni who were more likely to characterize the same locations as uncomfortable. Thus, my research presents a potential trend that connects age and the way that participants perceive soundscapes.

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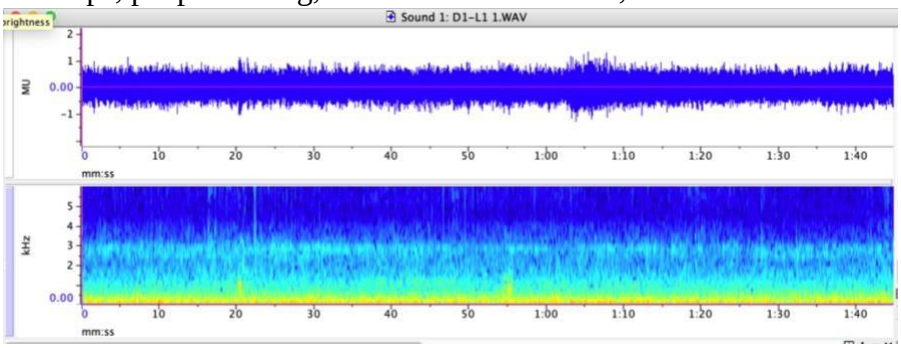
Appendix E1-Dec

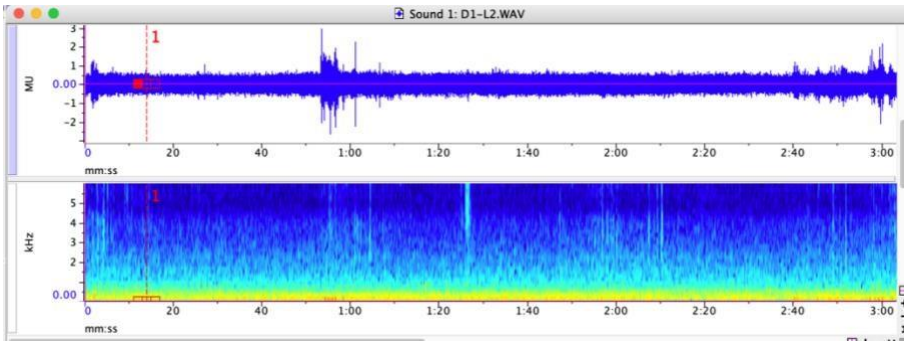
L1 Folsom:

Footsteps, people talking, low construction noise, bikes.



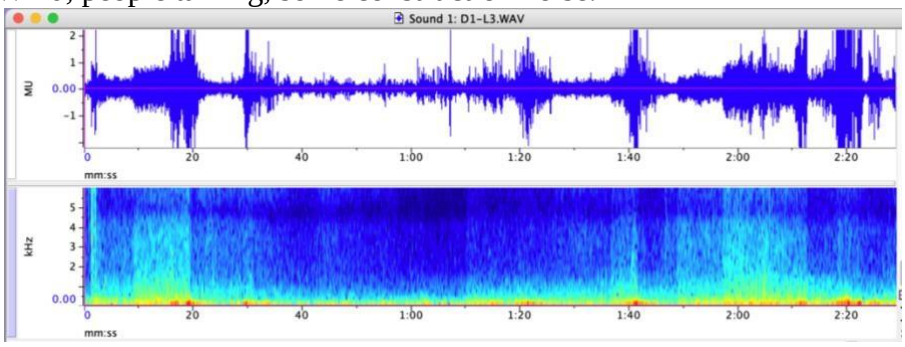
L2 Duane:

Consistent sound from HVAC unit.



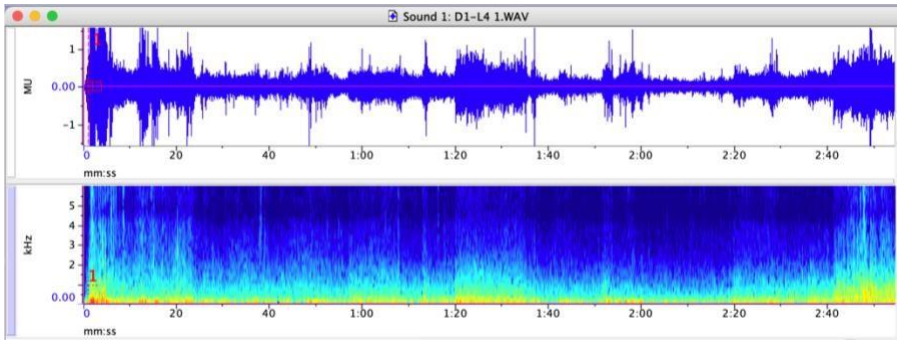
L3 Farrand:

Wind, people talking, some construction noise.

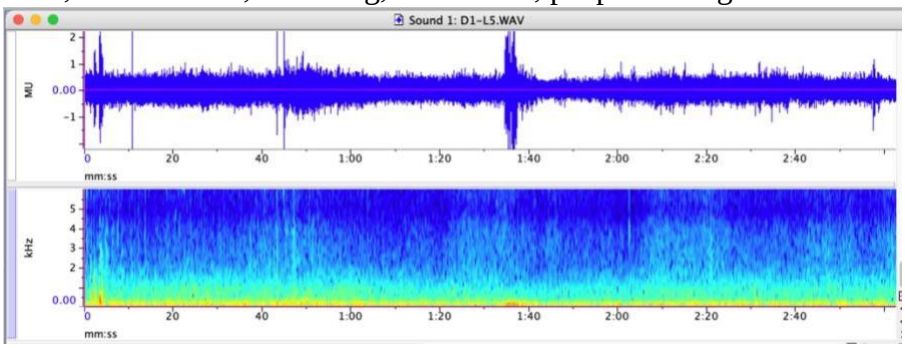


L4 UMC Court:

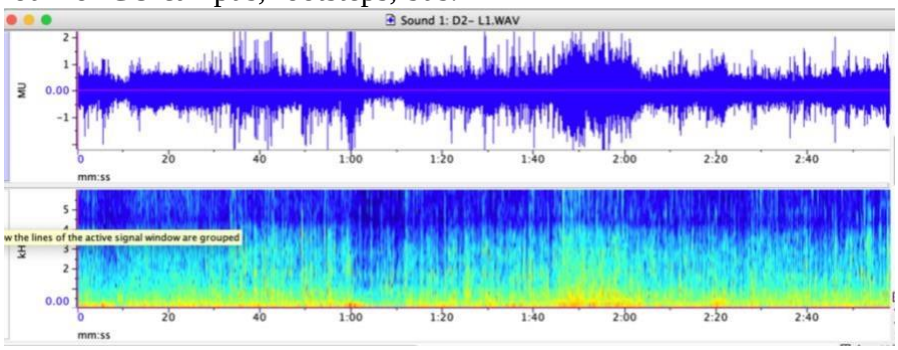
Wind, traffic noise, skateboard.



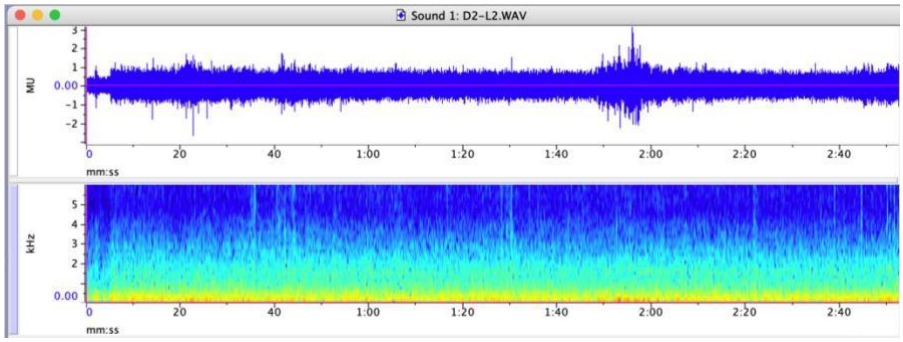
L5 Norlin:
Wind, Traffic noise, bird song, skateboard, people talking.



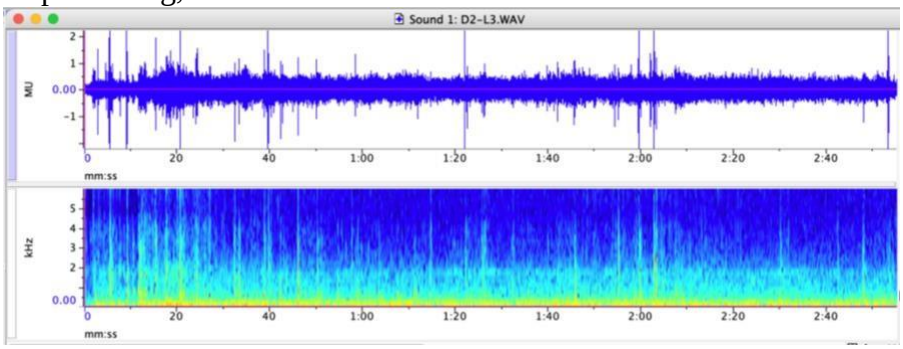
E2-Feb
L1 Folsom:
Tour for CU campus, footsteps, bus.



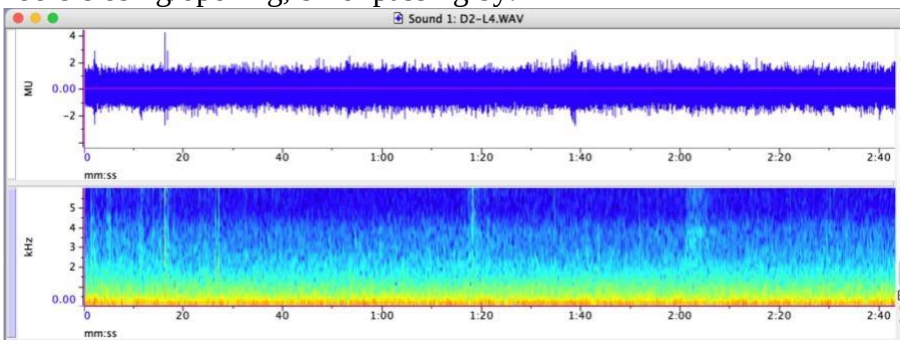
L2 Duane:
Consistent sound from HVAC unit, people talking/ laughing.



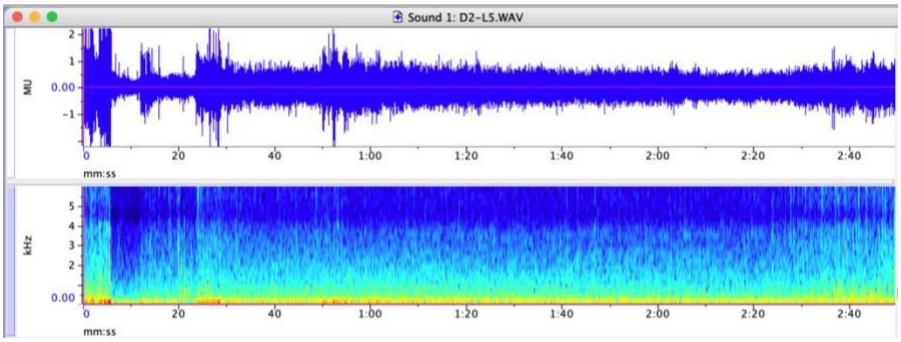
L3 Farrand:
People talking, skateboards.



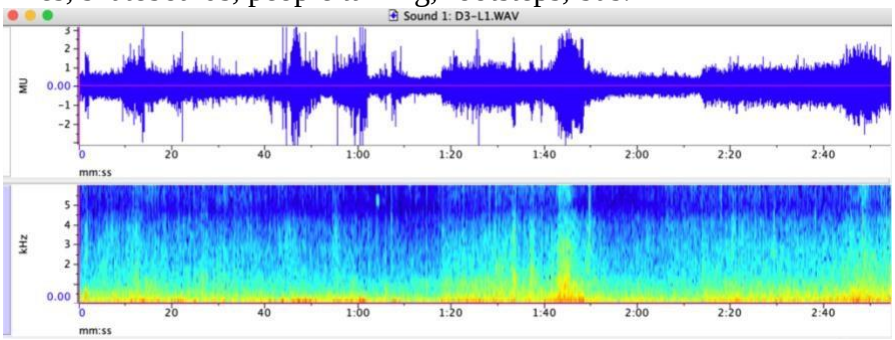
L4 UMC Court:
Doors closing/opening, biker passing by.



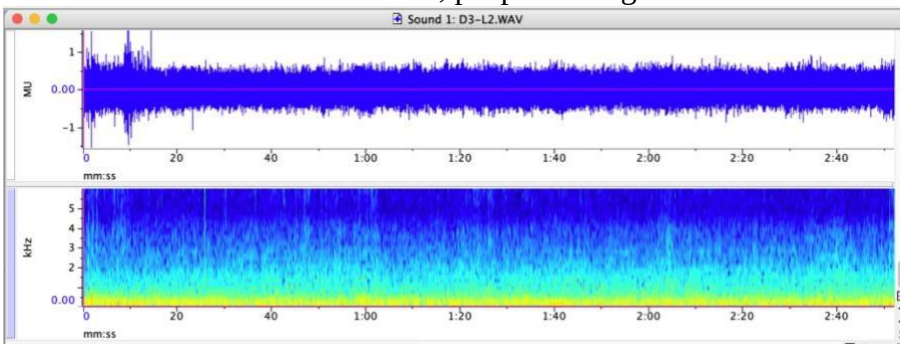
L5 Norlin:
People talking, footsteps.



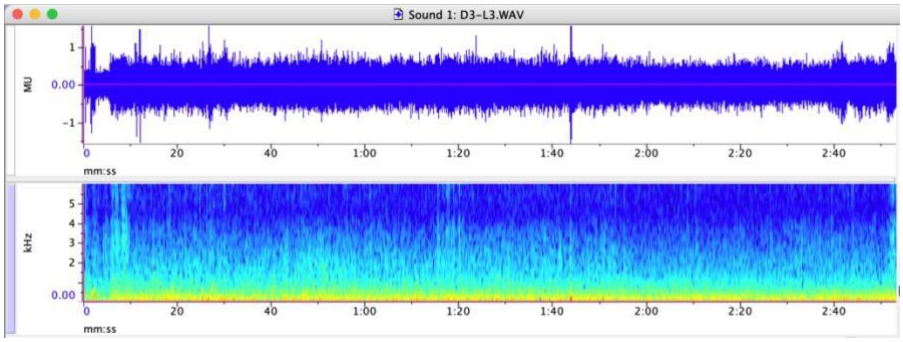
E3-Mar
L1 Folsom:
Bikes, skateboards, people talking, footsteps, bus.



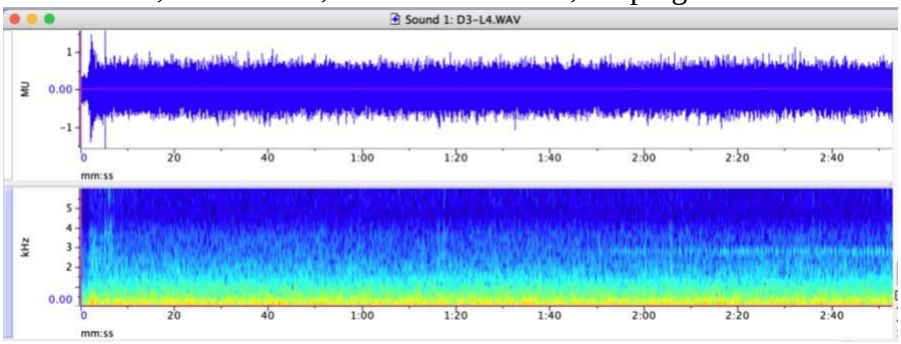
L2 Duane:
Consistent sound from HVAC unit, people talking.



L3 Farrand:
People talking, subtle HVAC unit, footsteps, car.



L4 UMC Court:
Traffic noise, subtle wind, subtle HVAC unit, beeping noise.



L5 Norlin:
Construction noise, subtle wind, bird song, traffic noise, footsteps.