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Acceptability of social conditions in Zion National Park: Incorporating auditory elements into a visual crowding research method

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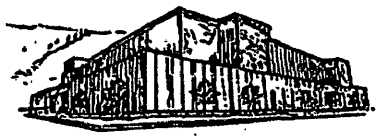

ACCEPTABILITY OF SOCIAL CONDITIONS IN ZION NATIONAL PARK: INCORPORATING AUDITORY ELEMENTS INTO A VISUAL CROWDING RESEARCH METHOD

by

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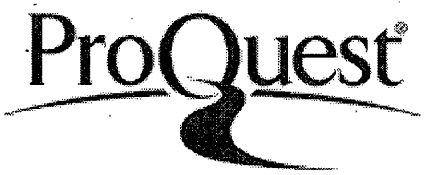

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Acceptability of Social Conditions in Zion National Park: Incorporating Auditory Elements into a Visual Crowding Research Method

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Studies of sound and its effect on people have focused primarily on the effects of sounds from aircraft overflights, the sounds of traffic, and the annoyance and intrusiveness of sounds during completion of tasks. Information on the effects of human caused sound on experience quality is limited. In this study, the effect of the sounds of visitors in a slot canyon on other people was investigated. The study was conducted in a laboratory setting with 197 college undergraduates.

A multi-sensory approach was developed for this study by incorporating sound into a previously-used visual crowding research method. Survey respondents assessed the acceptability of 16 settings which included various combinations of images depicting three different numbers of people in a slot canyon setting and three different levels of sound recorded in the area. Additionally, respondents viewed a series of images depicting 6 different levels of crowding in a slot canyon and assessed the acceptability of the number of people in each image.

Analysis of the data showed that sound level had a significant effect on sound acceptability as well as overall setting acceptability. This suggests that wildland recreation managers should consider the sounds of visitors as an important part of visitor experiences. Study findings suggest that a multi-sensory research approach may be useful in the development of standards of quality for crowding and levels of human sound. Very little of the variance in sound acceptability ratings is explained by respondent sensitivity to noise. Further research can clarify and extend these study findings, as well as develop methods for conducting similar studies in field settings.

Acknowledgements

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To each of them, I wish to extend my sincere gratitude and hope that I have made them proud.

Table of Contents

List of Tables and Figures

Chapter 1--Introduction

Introduction

Uninterrupted natural soundscapes are increasingly scarce in the world today. There are few places where a person can go to enjoy the sounds of nature without the intrusion of sounds from human sources. During the last century or so, enjoyment of natural quiet has become something that must be sought after, rather than something which can be taken for granted. The problem has become even more obvious during the last several decades, as the rate of change in our society seems to increase exponentially.

Many national parks have managed to escape the numerous changes that can affect soundscapes. However, escaping all of them is not possible when society is changing around the parks, often directly outside of park borders. Not only things such as airplanes and highways contribute to changes in park soundscapes, though. The number of people visiting national parks continues to increase with each passing year. These visitors all make sounds which contribute to the soundscape. Particularly in popular parks and heavily used areas, the large number of visitors can have a significant impact on park soundscapes. Ironically, many people choose to visit national parks so that they can experience the natural quiet typically associated with them. These visitors all have some impact on the soundscapes of parks, and may be significantly altering the very thing they came to experience.

This chapter introduces the purpose of this study of the role of sound in park settings and sets the context for a review of related literature. The subject of the study is described and followed by a statement of the problem. Next the objectives of the study are defined, and finally, the study questions are presented.

"Soundscape" defined

The term "soundscape" is similar to the term "landscape." However, rather than characterizing the visual features of the land as a landscape description would, a soundscape description characterizes the aural features of an area. A natural soundscape, therefore, is made up of sounds originating from nature and natural processes in an area, excluding sounds emanating from human-made sources. Although humans are part of nature, by definition the term natural soundscape includes non-human sounds making up the biophony (sounds of birds, wolves, and other living creatures) and the geophony (sounds of water, wind through leaves, etc.) that emanate from habitats (Krause, 2002). As one might imagine, natural soundscapes are not frequently found or experienced in their pure form. The size of the world population, the widespread locations of urban and suburban areas, and the use of various noise-producing technologies all make it quite difficult for people to find natural soundscapes on a daily basis. There are places, however, in which people may have more abundant opportunities to experience soundscapes without the constant presence of human-produced sounds.

Many national parks in the United States can and should provide these opportunities for visitors. National parks have been managed in such a way that the natural environment in many of them has escaped most of the effects of development. The National Park Service's dual management goals of protecting resources and providing opportunities for enjoyment of them make national parks a wonderful place to seek natural soundscapes.

The importance of soundscapes

National park soundscape legislation

In the National Park Service Organic Act, it is stated that the Park Service will "conserve the scenery, the natural and historical objects and the wildlife therein..." It is also stated in "Director's Order #47" (2000) that "an important part of the NPS mission is to preserve and/or restore the natural resources of the parks, including the natural soundscapes associated with units of the national park system." Natural sounds are considered to be an intrinsic element of what the Park Service is mandated to conserve.

The 1995 *Report on Effect of Aircraft Overflights on the National Park System: Executive Summary Report to Congress* acknowledges that resource conservation is the primary responsibility of the Park Service, according to the Organic Act as amended by the Redwoods Act of 1978.

The 2001 National Park Service "Management Policies" contains sections dealing specifically with policy regarding the preservation and management of soundscapes. It reiterates that in an effort to maintain the parks for future generations, in the event of a "conflict between conserving resources and values providing for enjoyment of them, conservation is to be predominant" (National Park Service, 2001). It again establishes that natural soundscapes are considered a park resource. In regard to external threats to the parks, it states:

> Recognizing that parks are integral parts of larger regional environments, the Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts; protect park resources and values; provide for visitor enjoyment; and address mutual interests in the quality of life of community residents, including matters such as compatible economic development and resource and environmental protection. (National Park Service, 2001)

It is also mentioned that the Park Service will take a leadership role and be proactive when issues arise that may affect a park's resources. In the section regarding restoration of natural systems, restoring natural soundscapes is called for specifically. (National Park Service, 2001)

Perhaps most importantly, the NPS Policies states that superintendents will use appropriate management planning to identify the acceptable levels of human-caused sound throughout a park. The Park Service will then take action to deal with inappropriate sounds by preventing or minimizing them. Visitors to the parks will not be allowed to engage in activities that unreasonably interfere with "the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park" (National Park Service, 2001).

The importance of soundscapes to wildland visitors

The vast majority of visitors to national parks feel that an important part of their visit is to enjoy natural quiet and the sounds of nature (Mace, Bell & Loomis, 2004; National Park Service, 1995). In wildland settings, people tend to be very sensitive to even low levels of noise from human sources. This holds true for studies conducted both in the field and in laboratory settings (Mace, et al., 2004). Noise in parks can also be annoying or intrusive to visitors (Miller, 1999) and can detract from their enjoyment of the experience.

The prevalence and distribution of human-produced sounds vary from park to park. Some parks, such as Yellowstone and Grand Canyon, have suffered relatively severe impacts to their soundscapes due to human-produced sounds. Other parks may not

have such obvious problems, but it is safe to say that no park is entirely free of human-produced sounds and still enjoys its natural soundscape, that of the wind, wildlife, and water or of no noticeable sound at all.

An example--Zion National Park, Utah

Zion National Park, located in Southwestern Utah, is an example of a national park in which sound has been monitored. Several times over the last 10 years the soundscape has been monitored in an attempt to understand it for purposes of protection and preservation, as well as to provide information for future management planning.

Sound observations were made in 1995, 1998, and 2000-2001. Information was gathered at various locations throughout the park and included factors such as decibel level variation, frequency of sounds, duration of sounds, and types of sounds. Having some long-term soundscape information allows for inferences to be made regarding changes in the soundscape of the park. It also assists managers in making better-informed decisions regarding future plans for the park and its soundscape-related policies.

Zion National Park is an interesting place to study soundscape because of the nature of the landscape in much of the park. The many canyons in the park result in unique sound conditions. Sounds may echo for long distances through canyons, bounce upward off of canyon walls toward those above, or not be heard by those in the bottom of a canyon until the sound source is directly overhead.

Why this study is worthwhile

Considering the importance of sound to visitors in wildland settings, as well as the importance placed upon sound in national park legislation, the effect of human induced sound on park visitors should be better understood. Hopefully, this exploratory study will contribute to such an understanding. Up to this point, sound has most often been studied in an urban context (Kuwano, Namba, Komatsu, et al., 2001). The effect of aircraft overflights in urban and suburban areas (Smith & Stansfeld, 1986; Staples, Cornelius & Gibbs, 1990); the effect of noise from other transportations systems (Miller, 2003); and the intrusive or disturbing effect of noise on the performance of tasks have all been studied fairly extensively (Kjellberg, Landstrom, Tesarz, et al., 1996).

Sound has been studied in a recreational context, but again, this research generally focuses on the effect of sound from aircraft overflights (Miller, 1999). Some studies have looked into auditory and visual interaction. Several have considered the interaction in terms of assessments of landscapes (Carles, Barrio & de Lucio, 1999; Carles, Bernáldez & de Lucio, 1992), one even in terms of a recreational setting (Mace, Bell & Loomis, 1999). However, that study, again, focused on aircraft sound. None of these studies have investigated the effects of the sounds of people on other recreationists or as part of the social environment in wildland settings.

The effects of sounds on people in a recreational context are also not fully understood, particularly the effects of the sounds of people rather than aircraft. Soundscapes are an issue of concern in national parks and other wildland settings. Findings gathered now may be used to shape future policy that affects the quality or preservation of natural soundscapes.

Problem Statement

Previous research has offered little information regarding people's perception of sound as part of the social environment in natural settings. There is a lack of experimental data and direct empirical analysis which would, perhaps, allow for a deeper understanding of this relationship.

By considering sounds of people, rather than aircraft or other mechanically-produced sounds, new and useful information about how sound affects people in natural recreational settings can be gained. Previously-used visual research methods can be modified and used in the context of a soundscape study to gain new and useful information that may provide more applicable results.

Objective

Of interest in this study is an understanding of how human sounds affect visitors in a wildland setting and an exploration of a multi-sensory approach as a way to assess several attributes of recreational settings. It is hoped that by adding sound to visual research methods used to understand perceptions of crowding, valuable information regarding people's perceptions of social conditions in a park setting can be gained.

Sounds produced by humans in a wildland recreational setting, such as talking, laughing and yelling, were used in order to assess how such sounds are perceived by other people. These sounds were added to visual methods of assessing people's perceptions of crowding. By adding sound, it is possible to build upon previously used methods in an attempt to gain more realistic results; just as adding the visual element into crowding studies improved the quality of study findings, including the aural element will

further improve the quality and accuracy of study findings. In real settings, people are not exposed to sounds or sights independently of one another. Therefore, it makes sense to attempt to study these elements in combination.

Study Questions

Previous studies of crowding have shown that the number of encounters with other people does not necessarily dictate respondents' evaluations of crowding. Factors such as perceived similarity to people encountered, activity in which the parties are engaged and behavior of people encountered have all been shown to moderate perceived levels of crowding. In one study, visitors surveyed were more bothered by the behavior of other visitors than the number of visitors they encountered (West, 1982). The most bothersome behaviors were yelling and other loud behaviors.

By adding sound to the visual methods of studying crowding, it will be possible to simulate, to some degree, conditions that visual representations alone cannot. In addition, it has been shown in studies of audio-visual interaction in landscape assessments that preference for a sound is moderated by the visual stimuli with which it is presented, and vice versa. Therefore, the following question is asked:

1. What is the relationship of human sound and number of people to acceptability ratings of social conditions?

As a follow-up to the first study question, study question 2 focuses on the possible effects of sound level on perceptions of crowding. As mentioned above, previous research has indicated that visitor characteristics such as behavior may contribute as

much to perceptions of crowding as do the number of encounters (Cole, 2001; West, 1982). The sounds of visitors in an area may portray, to some extent, the behavior of those visitors. With this in mind, the following question is asked:

2. Does the level of human sound in a setting affect the perceived acceptability of the number of people within that setting?

According to Weinstein (1978), people who are more sensitive to noise will have a lower tolerance for sound and are more easily disturbed than people who are less sensitive to noise. Participants in this study filled out a noise sensitivity scale adapted from Weinstein (1978)[1]. Their responses indicate how sensitive they are to noise in general.

Additionally, a scale developed for this study was used in an attempt to measure people's sensitivity to sound based on the context of the setting. People choose to visit particular settings for specific reasons. When people visit national parks and other wildland areas, many of them are looking for solitude, a chance to commune with nature, and a place where they can relax and escape from their busy lives (Mace, et al., 2004). People probably have different expectations for the types and levels of sounds they will hear depending on whether they are in an urban area or a natural area. Therefore, people may also be more sensitive to human-produced sounds in wildland recreation settings. Based on this, the questions are asked:

3a. How important are sound level and personal noise sensitivity to the acceptability of sound in a general context?

[1] The Weinstein Noise-Sensitivity Scale (1978) was developed as part of a study of college freshman which investigated initial reactions and ability to adapt to noise.

3b. How important are sound level and personal noise sensitivity to the acceptability of sound in a wildland recreation context?

It is hoped that by answering these questions an understanding of the interaction between the number of people in an area, the level of sound created by them, and the acceptability of such conditions can be gained. In addition, observations can be made regarding whether or not there is a relationship between people's sensitivity to noise and their assessment of the acceptability of the previously mentioned conditions.

Chapter 2--Literature Review

Introduction

In this chapter, information relevant to the subject of this study is presented. First, information related to sound is presented, including how we perceive sound, sound characterized as noise, sensitivity to noise, and a review of studies of sound in both urban and wildland contexts. Next, the importance of visitors' expectations for settings is discussed, including a section on solitude. Some studies in which the interaction of sight and sound was investigated are presented, as well as some other previously used visual methods. A discussion of different variables which can be used as assessment scales in studies of recreationists follows. A summary and questions raised by the reviewed literature are presented at the end of the chapter.

Our relationship to sound

How we perceive sound

In his chapter, *The Auditory Scene*, Albert Bregman defines perception as "the process of using the information provided by our senses to form mental representations of the world around us" (2002:215). In every situation, our senses can provide us with information about how something feels, tastes or smells, what we hear or what we see. The combination of all of these things shapes how we interpret a situation or setting and what we think about it. With all of the sensory input that we take in, however, why is it that we filter out some of the information? Bregman (2002) gives an interesting example about the perception of sound:

> Take the case of a baby being spoken to by her mother. The baby starts to imitate her mother's voice. However, she does not insert into the imitation the squeaks of her cradle that have been occurring at the same time. Why not? . . . Somehow she has been able to reject the squeak as not being part of the perceptual "object" formed by her mother's voice. (2002:216)

Similar to this example, we may be in a natural setting in which birds chirping, leaves rustling in the wind, water flowing and the sound of people's voices are all audible. Just as in the example, people may tend to separate out the sound of the people and perceive that as not being a part of the natural setting. The perceptual object, as Bregman says, of the sound of human voices may not fit in with the mental representation of the natural setting. When this happens, the sound (in this case human voices) seems to be out of place or disturbing.

Sound characterized as noise

These types of out-of-place or disturbing sounds are often referred to as noise, and if extreme enough in degree, intensity or frequency, noise pollution. Noise pollution is often due to human activities of one sort or another, and has been on the rise along with human population and use of various technologies. Ouis (2001) states that "[i]t is a well-known fact in all societies worldwide that noise is a serious environmental pollutant" (2001:109). People tend to characterize sounds which are unexpected, irregular, intermittent or high-pitched, and sounds which seem to offer no useful information as noise (Kariel, 1990). Whether actually categorized as noise pollution or not, the U.S. Environmental Protection Agency stated in a 1978 publication, "unwanted sound is America's most widespread nuisance" (1978:2). The concern expressed in the publication is that bothersome noise causes various health problems in people including sleep

disruption, hearing loss, heart disease and mental anxiety. Even if a person is able to "ignore" noise, she cannot keep her ears from taking in the signals and her body from reacting, consciously or subconsciously.

Even sounds that are not loud enough to actually damage the human ear can be quite annoying, disturbing and/or intrusive to people. Tatum (1996) offers an example to illustrate this point. He states that it is often accepted that 55 decibels is about the level of a normal conversation and, therefore, sounds of about 55 decibels should not be annoying. Tatum points out, however, that if someone is carrying on a prolonged conversation at 55 decibels, it might be quite difficult for another person to try to carry on his own conversation, study, read or sleep. If the 55-decibel conversation continues for five hours rather than five minutes, it might be annoying, just as if it is 3:00 in the morning rather than 3:00 in the afternoon. Under such circumstances, even a "normal" conversation at 55 decibels could be quite annoying.

The point of Tatum's example is that sounds may be characterized as noise in some situations, but not in others. It can depend on the context, the time of day, what else is occurring in the area or on the person hearing the sounds. People have different levels of sensitivity to noise, which is the topic of the next section.

Sensitivity to noise

Each person is affected differently by sound. Some people are more or less sensitive to sounds than others. Some types of sounds may seem very pleasant to some people, but irritating and unpleasant to others. Imagine selecting a random sample of people from a city street and placing them in a room where they would hear recordings of

sounds such as varying styles of music, a barking dog, or young children laughing. Some of the people might not be bothered by any of the sounds, some people might be bothered by all of them, and still others might be bothered by a select few.

Several studies described below have investigated this concept of sensitivity to noise. Typically, sensitivity is thought of as being a contributing factor to noise annoyance. Personal sensitivity to noise is seen as a relatively stable personality trait by some (Weinstein, 1978; Zimmer & Ellermeier, 1999). Many of the noise sensitivity studies have sought to strengthen a correlation between people's inherent level of noise sensitivity and the annoyance evaluations made by them.

Development of a scale for measuring noise sensitivity

In 1978, Weinstein published the results of a longitudinal study in which differences between subjects' initial reactions to noise as well as their ability to adapt to noise over a specific period of time were investigated. Fifty-five students filled out a questionnaire containing questions about noise sensitivity, including the 21-item Noise-Sensitivity Scale developed for the study, and general dorm living conditions, including noise, before the beginning of their freshman year. The students were then interviewed in the spring of their freshman year and were again asked questions about dorm living conditions and noise sensitivity. Weinstein found that noise-sensitive students were more disturbed by noise in the dorm than students with low self-reported noise sensitivity and that rather than adapting to noise over time, the students tended to be more bothered by the end of the school year.

Weinstein's Noise-Sensitivity Scale has been used in multiple studies since it was first developed, including studies which did not have students as subjects. Some of the items do refer to studying, but all items are not limited to situations that exclusively students would encounter (Weinstein, 1978).

Testing several noise sensitivity scales

Zimmer and Ellermeier (1999) tested Weinstein's scale, as well as three other noise sensitivity scales, in an attempt to investigate the validity and reliability of them. One scale was developed by Zimmer and Ellermeier and contained 52 items. The other two were one-item scales which asked the degree of participants' susceptibility to noise and susceptibility to sounds. The four scales were administered to 213 German students. It was found that the Weinstein and Zimmer and Ellermeier scales were reliable to a higher degree than the two one-item scales. In their study, as well as previous studies, there was no correlation between demographic variables and noise sensitivity.

The authors concluded that it is not recommended that single-item scales be used to measure noise sensitivity. Also, there were systematic differences in results from the two longer questionnaires, but it was acknowledged that the length of the Zimmer and Ellermeier scale may be prohibitive.

Noise sensitivity and task performance in a laboratory setting

Dornic, Laaksonen, and Ekehammar (1990) performed a series of six experiments in which subjects performed various tasks under a variety of noise conditions (See Dornic, et al., 1990 for a full description). Each of the participants filled out a Weinstein

Noise-Sensitivity Scale and several other survey instruments. It was found that noise sensitivity does not correlate with ability to perform tasks in a laboratory setting. However, noise sensitivity did correlate with noise-induced irritation, disturbance and tension during tasks for several experiments.

The authors concluded that participants with higher self-reported noise sensitivity may choose lower levels of noise in a laboratory situation. Those participants may also tend to feel higher levels of stress in laboratory situations in which noise is included.

Noise sensitivity in a hospital environment

A study of 150 postoperative patients (Topf, 1985) investigated the relationship between patient disturbance due to noise, amount of noise in the hospital room and general noise sensitivity of patients. Topf hypothesized that noise sensitivity of patients is predictive of the degree to which they are disturbed by hospital noise. In addition, she sought to verify that noise sensitivity is a personal characteristic rather than being attributable to decibel level.

As might be expected, Topf found that higher levels of noise in a patient's room correlated positively with degree of disturbance. She also found that higher levels of general noise sensitivity, as measured by Weinstein's Noise Sensitivity Scale, correlated with higher degrees of disturbance. In addition, the study provided support for the notion that noise sensitivity is a personal characteristic which is predictive of annoyance regardless of noise level.

A review of factors influencing noise assessments

In 1987, Job completed a review of social studies in which reactions to noise were assessed. He found that noise exposure explains less of the variation in reactions to noise than does attitude toward the source of noise and sensitivity to noise. He also found that studies using different measurement techniques and with participants of varying nationalities have had very similar results.

Previous research suggests that noise sensitivity is a personal characteristic which can have an effect on people's reactions to noise. Quite often, these reactions to noise are measured subjectively using degree of annoyance as a measure. When people are annoyed by a sound, it is often because the sound is disturbing or intrusive. In these situations, a person is required to divert attention from the task at hand to give attention to the sound. The next section reviews information related to attention and the difference between voluntary and involuntary attention.

Voluntary and involuntary attention

Involuntary attention, as opposed to voluntary or directed attention, requires very little effort, if any. Things that are interesting or exciting require very little effort to pay attention to. Paying attention to things that are not interesting, however, requires mental effort. In our daily lives, we are frequently in situations that require directed attention. When feeling mentally fatigued, such things can be quite burdensome (Kaplan & Kaplan, 1989).

People who are mentally fatigued may seek solitude or simply wish to be in an environment that does not require directed attention as a way to refresh themselves. This

type of experience may be found in a natural setting such as the one considered in this study. For many people, simply being in an environment that offers interesting things to see, hear, feel or experience--things which do not require effort to pay attention to--can aid in the alleviation of mental fatigue. However, if there are distractions present, such as some human-produced sounds, enjoying the setting begins to require directed attention. The effort required for directed attention detracts from the relaxing and rejuvenating experience of the setting. It seems logical, therefore, that the necessity of directed attention in this situation could certainly lead to annoyance at things like distracting sounds and perhaps make the once rejuvenating setting unacceptable.

As Hammitt asked in reference to the type of attention, involuntary versus voluntary, "Is this not part of the 'solitude' to which wilderness users refer--the chance to get away from it all? Not a chance for complete isolation, but a chance to select an environmental setting where involuntary attention is the dominant means by which information is processed" (1982:485).

Knowing that people often seek solitude and recreational settings in which voluntary attention is not required, two aspects of sights and sounds of a recreational setting--the number of people visible and the sound of people in the area--were focused on specifically. In an attempt to understand the relationship of sound and its effects on people in different situations, a discussion of related sound studies and crowding studies follows. Presented first are studies of noise in general urban or suburban environments. These are followed by studies related to noise in a wildland context and its effect on visitors to such areas.

Previous studies of sound

Sound in general society

Most aural studies conducted in an urban context deal with sound and its effect on people in their homes or while at work or school. Of interest is how much the sounds interfere with tasks or how much annoyance results from sounds. The types of sounds commonly focused on are often those from aircraft or nearby airports. Sounds associated with general urban settings have also been investigated.

Aircraft sound

In a 1986 study of aircraft noise exposure and the occurrence of everyday errors, Smith and Stansfeld used subjects who had taken part in aircraft sound studies in 1977 and 1980. Of interest was whether or not people living in high noise areas reported higher occurrences of everyday errors than people living in low noise areas. Examples of everyday errors as presented in the study are forgetting an appointment, forgetting why you went to a certain part of the house, or having to reread something several times. Subjects were also asked whether or not they considered themselves to be more or less sensitive to noise than other people.

The results of the mail-back questionnaire indicated that those living in a high aircraft noise area reported more occurrences of everyday errors than those living in low aircraft noise areas. People who reported themselves as more sensitive to noise also reported a higher rate of everyday errors, but there was no correlation between the level of aircraft noise and noise sensitivity. The authors recommended repeating this study in an attempt to clarify why noise sensitive subjects reported a higher occurrence of errors.

They also note that it is not clear whether these findings would translate to other types of noise, or are unique to aircraft noise.

Staples, Cornelius and Gibbs (1999) researched noise disturbance based on the threat of noise to environmental quality in neighborhoods in the vicinity of a developing airport. A questionnaire containing several different scales was distributed in five neighborhoods located near the airport with an average sound level of 55 to 60 decibels (See Staples, et al., 1999 for a full description).

It was found that environmental noise risk assessment did, in fact, predict disturbance. However, general annoyance with neighborhood conditions and noise sensitivity did not predict disturbance. Those participants who were disturbed by noise also tended to be more particular about other neighborhood attributes.

Transportation system sound

Miller's paper (2003) focused on noise resulting from the transportation system in the United States. In the article, Miller contends that although the effects of transportation system noise are examined and mitigated in areas where people live, very little attention has been paid to the overall effect of transportation noise on the soundscape over larger areas. Miller attempted to estimate the effect of transportation noise in the United States. To address this issue, Miller looked at the influence of noise created by the three main parts of the U.S. transportation system: highways, railways and commercial plane routes. County by county, for each of the 48 contiguous states, a baseline noise level was determined based on population and local traffic networks. The sound from a

transportation source was assumed to be noticeable if its decibel level is higher than that of the county's baseline decibel level. For a full description of methods see Miller, 2003.

Graphical depictions of the results could not be included here (see Miller, 2003) but to summarize, highway noise is audible in almost every county in the country for at least part of the day, with greater noticeability in the eastern half of the country and on the western coast. Railway noise is less noticeable in both the number of counties and percent of time audible with the eastern half of the country being more affected. Commercial jets are noticeable during a higher percentage of the day compared to both highway and railway noise, although it is noticeable in slightly fewer counties than highway noise.

Ouis (2001) reviewed published findings related to road traffic noise and its effect on people's well being, mainly in terms of annoyance. Annoyance is one of the first outward signs of stress caused by exposure to noise and is a widely reported reaction (Ouis, 2001). He found that long-term exposure to traffic noise leads to discomfort, and therefore reduces people's well-being.

Intrusive sound

In "Scaling the Annoyance of Intrusive Sounds," Fidell and Teffeteller (1979) studied whether sounds at relatively low levels might be judged by participants to be disproportionately annoying and disruptive compared to sounds at higher levels. Considering that previous research had indicated that the annoyance of low level sounds is related to the background sounds, they hypothesized that how noticeable low level sounds are might be a major factor in how annoying they are. Another purpose of the

study was to find at what levels sounds are noticed by people involved in a foreground task.

The ten study participants played video games during a two hour session. During the session, background noise was played constantly with interruptions by other sounds such as that of an egg beater or vacuum cleaner. Participants pushed a button each time they heard a sound other than that of the background sound and gave an annoyance rating to each intrusive sound.

Fidell and Teffeteller found that sounds were noticed at 48 decibels, on average, while participants were engaged in a foreground task. They contrast this with findings from a previous study in which participants who were not engaged in a foreground task noticed sounds at about 38 decibels on average. They also concluded that the annoyance of the sounds could be related to how detectable the sounds were. Because the sample size was so small, definitive claims based on the findings could not be made, and repeating the study with more participants was recommended.

A 1996 study by Kjellberg, Landstrom, Tesarz, Sőderberg and Åkerlund looked into annoyance caused by noise in the workplace. Because noise level has been shown to account only partially for annoyance, they considered hearing status, sex, and the necessity of the noise as judged by the subjects.

Sound levels in the workplaces of 439 subjects were recorded; all levels were between 40 and 85 decibels in each of the three workplace types--office, laboratory and industrial. Annoyance ratings between zero and 100 were elicited from participants regarding the noises, and information such as the effect of noise on performance of work and the frequency of attention paid to the noise during the work day was gathered. The

cumulative time of exposure to the same noise environment, work task characteristics, type of work site and individual characteristics (age, sex, hearing status and noise sensitivity) were recorded. The participants also rated characteristics of the noise which they were exposed to in their workplace as follows: "variability (frequency of changes of the noise during a work day); predictability (number of surprising changes); degree of self-control of noise, interference with speech; estimated possibility of lowering the noise level in the work place; the presence or absence of different noise sources" (1996:125).

Kjellberg, et al. (1996) found that, by including the variables mentioned above in analysis of noise annoyance, they were able to greatly increase the variance in annoyance attributed to noise by study participants. For a full discussion of results see Kjellberg, et al. (1996).

The effect of sound on wildland recreation

In 1934, Secretary of the Interior Harold Ickes mentioned his concern about the effect that air traffic might have on national parks (Lee, 1994). In the decades since, there has been quite an increase not only in aircraft noise, but in other sources of noise in wildland settings as well. The extensive highway system, the increase in numbers of cars and people in parks and other recreation areas, and the dramatic increase in commercial and air tour flights over many national parks have had an effect on the soundscape of recreation areas and most likely on recreationists themselves.

To address these issues, a number of soundscape studies have been conducted focusing on recreation areas such as wilderness and national parks. The following section

reviews some of these studies related to sound and the impact on visitors to recreation areas.

Aircraft overflights of wilderness areas

One study focused on the effect of aircraft overflights on visitors to wilderness areas in Wyoming (Tarrant, Haas & Manfredo, 1995). Again, as in many other sound studies, participants were asked to rate their annoyance at aircraft overflights. In addition, information regarding visitors' motives for recreation, their past recreation experiences, and their attitudes and tolerance for encountering overflights was collected from the 439 participants.

The study showed that over one-third of the participants were not annoyed by overflights, but instead, overflights had more of an effect on solitude and tranquility. Participants with more previous experience in wilderness recreation, those with a stronger preference for solitude, and those with a negative attitude toward seeing aircraft reported more negative evaluations of aircraft overflights than other participants.

In the study, the actual decibel level of overflights was not recorded so it is not possible to look into the relationship between participant evaluations of overflights and the actual sound level produced by them. Another limitation is that participants were asked to focus on one particular overflight that they remembered, rather than looking at the cumulative effects of all overflights experienced. Despite these limitations, the authors recommend that in similar future studies "a multidimensional measure of visitor evaluations of airflights should be employed as the dependent variable. . . [and] non-noise

factors, such as wilderness visitor characteristics, should be included as potential independent variables..." (1994:358).

In another study of the effects of overflights on wilderness recreationists by Fidell, Silvati, Howe and others (1996), decibel levels of aircraft were recorded at 12 wilderness areas. Although they were not able to record completely accurate decibel data, it was possible to roughly construct the relationship of annoyance evaluations and estimated noise exposure of participants. Also, this study focused on the cumulative effects of overflights on visitors, rather than focusing on specific overflights as in the previously mentioned study.

The authors found that the vast majority of participants were not really bothered by aircraft overflights, with annoyance of any degree being reported only five to 32 percent of the time at the 12 wilderness areas studied. A significant amount of annoyance was reported a total of five percent of the time for all study areas cumulatively.

Because the 12 study sites were specifically chosen based on how much overflight exposure there was estimated to be; how much visitor use there was; the diversity of recreation types; and the diversity of ecotype and natural soundscape, the authors caution against applying the findings to other wilderness areas. It was also recommended that an effort be made in future studies to obtain more accurate noise exposure levels than was possible for this study.

Wilderness managers identified aircraft overflights as an important threat to wilderness areas in several surveys reviewed by Hodapp (1989). Because of this expressed concern, an understanding of the effects of overflight noise on wilderness users is important, but Hodapp observed that most of the studies relied upon for this

information come from the field of study investigating the effects of sounds on communities near airports. The data for these studies had been collected primarily in urban settings. Because the ambient noise level in these settings is much higher than typical ambient noise levels in wilderness areas, Hodapp contended that findings of these studies are not really applicable to wilderness areas. He pointed out that because of the low ambient sound levels, aircraft noise is clearly audible for longer periods of time when flying over a wilderness area compared to flying over an urban setting.

Hodapp outlined several guidelines for a proposed study of overflights of wilderness areas. These guidelines focused on establishing a clear record of ambient sound levels in wilderness areas so that the possible effects of any proposed changes to regional overflights can be carefully assessed.

Overflights of national parks

Another report (Miller, 1999) focused on the effects of overflights on national park visitors. Two studies were included: a three-part study consisting of visitor interviews, sound monitoring and sound source identification, and a cognitive survey aimed at finding out how visitors interpret specific words and phrases related to sound. The studies were conducted at three parks which have high numbers of sight-seeing overflights--Grand Canyon, Hawaii Volcanoes, and Haleakala National Parks.

Miller noted that visitors to overlook sites that required short hikes reported more interference with natural quiet and annoyance than did visitors to overlooks that require only a short walk to access. He speculates that "it may be that visitors who commit some

time to a particular park experience are likely to be more sensitive to the intrusions of tour aircraft noise than are visitors at more easily accessible sites" (1999:115).

Also worthy of note is the fact that visitors make a distinction between interference and annoyance with regard to aircraft noise. Noise interference can lead to annoyance, but does not always do so; once the noise has ended, the interference ends, but annoyance at the noise may continue. Miller also notes that most visitors did not mention aircraft noise when asked open-ended questions about their experiences.

Overflights of recreational areas

Another study acknowledged the limitations of knowledge about aircraft noise in recreational settings and human responses to it. Aasvang and Engdahl (2003) conducted a combined field and laboratory study to investigate this relationship in an attempt to develop indicators for use in recreational areas.

The field study took place in a recreation area near a Norwegian airport. Twenty-six participants recorded the time of each overflight during a 50-minute session. For each observed overflight, the participants recorded the level of their annoyance and whether or not the aircraft noise was acceptable in an outdoor recreational setting. At the end of the session, participants also filled out a questionnaire asking about total annoyance from all of the aircraft observed during the session.

During the field session, a recording was made which was later played for participants in the laboratory portion of the study. Twenty-five of the participants from the field study were present in addition to another 13 participants. The participants recorded the same information and completed the same questionnaire as in the field

study. It was noted that the background noise level was lower in the lab study than the field study and did not include background sounds such as wind, bird songs and people passing by.

Aasvang and Engdahl found a high correlation between the level of noise exposure and the annoyance and acceptability for individual overflights and for overall assessments for both the field and lab studies. The authors feel that the highly controlled study offers some advantages, but realize that it might be somewhat unrealistic.

The studies reviewed here illustrate by their focus and methods that there is a notable difference in the context in which people are exposed to noise--urban versus wildland. People have different expectations for sound, as well as other conditions, when they are in different places such as an urban center, their homes, or a wildland or backcountry area. Sound in a wildland recreational setting was the focus of this study. The following section looks into the expectations of visitors to these natural areas.

Sound and setting expectations

Visitors to natural areas often have certain expectations about what the area will be like or should be like and visit particular destinations for specific reasons (Chhetri, Arrowsmith & Jackson, 2003). Not only do people need to choose what kind of activities they wish to engage in and what kind of experience they want, but also what type of setting to visit (Harrison, Clark, & Stankey, 1980). It seems likely that people's expectations for a setting are somewhat responsible for, or at least influential in, their decision to visit a particular area. It follows, therefore, that visitors' experiences in an area may certainly be affected by the characteristics of the setting. With this in mind, it is

clear that the setting in which people recreate or which they choose to visit is important to them. Their satisfaction or enjoyment of the experience is related to what characteristics, such as sights and sounds, they perceive in that setting (Chhetri, et al., 2003). If these setting characteristics are not what was expected or are perceived as unpleasant or unacceptable, visitors may not enjoy their experience, or may not be able to accomplish the goal of their visit.

An example to illustrate the importance of expectations of visitors for recreational settings can be found in a study of the acceptability of encountering various types of visitors to a national park reserve in Canada (Freimund, Vaske, Donnelly & Miller, 2002). In the study, participants were asked how acceptable they found a range of encounters with visitors engaged in different activities within three different areas of the preserve: access areas, attraction sites and wild places. Access areas were described in the survey as areas where numerous encounters can be expected with many different types of visitors. Attraction areas were described as places with cultural significance and outstanding natural features. Finally, wild places were described as isolated areas with opportunities for solitude.

Twelve encounters with kayaks were assessed as very acceptable in access areas and somewhat acceptable in attraction areas. Kayak encounters became unacceptable at nine encounters in wild places. Contrasting with this, only three motorboat encounters were acceptable in access areas; less than three encounters were acceptable at attraction sites. Motorboat encounters became unacceptable with only one encounter in wild places. Likewise, hearing aircraft and motorized boats was significantly less tolerable in wild

places than in attraction areas and even less tolerable than in access areas. Motorboaters were more tolerant of both aircraft and motorized watercraft sounds than kayakers.

The differences in mean acceptability ratings of each different kind of visitor and for each different type of place within the preserve indicate that the expectations of the visitors were different depending on the context of the area. In the study, expectations clearly influenced the perceived acceptability of encounters with other visitors.

Visitors to areas such as the one explored in this study may often have particular reasons for a visit, and therefore, particular expectations. Many visitors to national parks are searching for solitude, for a chance to commune with nature, and as a way to escape the hustle and bustle of modern life. People often visit parks in search of a relaxing and rejuvenating experience and as a way to escape the stressors of urban environments (Mace et al., 2004) that are so prevalent in many people's lives. The best way to relax and be rejuvenated, for many, is to enjoy some "peace and quiet."

Zion, like many other national parks, contains large areas that are recommended for wilderness designation and managed accordingly. Therefore, recreation activities in the park have often focused on ideas linked to wilderness: solitude and opportunities for primitive and unconfined recreation (Freimund, et al., 2003; NPS, 2001).

Solitude

People often do seek opportunities for solitude when visiting areas that are either actually designated as wilderness or perceived to be wilderness or backcountry areas by visitors. It has been shown that one of the setting attributes that wilderness visitors value most is campsite privacy (Merigliano, 1990). Wildland visitors frequently value solitude

as well as campsite privacy in their wilderness experiences. As described by Hammitt (1982), solitude does not have to mean physical isolation. Rather, he suggests that people may experience solitude while with a group, as long as they feel comfortable and free to be themselves in that group. However, if they feel disrupted by other people, either by seeing or hearing them, the feeling of solitude is impaired.

As a way to experience solitude, people also look to wilderness and backcountry areas where they can escape and isolate themselves, not from other people, but from social structures, rules and expectations of daily life (Hammitt, 1982). These are all elements over which most people have little control on a daily basis. Hammitt suggests that when people seek solitude, they are really seeking opportunities to control their environment and have the freedom to choose if, how and when they will interact with other people or exchange any sort of information with them. So long as these functions stay within a person's control, she maintains her ability to experience solitude, even if others are within sight or hearing distance.

People often seek solitude as a way to relax and rejuvenate themselves, particularly if they feel mentally fatigued as a result of work, stress, or the rigors of everyday living. Many people visit national parks as a way to find solitude because of the backcountry and wilderness settings that can be found there. In the solitude of wildland settings, people are able to have natural experiences in which they can forget about daily life and spend time in self-reflection, discovering themselves in a natural environment (Miller, 2003).

In this study, two aspects of settings which can have a significant effect on visitor experiences, what people hear and what people see, are considered. The 1995 "National

Park Service Visitor Survey" was conducted system-wide to determine the importance of natural quiet and natural scenery to park visitors. The Visitor Survey found that over 90 percent of survey respondents gave "enjoy natural quiet" as a reason for visiting the park a rating of moderately to extremely important and about 93 percent rated "view natural scenery" as moderately to extremely important (United States Department of the Interior, National Parks Service, 1995). These findings indicate that both the visual and auditory conditions of a setting are important parts of visitor experiences.

Visitors to wildland recreation areas do come with certain expectations for the condition of the setting. These may be expectations for what type of activity they will engage in, what type of wildlife might be seen, or, as focused on in this study, how many people they will see and how much sound from people they will hear.

With the knowledge that visitors have these expectations, managers of wildland recreation areas often use a system of indicators and standards to monitor the conditions of specific setting attributes about which visitors might be concerned. The following section discusses indicators and the use of sound level and number of people as indicators.

Indicators and standards of quality

In a National Park Service handbook (1997), indicators are defined as "specific measurable variables that will be monitored" and standards are defined as "minimal acceptable conditions" of those variables (1997:11). Possible indicators include things such as the social environment (encounters with other visitors) and the physical

environment (erosion along trails) (Manning, 1999). A standard for encounters with other visitors, for example, may be defined as no more than 10 per day along a particular trail.

Research geared toward identifying potential indicators for recreation areas has often focused on what types of variables would define the quality of recreation experiences for visitors (Manning, 1999). In studies in which visitors were asked about variables important to them, both sound level and number of people have come up as possible indicators of quality. In a 1990 wilderness study by Merigliano, "number of occupied campsites within sight or sound of each other or visitor report of number of groups camped within sight or sound" was identified as a potential indicator (Manning, 1999:128).

Shindler and Shelby (1992) conducted a study at wilderness campsites and also listed "out of sight/sound of other visitors" and "screening from other sites" as potential indicators (Manning, 1999:128).

Roggenbuck, Williams and Watson (1993) conducted a visitor study at four wilderness areas. The list of potential indicators resulting from this study included a number of sound- and encounter-related items including two addressing the amount of noise from human activities originating both from inside and outside the wilderness area; three related to the number of hiker and horse groups that camp within sight or sound of a person's campsite or pass by the campsite; and four related to the number of hikers or hiker groups seen along the trail either in passing or for an extended time (Manning, 1999:129).

In a study of Cohutta Wilderness visitors in Georgia, Shafer and Hammitt (1994) also came up with several potential indicators: "The total amount of time that your party

has in an area without seeing or hearing anyone else;" "The amount of noise heard in the area that comes from other wilderness visitors;" "The amount of noise heard in the area that comes from outside the wilderness;" and "The number of groups that pass within sight of your camp" (Manning, 1999:130-131).

Visual methods for studying crowding

Number of encounters with other people is something that frequently appears in indicator studies and is the subject of quite a bit of research. Crowding in recreation areas has been studied for years because it is assumed to not only have an effect on resource conditions, but also on the quality of and satisfaction with visitor experiences.

In earlier studies, the assumption was that the more encounters a person had, the more crowded that person would feel, and therefore a reduction in the quality of the experience would result (Cole, 2001). However, later studies did not support this, finding that in some cases, the perceived quality of experiences actually increased with increasing numbers of encounters. In many cases, it is not the number of people encountered, but some characteristic of the encounters that affects the quality of the visitor experience, such as whether the two groups of recreationists are engaged in the same type of activity; the level of experience of the recreationists; and the behavior of the group encountered (Cole, 2001; Manning and Freimund, 2004; Vaske and Donnelly, 2001).

One research method that has helped to address encounter characteristics more directly has been the use of visual research methods. Crowding studies that do not use visual methods depend on verbal descriptions of settings or simply ask participants to

indicate the maximum number of acceptable encounters either as an open-ended question or by presenting several different numbers of possible encounters which participants rate. When images depicting different levels of crowding are shown, it allows for more control of the variable and more consistent results. All survey respondents see the same number of people as well as some characteristics of those people. The participants do not need to make interpretations or assumptions about things such as group size or type of activity because the varying conditions are presented to them. (Manning & Freimund, 2004)

Because things such as visitor behavior, group size and type of recreation activity can have an effect on perceived crowding, Manning and Freimund (2004) contend that visual research methods are a better way to study crowding because these types of things can be presented visually to study participants. Behavior, in particular, is something which is not easily conveyed through narrative descriptions and can be presented, to some extent, through visual representations of recreation settings.

Another benefit of visual methods is that it allows people to more accurately judge acceptable numbers of people or encounters in high use areas. It is difficult for people to report accurately the number of people or groups they encountered in high use areas. There is also more variability in standards for crowding derived from studies in high-use areas, likely the result of measurement error resulting from the difficulty of recalling high numbers of encounters. (Manning and Freimund, 2004)

Another point of interest described by Manning and Freimund is the difference in reported numbers of people that are acceptable when visual methods and narrative methods were both used in the same place. When photographs were used to find the crowding-related standard of quality for one particular area, the result was about 28

people at a time. However, a narrative approach yielded a crowding-related standard of 17 people at a time for the same area. Manning and Freimund suggest that crowding literature may support the standard of 28 people at one time as being more realistic because it allows people to observe some characteristics of the visitor encounters. As mentioned previously, characteristics of encounters such as behavior, group size and type, and activity can all have an effect on perceived crowding.

By incorporating visual aspects into studies of crowding, it has been possible to understand, in more detail, the effects of encounters on recreationists. Studies of factors other than crowding have used visual methods as part of the research. Below are descriptions of several studies which have looked into the interaction between sight and sound.

Interactions between sight and sound

By including both images and sounds in the following studies, researchers were able to investigate relationships between factors that would not have been possible when using only images or sounds. A more complete understanding of previous findings is possible by investigating the interactions of sights and sounds and how people assess them together versus individually.

Urban settings

Kuwano, Namba, Komatsu, Kato and Hayashi (2001) investigated the auditory and visual interactions of traffic and foliage by presenting to study participants a set of varying conditions. Some participants evaluated only auditory stimuli, some only visual

stimuli, and others evaluated both presented together. They found that both the traffic noise and the sound of rustling leaves were evaluated negatively when presented alone. When visual stimuli were presented independently, images without any visual foliage and showing only cars were evaluated more negatively than images showing at least some green foliage. When the visual and auditory stimuli were presented together, it was found that the sound of traffic was evaluated less negatively if green foliage was visible. The sounds of rustling leaves were evaluated less negatively when presented with images showing green foliage.

Carles, Bernáldez and de Lucio (1992) also conducted a study of audio-visual interactions with 127 school-age children. The four sounds used were that of birds, water, crickets, and a park (children's voices and distant traffic), and the eight images depicted several natural landscapes with varying types and degrees of vegetation, an old water mill in a forest setting and a suburban park.

The natural sounds, in particular bird sounds, were much more preferred than the park sound. The barren steppe landscape was the least preferred of the eight depicted landscapes. The sound of water combined with a tropical river image was much more preferred than the sound of water combined with the barren steppe landscape. The authors attribute this variation to the presence or lack of congruence between the auditory and visual components of combinations. This was also found for the sound of crickets which was most preferred in combination with images depicting heavily timbered areas but not in combination with the barren steppe land. Again, the park noise-barren steppe land was much less preferred than that sound combined with images depicting human-influenced natural landscapes (olive grove, suburban park).

In a 1999 study, the influence of sound on landscape values was conducted with a focus on how the impact of sound on a landscape can connote a degraded environment (Carles, Barrio & de Lucio, 1999). Sounds used in this study included completely natural sounds as well as sounds containing human voices and mechanical sounds resulting from human activity. Images were of urban green spaces with a balance between built and natural elements.

The study focused on the hypothesis that sounds not expected in combination with the images would be regarded negatively as potential indicators of a degraded environment. As in the previously mentioned study, it was found that a perceived incongruence between sights and sounds led to more negative evaluations. Interestingly, images of city parks were assessed more negatively when combined with the actual park sounds than with natural sounds. The authors contend that this points to a connection between decreased landscape quality and deteriorated soundscapes. Conversely, natural sounds combined with both natural and built-up images increased appreciation of the landscapes in some cases as compared to assessments of the landscapes independently. This, according to the authors, indicates that natural sounds can enhance landscapes.

Wildland setting

Eighty students participated in a study (Mace, Bell & Loomis, 1999) investigating the influence of helicopter noise on landscape assessments of Grand Canyon scenic vistas. Scenes were accompanied by background sounds (including things such as birds and running water), low level helicopter sound (40 decibels) and high level helicopter sound (80 decibels). Assessments of the landscapes included things such as tranquility,

solitude, naturalness and annoyance. Both the high and low level helicopter sounds negatively affected each of the variables assessed by participants.

Ratings of annoyance significantly increased for both levels of helicopter sound, while the ratings for tranquility and solitude, both important aspects of wilderness experiences, significantly decreased. In addition, scenic beauty evaluations of the vistas also decreased, showing that auditory conditions affect perceptions of the visual quality of landscapes.

These studies clearly illustrate a connection between the visual and auditory characteristics of a setting. In many cases, considering only visual or auditory aspects in a study may yield incomplete results, limiting the understanding as well as the applicability of the findings. It makes sense to ask study participants to evaluate both sights and sounds if the study is meant to investigate conditions of natural settings such as was done in this study. In real life, sights and sounds of a setting are not experienced independently of one another. Therefore, if exposure is limited to only one of these aspects in a study, participants cannot be expected to offer accurate and informed judgments of the setting. This is evidenced by the established interaction between auditory and visual stimuli in studies such as those described above.

Park sensitivity

As mentioned previously, if sights and sounds presented together seem incongruent, negative assessments result (Carles, et al., 1992 and Carles, et al., 1999). This seems to indicate that the context in which aural or visual stimuli are presented is important. Things that seem appropriate or acceptable in the context of one setting may

seem entirely inappropriate or unacceptable in the context of another. It may be that people are more sensitive to setting conditions such as noise level, type of noise, or number of people when they are presented in a wildland context.

With regard to sound, some people may be more sensitive to sound in settings where they feel natural quiet is more appropriate than loud or human-produced sounds. This is illustrated by the findings of Carles, et al. (1999) mentioned above--if human sounds were audible in combination with images depicting natural areas, participants felt it was an indication of degradation to the natural environment. Likewise, this is the case in the Freimund, et al. (2002) study mentioned previously; sounds of aircraft and motorboats are tolerated much less in wild places than in attraction sites or access areas. In the current study, the national park setting may account for some of the apparent sensitivity to higher levels of human sounds; some people may expect that national parks be areas with little human sound and therefore find human sounds, particularly at higher levels, to be unacceptable.

Setting may also affect how sensitive people are to levels of crowding. Crowding studies conducted in heavily-used areas do tend to show a correlation between the number of people encountered and perceived crowding. However, in less heavily-used areas such as some parks and wilderness areas, this relationship is not evident. It may be that factors such as a person's expectations in such settings influence how crowded she perceives the area to be. (Cole, 2001)

As a way to investigate setting-specific sensitivity to noise, a 10-item Outdoor Recreation Noise Sensitivity Scale was developed. The format of the scale and the style in which the items were worded were based on the Weinstein Noise Sensitivity Scale.

However, unlike the general context of Weinstein's scale, this scale was specifically designed with a wildland recreation context. The items reflect situations which may occur in such a setting with a specific focus on sound from human sources in those situations. Items were written to reflect dimensions which frequently appear in recreation research focusing on experiences of visitors (Manning, Valliere, Wang & Jacobi, 1999; Mace, et al. 1999). These dimensions include displacement[a], solitude[b], social norms[c], goal interference[d], naturalness[e], crowding[f] and being bothered[g]. The 10 items are listed below with the corresponding dimensions indicated by the superscript letters.

1. When I am outdoors, it bothers me to hear human-caused noise from a nearby road. [g]
2. Hearing other people interferes with my enjoyment of the outdoors. [d]
3. I mind if people yell or laugh loudly while they are outdoors. [g]
4. If I am being quiet while I'm outdoors, other people should be quiet too. [c]
5. Hearing aircraft interferes with my enjoyment of the outdoors. [d]
6. At night, people should be quiet while they are outdoors. [c]
7. If there is human-caused noise in the area, I am likely to go someplace else. [a]
8. Even if I can't see people but I can hear them, I feel like there are too many people in the area. [f]
9. I can only experience solitude in quiet places. [b]
10. If I can hear human-caused noise in an outdoor area, it makes the place seem less natural. [e]

The scale covers a broad array of visitor experience dimensions intentionally because it is an experimental scale. Scale items were rated on a six-point scale ranging from "always" to "never" and including "I don't know" as an option. These setting-specific assessments may offer some insight into context-specific noise sensitivity.

People make judgments about settings as they experience them through the lens of their personal sensitivity as well as their expectations of setting conditions based on different contexts. In this case, when people observed the settings presented to them during the survey, the particular context as well as their personal sensitivities to number

of people and sound came together and resulted in their judgments of how acceptable each setting was to them.

When asking study participants to judge a setting, there are a number of approaches that can be used including scales of preference, acceptability and pleasantness, a number of which were employed by the studies above. Below is a discussion of some of these scales and considerations that led to the choice of an acceptability scale for this study.

Judgments of settings

Various scales are used in studies allowing for different types of judgments to be made depending upon what study participants are meant to observe and what the study was designed to investigate. Research focused on developing indicators for various environmental and social conditions has typically employed one of the following evaluative dimensions: preference, desirability, pleasantness, ideal, favorableness, acceptability, satisfaction, okay, or tolerance (Manning, et al., 1999).

Each of these scales has advantages and disadvantages. Also, results often differ based on which evaluative dimension is used. For example, Manning, et al. (1999) found in a review of crowding-related studies that assessments made by participants using preference-based scales versus acceptability-based scales differed substantially. Numbers of encounters preferred were often less than half of the number of acceptable encounters. The reason for these differences is the difference in meaning of each of these dimensions to study participants. (Manning, et al. 1999)

By comparing multiple studies, Manning, et al. (1999) found that the various assessment scales seem to fall along a spectrum ranging from preference scales on the low end for encounters to scales of absolute tolerance on the high end. Falling more in the middle of this spectrum are management action and acceptability. This seems logical considering, for example, that while people may prefer to encounter only five other visitors along a trail they may be able to accept 10 encounters. At the point when 12 encounters occur, people may support management action limiting access to the trail, or if 20 encounters are reached, people will no longer tolerate the crowded conditions and may choose to go elsewhere.

For this study, an acceptability scale was chosen. Using this scale, participants assessed the acceptability of the number of people visible and the level of human sound audible in settings presented to them. Participants judged the settings based on acceptability for several reasons. As mentioned above, acceptability falls in the middle of the spectrum of possible options for a scale (Manning, et al. 1999; Manning and Freimund, 2004) and is neither too liberal nor too conservative.

Judging the acceptability of settings allows participants to indicate what conditions they find acceptable or unacceptable. This type of information may be more useful and applicable than knowing what setting conditions people prefer. For the sake of the quality of visitor experiences, it might be better to base management decisions on what visitors consider to be acceptable rather than basing decisions on conditions visitors assess as degraded to the point that they may choose to go elsewhere. If the goal of management is to provide high-quality visitor experiences, it does not seem logical to

allow conditions to degrade enough that visitors are displaced, but makes more sense to attempt to maintain conditions acceptable to most visitors.

In addition to being in the middle of the range of possible scale choices, an acceptability scale was used in a previous study which investigated crowding in Zion National Park (Manning, Freimund & Marion, 2004). The use of an acceptability scale in this study will allow for comparisons to be made between the two studies, and perhaps, therefore, for more useful information to be gained.

Summary and questions emerging from the literature

A multi-sensory approach

In this study, the intention was to consider two particular conditions that make up a setting, the level of human sound and the number of people visible, and to employ a multi-sensory approach to studying visitors' experiences. Up to this point, the majority of sound research has focused on noise, typically from aircraft or other transportation systems, in an urban setting. Other research has looked into noise as an intrusion upon activities or tasks.

Research related to sound and its impact on recreationists has, again, primarily focused on aircraft noise. Those studies which have looked at the interaction of sight and sound have typically been done in landscape assessment studies not specific to recreation. The study reviewed here which does look into this interaction in a wildland recreation context investigates the effect of aircraft noise on assessments of the landscape. Additionally, another field of study which has begun to employ visual methods is

recreation crowding research. However, these studies have included only the visual aspect of settings.

Questions emerging after a review of this literature are: What is the impact of the sound of humans on visitors to a recreation area? What effect will different levels of sound and different numbers of people have on the acceptability of settings?

Noise and context sensitivity

To provide more insight into the setting assessments provided by study participants, the Weinstein Noise-Sensitivity Scale and the newly-developed Outdoor Recreation Noise Sensitivity Scale were also administered. The prospect that these scales may make it possible to identify any moderating effects of general noise sensitivity and context-specific noise sensitivity on acceptability assessments of the settings was investigated in this study. Literature has shown that noise sensitivity is a personal characteristic that may have more of an effect on noise annoyance than actual noise exposure. Whether or not this is also the case for assessments of acceptability can be answered by the study findings.

Both crowding research and studies of audio-visual interaction support the notion that context can make a difference in perceptions of visual and aural variables. The Outdoor Recreation Noise Sensitivity Scale was used to contribute to a further understanding of this.

A question emerging from this literature is: Will personal sensitivity to noise have an effect on assessments of acceptability of different levels of sound?

Judgments of setting acceptability

What is of interest in this study is the relationship between characteristics of settings, based on the number of people visible and the amount of audible human sound, and how these settings are assessed by people with varying degrees of noise sensitivity and in a particular context. Likewise, the relationship between levels of sound and acceptability of crowding conditions is of interest. These relationships were tested through participant assessments of acceptability for the varying combinations of sounds and images.

The use of an acceptability scale was based on the literature indicating that it is a mid-range scale, neither too liberal nor too conservative. Acceptability scales have been used frequently in studies of crowding in recreation settings and studies of visitor experiences.

A question emerging from this literature is: Will the sound level of the settings have an effect on perceptions of crowding?

In a review of literature relevant to this study, no other studies employing a multi-sensory approach to research of recreational settings were discovered. The intent of this experimental study was to use such a multi-sensory approach to present a surrogate representation of reality. The use of a multi-sensory approach has, in part, been well-grounded in crowding research literature, and the benefits of a visual research approach have been documented in studies of subjects such as recreation crowding, scenic beauty, and campsite impacts. Adding sound to this approach is a new method, but the success of previous visual research methods is encouraging. The multi-sensory research methods used in this exploratory study are described in the following chapter.

Chapter 3--Methods

Introduction

In this chapter, the methods employed in development and administration of this study are described. First is a description of the place the study focused on and why it was chosen. Next is a detailed description of the survey instrument, including how sounds were recorded and edited, how the visual portion of the survey was designed, and what was included in the survey response form. There is then an explanation of how the survey was conducted, followed by a description of how data were managed.

Study area

Zion National Park in southwestern Utah was chosen as the area of focus for this study. There are possibilities for many unique soundscape characteristics due to the canyon setting of the park and the presence of many smaller canyons which are popular hiking destinations for park visitors.

Zion National Park, established in 1909, encompasses almost 150,000 acres of land characterized by deep sandstone canyons with towering rock walls as well as high mesas and plateaus; the northern portion of the park has forest cover while the southern portion of the park has desert vegetation. The most frequently visited area is Zion Canyon, on the western side of the park, which was the area focused on in this study. (National Park Service, 2001)

Many of the smaller canyons in Zion National Park are easily accessible to visitors with trails leading directly into or through them. Within many of these canyons, sounds often seem to echo or travel longer distances than in open-air settings. Therefore,

sounds originating within a canyon may seem to be louder or closer than they actually are. Sounds from within a canyon may also travel upward and be easily heard above the canyon walls. It was also observed that when in a narrow canyon, the origins of sounds from above or outside the canyon are harder to place.

Many of the canyons in the park are very narrow and winding, limiting visibility ahead of or behind a person's location. In such areas, it is possible to hear people even when they are not visible. This may be due to the way that sound travels through a canyon, or it may simply be that people are nearby but not visible around a bend in the canyon wall.

The Virgin River Narrows is an area in Zion Canyon which is aptly described by all of the above characteristics. It is, as its name indicates, a narrow canyon with walls that in some places reach a sheer 2000 feet above the floor of the canyon. The width of the canyon varies and is quite narrow in some places, approximately the width of a broad sidewalk, while in other places it is less narrow, about the width of a two-way street. The canyon winds and curves and does have several areas where it is not possible to see around a bend.

The Virgin River flows through the canyon and ranges from a depth of several inches to several feet, depending on the location, time of year, and recent rainfall. For hikers going into the canyon, the only way to progress is by walking in the river itself, a very popular activity on hot and dry summer days.

The area is easily accessible and frequented by visitors. The Virgin River Narrows are reached at the end of a one-mile, paved trail which follows the path of the river. At the end of the trail is a wide area which is a popular place to wade in a shallow

portion of the river. Beyond this area, the canyon narrows and hikers proceed upriver through the water, occasionally finding small, dry areas of riverbank to walk on.

Another reason the site was chosen for this study is that it was also the area of focus in a 2003 study conducted by Manning, Freimund and Marion. The study was conducted on-site and used visual crowding research methods. A comparison can be made between their findings, based on data collected on-site, and the findings of a portion of this study. This comparison provided useful information.

In addition, several observational sound studies were conducted at Zion National Park, as mentioned previously, so baseline data regarding the soundscape characteristics of the park are available. It seemed wise to attempt to gather more information about a site for which a bit of work has already been done. By doing so, existing knowledge is built upon, which may be more useful and beneficial in the end.

Survey instrument

Sound samples

The sound recordings were made over a three-week period in August, 2004. Seven recording sessions were completed in the Virgin River Narrows and along the River Trail, the one-mile paved trail which follows the Virgin River. The recording sessions were one hour in length and were conducted at various times throughout the day in an attempt to capture the full range of daytime sound activity. Morning sessions were at 8:03, 9:39, and 10:08; afternoon sessions were at 12:18, 12:38, and 1:50; and an evening session was at 5:08.

Recordings were made at five different areas along the Virgin River. Two were made just before the beginning of the Virgin River Narrows along the river bank. The remaining five recordings were made at four locations next to the river in the canyon.

A Sony ECM-MS957 Stereo Microphone and a Sony Net MD Walkman MZ-NF810 minidisc recorder were used to record. The microphone was placed on a tripod approximately three feet off the ground and away from vegetation. If placed too near vegetation, a disproportionate amount of sound from rustling leaves may have been recorded.

During each recording session, the minimum and maximum decibel levels were recorded every two minutes using a Center 320 Series Sound Level Meter. The decibel meter allows these measurements to be recorded, but it is necessary to note that maximum and minimum decibel levels recorded were not the average high and average low during each two minute segment. The measurements were maximum and minimum decibel levels that may have occurred only very briefly. For example, if the maximum decibel level during a two-minute period was 70 decibels and the minimum was 50 decibels, it is possible that for one minute and 58 seconds the decibel level was 50, and for just two seconds the decibel level was 70. Therefore, it is important to remember that it is not accurate to think of the average decibel level for a two minute segment as the midpoint between the minimum and maximum decibel levels recorded.

In addition to the decibel level information, notes regarding weather conditions, location, and time of day were also recorded. The distribution of sound levels gained in this recording process were also compared to the distributions that resulted form the park wide soundscape monitoring program to ensure the scope of sound was within reason.

Selecting sounds for use in this study

Selection of recorded segments for this study was based on sound content and quality. Most segments needed to contain sounds of people, which were the decided focus of this study, as well as reflect the natural sounds present in the area. Segments of an appropriate length were sought. Segments needed to be sufficiently long enough to allow participants time to hear and assess them while not being so long as to cause an overly long survey in which participants might lose interest.

The segments needed to contain sounds fitting into the three categories of natural, low levels of human sound and high levels of human sound which were to be used in the study. Segments fitting into the "natural" category contained only the sounds of natural quiet such as running water and birds. Segments fitting into the "low" category contained human sounds at relatively low levels. The sound of the river was audible in all segments, but in this category, sounds of people talking, laughing or walking through the river were also audible at a level that reflected people doing so either rather quietly or at a distance. In the "high" category, segments also contained sounds of people talking, laughing or walking through the river, but at louder levels. Yells and loud splashing were also audible in these segments. In the high level category, the human sounds reflected people doing things very nearby or simply doing them loudly.

These sound levels were chosen based on the types of sounds which were recorded in the Virgin River Narrows. When no human sounds were audible, the decibel level of the natural soundscape was generally between 45 and 50 decibels. Most of the recordings contained human sounds the majority of the time. Most often the human sound was in the range of 50 to 60 decibels. The louder human sounds occurred during almost

every recording session and were between 60 and 75 decibels. The higher decibel levels generally resulted from the type of behavior (yelling, splashing, etc.) or the proximity of the people to the microphone.

When seeking segments for each of these categories, segments of high quality sound without interruptions such as wind blowing across the microphone or insects buzzing by were sought. Segments in which aircraft were audible were excluded.

Editing of sound segments

For the editing necessary for some segments, Sound Forge computer software was used. Some short segments were looped to make them an appropriate length of 12 or 15 seconds. For some of the segments, additional editing was necessary to ensure that the entire length of the segment was within the appropriate decibel range. If a small spike in decibel level occurred in the middle of an otherwise consistent segment, that section could be removed, even if it was only a fraction of a second. If removal was unnecessary or would have resulted in an unnatural sounding segment, the decibel level of just that part of the recording could be lowered to within the proper range. These decibel ranges were about 40 to 50 decibels for the natural category, 50 to 60 decibels for the low category, and 60 to 70 decibels for the high category. By using the Sound Forge software, it was possible to ensure that each sound segment fit the criteria for content and quality and that the segments in each category of sound were different from the other categories.

The appropriate decibel levels for each category were not chosen arbitrarily, but rather, were based on observations made at the recording sites during each recording session. As previously mentioned, minimum and maximum decibel levels were recorded

every 2 minutes at every site. The distribution and frequency of these decibel level occurrences was noted, allowing for a realistic reflection of decibel ranges occurring in the area. In the Virgin River Narrows, maximum and minimum decibel levels observed during recording sessions were within the 40 to 50 decibel range about 33 percent of the time, within the 50 to 60 decibel range about 43 percent of the time, and above 60 decibels about 21 percent of the time.

After editing was complete there were a total of 12 sound segments for each category--natural, low and high. Of the 12, those with the best quality of sound were chosen for use in the survey instrument: seven for natural sound, six for low human sound and three for high human sound.

Development of the visual portion of the survey

Microsoft PowerPoint was utilized as a way to present this survey. In the first visually presented section of the survey, background information related to Zion National Park was given so that study participants would have a context for the survey and have the same location characteristics in mind while responding to the survey items. Pictures from the park were shown to participants while an accompanying description of the park was read aloud. This description was based on desired conditions for primitive zones as laid out in the Zion General Management Plan (2001) and included information about the locale, climate, vegetation, visitation and popular recreation activities within the park. The description also summarized what type of experience visitors to a primitive area within the park might expect based on the General Management Plan desired conditions. (See Appendix B) It was important that all survey respondents be familiar

with the context of the location of the study and what visitors to the area might reasonably expect to experience.

A total of 13 images were presented along with the verbal description. They included a map showing the location of Zion National Park within the region; a map showing the area of the Virgin River Narrows within Zion Canyon; and pictures depicting vegetation types, geology of the area, and popular activities as well as several pictures of the Virgin River Narrows.

Presentation of the settings

The second section of the survey consisted of presentation of the settings--images accompanied by sound. The images used all had the same background and depicted three different levels of crowding. The background showed a section of the Virgin River Narrows that was relatively straight and allowed for a more distant view than other sections of the river.

Adobe Photoshop software was used to edit the number and placement of people in the images. One image contained no people. Six other images contained either about four people or 16 people to depict two different levels of crowding. In the three images showing about four people, the people were placed in the foreground, mid-ground and background. People were more widely dispersed in the images showing 16 people, but an attempt was made to cluster people toward the foreground, mid-ground and background.

In addition to the 16 test settings, three practice settings were presented. These settings were also depictions of the Narrows, using both pictures and sounds from the

area. However, the practice settings did not use any of the same images or sounds that were used in the test settings.

In order to pair the images with the sound segments, a random number table was used. The proper number of sight and sound combinations was necessary, so the sound segments of different levels were numbered and then randomly selected to be paired with an appropriate image. There were pre-established criteria for changing the random arrangement. It was decided that the setting "natural sound, zero people" should not appear next to the setting "high sound, 16 people" to avoid artificially abrupt changes in the amount of sound and people. This order did result in the randomized arrangement, so according to the pre-established criteria, the last setting in the arrangement was moved up to separate those two settings. Each setting was presented for a preset time. The first eight settings were presented for 15 seconds each and the last eight were presented for 12 seconds each.

Presentation of photographs

The next portion of the survey included a series of six photographs depicting six different levels of crowding in the Narrows. These photographs were not presented with accompanying sounds. The same series of photographs were used in a 2003 study that took place in Zion National Park (Manning, et al., 2004). Use of these photographs in the current study allows for a comparison to be made between the responses obtained in the field and those obtained in a laboratory setting.

The photographs were shown twice. Initially, they were presented briefly in order of increasing number of people and were all shown simultaneously on one slide. They

were then shown in a random order, arranged using a random number table, for six seconds each. The photographs were shown twice in order to simulate the method of presentation in the field study. Participants in the 2004 Manning, et al. study were shown all six photographs at once and were able to look back and forth between them when making assessments of crowding. It was determined that participants in the current study should be given an opportunity to familiarize themselves with the photographs since they would not be able to look back and forth between them.

Presentation of instructions

Instructions for each section of the survey were presented on screen and read aloud to participants in addition to being printed on the top of each section of the paper response form. The slides with each set of instructions were shown at the appropriate time during the survey session. (See Appendix B)

Development of the paper portion of the survey

All survey participants were given a paper response form. The form included sections for recording assessments of the settings and assessments of the series of crowding photographs as well as the Outdoor Recreation Noise Sensitivity Scale (ORNSS), the Weinstein Noise-Sensitivity Scale (WNSS), and a brief demographic questionnaire.

Setting assessments

The first part of the paper response form corresponded to the visual portion of the survey presenting the various settings. After each setting was presented, the participants marked their assessments on the form using a Likert-type scale of acceptability ranging from -4 (very unacceptable) to +4 (very acceptable). They first rated the acceptability of the amount of human sound and then rated the acceptability of the number of people in each setting by circling a number on their form. Separate assessments were made for sound level and number of people because "sounds and images are independently perceived" (Carles, et al., 1999). This approach allowed sound level and number of people present in the settings to be assessed independently in later analysis.

Crowding assessment

The second section of the paper response form provided a place to record assessments of the series of six photographs depicting different levels of crowding. Again, a Likert-type scale ranging from -4 (very unacceptable) to +4 (very acceptable) was used. The number of people in each photograph was rated in terms of crowding. After viewing each photograph, participants circled the appropriate number on their response form.

Outdoor Recreation Noise Sensitivity Scale

After completing the visually presented portions of the survey, the participants completed the remaining three sections. The first of these was the 10-item ORNSS. A six-point scale was printed to the right of the items. The scale ranged from 1 (always) to 5

(never) and also included "I don't know" as an option. See Appendix A for a list of scale items.

Weinstein Noise-Sensitivity scale

The next section was the WNSS, presented in a slightly adapted manner. The original scale contains 21 items. Two items (*) were added, and the wording was changed slightly (†) for several of the items. Responses ranged from 1 (strongly disagree) to 6 (strongly agree). The response option "I don't know" was added. See Appendix A for a list of the items.

Demographic questionnaire

The last portion of the survey response form was a brief demographic questionnaire. This questionnaire supplied descriptive information about our sample, gave us an idea of participants' recreational experience in national parks, and allowed for an analysis of any correlation between demographic variables and participants' self-reported sensitivity or acceptability ratings. The questions can be seen in Appendix A

Pre-testing

Pre-testing was done before the survey was administered to study participants. Pre-testing was conducted with several graduate students from the College of Forestry and Conservation, University of Montana. The survey pre-test took place in the same room and used the same equipment intended for use in actual survey sessions. The use of graduate students prevented the necessity of using members of the subject pool. Also,

graduate students were able to offer insights and suggestions because they are familiar with survey methods.

Several small changes were made as a result of pre-testing. The number of settings was reduced to the number described in this chapter in order to remove settings that seemed very unrealistic, and therefore potentially confusing to participants. The setting depicting an opposite extreme of sound level (high) and number of people (zero) was removed. The setting depicting a high level of sound with four people was also removed because the level of sound seemed incongruent with the number of people in a static picture and therefore might have been confusing.

Another change was made by placing the ORNSS before the WNSS. It was suggested that, because of the context of the outdoor recreation scale, it would make more sense to have it follow the setting and crowding assessments which are also in an outdoor context.

Details of the survey

Laboratory setting

It has been shown in previous research (Aasvang and Engdahl, 2004; Boster and Daniel, 1972; Brown and Daniel, 1986; Daniel and Boster, 1976) that results from studies conducted in laboratory settings are similar to results from field settings. According to Brown and Daniel, "color slides have been shown...to be good substitutes for actual on-site scenes" (1986:485). In addition, a laboratory setting allows for more controlled study conditions. A controlled study assures that each study participant is exposed to the same set of sounds, leading to greater consistency in the study.

Three rooms were used for this study. The majority of the survey sessions took place in a fourth-floor room darkened by blinds. Images were projected onto a screen in the front of the room. Speakers were placed in an outward-facing position on either side of the screen. Tables placed in a crescent shape ensured that all participants would be facing the screen. The distance of seats from the screen was kept consistent for each of the 17 sessions that took place in the room. Between two and 11 participants, with an average of seven participants, were in the room for each session. One other session was also conducted in this room with a larger group of 25 participants.

Three other sessions took place in two other rooms. Two of these sessions took place in a second-floor room with no windows. Again, the screen and speakers were in the front of the room. The screen was larger in this room, but the distance of participants from the screen was greater. In one of the sessions in this room there were 28 participants and in the second session there were 18.

The third room was a second-floor room with windows darkened by blinds. The screen and speakers occupied the same position in this room as in the other two. The screen in this room was also larger than in the first, but again, the distance between the 14 participants and the screen was greater.

The decibel level meter used during recording sessions in the Virgin River Narrows was used to calibrate the volume of the speakers in each room. The decibel level of the sound segments was checked from the center of the seating area in each room, as well as the back and the front. The rooms were not large enough to cause a significant difference in decibel level from the front of the seating area to the back. This ensured consistency of the sound levels for all study participants.

Survey Process

The survey sessions, which took place over a five week period in March and April 2005, took about 25 minutes to complete. When all of the participants had entered the room, the front of the room was darkened and the door was closed to prevent any outside sounds from disturbing participants. Survey response forms were handed out and a brief description of the purpose of the study was given. The presentation then began. The appropriate information and instructions were read in conjunction with the visually-presented portions of the survey. The two noise sensitivity scales and the demographic questionnaires were completed by participants at their own pace, and they were allowed to leave the room after handing in the completed survey response form.

Survey Sample

College students made up the sample for this study. Students were chosen as subjects because they are an easily accessible population and research indicates that they are a diverse population who represent society well (Arthur, 1977; Brown & Daniel, 1986; Buyhoff & Leuschner, 1978; Buyhoff, G.J., Wellman, J.D. & Daniel, T.C. 1982; Schroeder & Daniel, 1981). For this study, 202 surveys were collected. Of these, five were removed because of missing data. Of the 197 respondents who provided complete surveys, 116 (58.9 percent) were enrolled in a 100-level psychology course; 12 (6.1 percent) were enrolled in a 100-level recreation management course; 17 (8.6 percent) were enrolled in a 200-level recreation management course; 27 (13.7 percent) were enrolled in a 300-level recreation management course; and 25 (12.7 percent) were enrolled in a 400-level recreation management course.

The sample population represented 37 different majors. Students majoring in recreation management constituted 29.4 percent of the sample. This large percentage is due to the fact that in the 100- and 200-level recreation management courses, approximately 50 percent of the students were recreation management majors, in the 300-level course 70 percent were recreation management majors, and in the 400-level course all of the students were recreation management majors. Others that made up a significant percent of the total number of majors are undecided/general curriculum (11.2 percent), education (7.1 percent), business (6.1 percent), and forestry (5.1 percent). Of the 37 majors, 34 are represented within the 100-level psychology course. For a list of majors, see Appendix C.

The number of males and females in the sample was nearly equal with 95 male participants (48.2 percent) and 102 female (51.8 percent) participants. The age of participants ranged from 18 to 47 years. The mean age was 21.95 years and the median age was 21.0 years. Approximately 70 percent of the participants were between 19 and 23 years of age. Students who were 18 years old made up another 9.1 percent of the sample and 24- and 25-year olds together made up 8.6 percent.

With regards to visits to a national park in the last two years, 18 (9.1 percent) responded that they had not visited, 118 (59.9 percent) had visited 1 to 4 times, 41 (20.8 percent) had visited 5 to 9 times, and 20 (10.2 percent) had visited 10 or more times. Of those who had visited a national park in the last two years, 120 (67 percent) had camped overnight.

Fifty-three (26.9 percent) of the participants indicated that they had previously visited Zion National Park. Of those 53 participants, 52 had visited the park 1 to 4 times

and only one had visited 5 to 9 times. Only 15 participants (7.7 percent) had hiked in the Virgin River Narrows.

To further describe the survey sample, a comparison was made between crowding assessments made by participants in this survey and participants from a 2003 field survey. The comparison allowed for an observation of similarities and differences in the way the two survey populations assessed the different levels of crowding represented in the six photographs.

Results from the field study were reported in a June, 2004 report to the National Park Service (Manning, Freimund & Marion). The study was conducted in 2003 in the same area of Zion National Park as was assessed in this study, the Virgin River Narrows. In the Manning, et al. study, visitors were asked to view a series of photographs depicting different numbers of people in a section of the Narrows. The study was conducted on-site with participants being approached as they exited the Virgin River Narrows trailhead. There was an 88 percent response rate for a total sample size of 213 visitors.

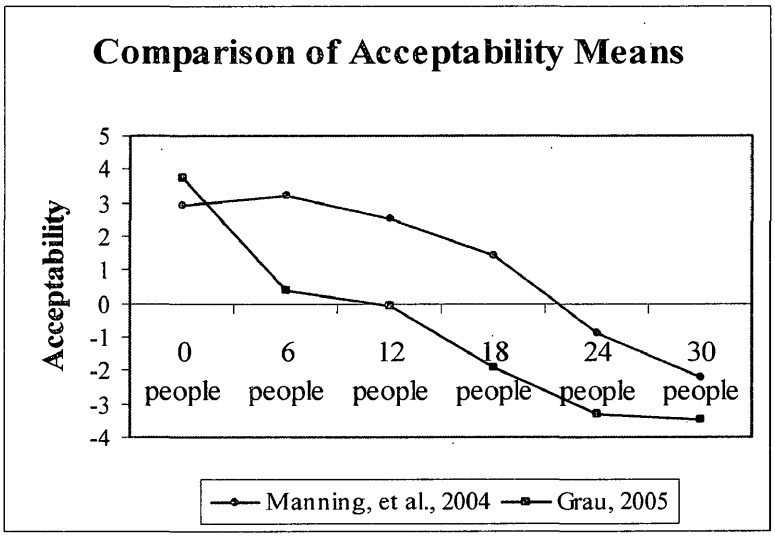
In the table and graph below is the information upon which a comparison between the two studies can be made. A statistical comparison is not advised because of the differences in survey methods. Table 1 provides the mean acceptability rating for each number of people visible at one time in the photographs used in both studies.

Table 1. Acceptability ratings of visitor congestion in on-site and lab studies

Acceptability Means		
	Grau, 2005	Manning, et al., 2004
0 people	3.71	2.9
6 people	0.40	3.2
12 people	-0.07	2.5
18 people	-1.92	1.4
24 people	-3.28	-0.9
30 people	-3.46	-2.2

The following figure provides a visual representation of the mean acceptability ratings for this study and the 2004 Manning, et al. study plotted on the same graph for easy comparison of the two.

Figure 1. Line graph representing acceptability curves of visitor congestion in on-site and lab studies



Based on comparison of the mean acceptability ratings of the number of people in the photographs from the Manning, et al. (2004) study and this study, it can be seen that there is a very similar pattern in responses. It is also clear, however, that students in a laboratory setting were more critical of the number of people in the photographs than were survey respondents in the field. It is important to keep in mind that this may indicate

that the setting assessments are also more critical than they might be if obtained in a field setting.

One can only speculate as to what lead to the difference in evaluations between the two studies. It could be that viewing the photographs in a laboratory setting rather than in the field is what accounts for the difference. However, this is not in line with the previous literature. Therefore, other considerations must be taken into account.

The difference in results of the two studies could be due to differences in survey methods such as the way the questions were worded or the format in which the photographs were shown (projected onto a screen versus laminated eight by 10 inch photographs). It could also be the context of the setting which led to the differences. In the 2003 study, participants were approached as they exited the Virgin River Narrows trailhead. All participants had just been in the very place depicted in the photographs and surrounded by many others. In this study, participants had only a brief narrative and photographic description of the area to set the context.

The participants in the on-site study may have had other characteristics of the setting fresh in their minds when making their evaluations. The participants in this study, however, were only able to imagine that they were in the setting as described at the beginning of the survey. An example of the difference in context perhaps experienced by the two sample groups is the scale of the Virgin River Narrows. People who had just been in the area would know how massive the canyon walls appear to be from the bottom of the slot canyon. This may have affected the perspective with which respondents viewed others in the canyon. Participants in the laboratory, however, were shown a photograph which could not accurately reflect the size of the canyon walls. This may have resulted in

a different perspective when viewing the photographs in which the people visible captured more attention than the surroundings. The contextual difference of the setting in the minds of study participants could be what accounts for the more critical evaluations obtained in the laboratory setting.

It could also be simply that the sample population in this study was different from the sample population in the 2003 study. The differences in survey respondents could be what accounts for the more critical, although similar, response pattern in this study.

Data management

Coding of data

Data were entered into SPSS software for analysis. The program uses only numerical variables. Therefore, non-numerical survey responses were coded. The codes can be seen as the subscript numbers next to each possible survey response in Appendix A. The list of 37 majors and their corresponding codes are in Appendix C.

Reversing scales

The two noise sensitivity scales both use Likert-type scales for responses. The ORNSS scale ranges from 1 (always) to 5 (never). The WNSS uses a six-point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree). Eight of the WNSS scale items (1, 3, 8, 9, 12, 14, 15 and 20) were scored in the opposite direction before the responses were added together because they were written as positive statements as opposed to the remainder of the scale which is written using negative statements.

High cumulative scores for the WNSS indicate higher noise sensitivity, while the opposite is true for the ORNSS. To make the scoring consistent between both scales, all scores for the ORNSS were reversed and then summed.

As mentioned above, responses for each scale were summed to give an overall noise sensitivity score. The WNSS was intended to be used as an additive scale. However, "I don't know" was added as a response option to the WNSS as well as the ORNSS. Because this option did not have a correlating numerical value, it prevented the use of the two scales as simply additive scales. Each person's responses were averaged based on the number of non-I don't know responses that were marked. This resulted in the average ORNSS and WNSS scores used in the data analysis.

Data entry

As mentioned above, the data were entered into SPSS for analysis. Each response category was given its own variable in the data set. Two variables were entered for each setting, one variable for the sound rating and one for the rating of the number of people. There was one variable for each of the six crowding-series photographs as well as each item from the ORNSS and WNSS. There were also eight variables for demographic information. There was also a variable for indicating the course each person was enrolled in (psychology or one of the four recreation management courses) as well as one for the survey form code (one through 197). Two variables were created for each participant's average ORNSS and WNSS scores.

Summary

Sounds and images for this study were collected in the Virgin River Narrows in Zion National Park. Both sounds and images were edited using computer software. The sound segments of three different decibel levels were paired with images depicting three different levels of crowding to make up the settings portrayed in this study. Both the settings, including images and sounds, and the series of photographs shown without sound were presented using PowerPoint software.

Instructions for each section of the survey were presented visually by projection on the screen, printed on the survey response form, and read aloud to participants. The two noise sensitivity scales and the demographic questionnaire were not projected on the screen, instead appearing only on the survey response form.

The survey sessions took place in one of three rooms during 21 sessions. A total of 202 students enrolled in either an introductory psychology course or a recreation management course participated in the study. Of those, 197 provided usable responses which were entered into SPSS for analysis. Analysis of the data is described in the following chapter.

Chapter 4--Analysis

Introduction

In this chapter, results from analyses of the survey data are presented. Each study question precedes a description of statistical methods used and a presentation of the results. A brief conclusion is then given at the end of each section. A full discussion of these results can be found in chapter five.

Investigating the study questions

The interaction between sound level, number of people and sensitivity to noise in a general and wildland recreation context

Study Question 1. What is the relationship of human sound and number of people to acceptability ratings?

Several types of analysis were run to answer study question 1, including regressions, general linear models and one-way ANOVAs. First, regressions with sound acceptability as the dependent variable and sound level as the independent variable as well as with people acceptability as the dependent variable and number of people as the independent variable were run. The first regression on acceptability of people resulted in an R^2 of 0.38 with a significance of 0.00. This indicates that the number of people explains 38 percent of the variance in people acceptability, and a slope of -2.75 indicates that for each increase in the number of people there is an expected decrease of 2.75 in acceptability of the number of people:

People acceptability = 6.79 - 2.75(number of people) + error

The second regression was on sound acceptability. The resulting R^2 was 0.63 with a significance of 0.00. This indicates that sound level accounts for 63 percent of the variance in sound acceptability ratings. The slope for sound level was -3.07 in Regression 2, and the regression equation follows:

Sound acceptability = 6.19 - 3.07(sound level) + error

The results of the regressions are listed in Table 2 below and indicate that both number of people and sound level have an effect on acceptability ratings.

Table 2. SPSS output--people and sound acceptability (dep.), number of people and sound levels (ind.)

Model Summary						
	R	R^2	Adjusted R^2	Std. Error of the Est.		
Regression 1 - people	0.62	0.38	0.38	2.15		
Regression 2 - sound	0.79	0.63	0.63	1.77		
ANOVA						
		Sum of Squares	Degrees of freedom	Mean Square	F	Sig.
Regression 1 - people	Regression Residual Total	8927.92 14549.94 23477.86	1 3139 3140	8927.92 4.64	1926.11	0.00
Regression 2 - sound	Regression Residual Total	16617.87 9858.56 26476.44	1 3139 3140	16617.87 3.14	5291.19	0.00
Coefficients						
		Slope	Std. Error	t	Sig.	
Regression 1 - people	Constant # of people	6.79 -2.75	0.16 0.06	42.07 -43.89	0.00 0.00	
Regression 2 - sound	Constant Sound level	6.19 -3.07	0.08 0.04	77.15 -72.74	0.00 0.00	

To further clarify the effect of sound level and number of people on acceptability ratings, correlations between demographic variables and sound acceptability ratings as

well as people acceptability ratings were run. The demographic variables resulted from participant responses to the questionnaire at the end of the survey and include age, gender, major, visits to national parks and visits to Zion National Park. For each variable, there is negligible correlation with sound acceptability and people acceptability ratings. This indicates that there is no significant correlation between acceptability ratings and demographic variables. Regressions run with sound acceptability and people acceptability as dependent variables and each of the demographic variables as independent variables were run. In both cases, demographic variables explained very little of the variance in acceptability ratings ($R^2 > 0.10$).

In order to observe the effects of sound level and number of people together, the acceptability ratings for sound and people were added together to provide an overall setting acceptability. The combined acceptability ratings for the settings ranged from -8 to +8. A regression on setting acceptability with both sound level and number of people as independent variables resulted in an R^2 of 0.55 and the following regression equation:
Setting acceptability = 13.52 - 3.61(sound level) - 2.60(# of people) + error

Table 3 uses the regression equation for combined setting acceptability to predict setting acceptability ratings. The first two columns represent possible combinations of sound level and number of people in the settings. A higher level of sound (70 to 80 decibels) and number of people (28) than were used in this study were also added. The third column presents acceptability ratings resulting from the combinations as calculated using the regression equation. Means resulting from combinations actually used in this study are marked with an asterisk (*).The last two predicted acceptability ratings are

outside the range of the scale indicating that a rating of very unacceptable is not sufficiently negative to assess the combinations.

Table 3. Setting acceptability as predicted by the regression equation for each combination of sound level and number of people

Level of sound	Number of people	Setting acceptability rating
Natural	0	7.31*
Natural	4	4.71*
Natural	16	2.11*
Natural	28	-0.49
Low human	0	3.70
Low human	4	1.10*
Low human	16	-1.50*
Low human	28	-4.10
High human	0	0.09
High human	4	-2.51
High human	16	-5.11*
High human	28	-7.71
Higher human	0	-3.52
Higher human	4	-6.12
Higher human	16	-8.72
Higher human	28	-11.32

The information in Table 4 resulted from a general linear model and a Bonferroni post hoc test. In the table below, the settings are organized by increasing sound level first and within sound level by increasing numbers of people. The column with the heading "Setting without significant difference in mean" lists, by number, which settings have means that are not significantly different from one another at the 0.05 level of significance.

It is clear that the number of people in the settings influences setting acceptability ratings. For example, settings with natural sound and four people have higher setting acceptability ratings than settings with natural sound and 16 people. The table also allows for observation of the effect of sound. When comparing settings with the same number of

people but different sound levels, settings with natural sounds have higher setting acceptability ratings than settings with low levels of human sound, which, in turn, have higher acceptability ratings than settings with high levels of human sound. Sound level clearly makes a difference in combined setting acceptability ratings.

Table 4. Mean setting acceptability and listings of settings which are not significantly different from one another

Setting number	Sound Level	# of People	Mean Setting Accept-ability	Settings Without Significant Difference in Mean:
Setting 4	Natural	0	7.29	
Setting 7	Natural	4	4.36	1
Setting 1	Natural	4	5.42	7, 11
Setting 11	Natural	4	5.54	1
Setting 10	Natural	16	1.33	5, 6, 13
Setting 5	Natural	16	2.29	6, 12
Setting 12	Natural	16	2.57	5, 6
Setting 14	Low	4	0.13	3, 13
Setting 13	Low	4	0.50	10, 14
Setting 6	Low	4	1.70	5, 10, 12
Setting 3	Low	16	-0.90	8, 14
Setting 8	Low	16	-1.42	3
Setting 16	Low	16	-2.75	
Setting 9	High	16	-4.40	2, 15
Setting 2	High	16	-4.43	9, 15
Setting 15	High	16	-5.50	2, 9

The previously presented results indicate that both sound level and number of people have an effect on acceptability ratings. In general, the settings with natural sound are perceived as the most acceptable, even if there are 16 people. The settings with 16 people are perceived as the least acceptable except when paired with natural sound.

There is a measurable difference in both sound acceptability and setting acceptability based on sound level. Setting acceptability is improved by at least 1.65 for settings with 16 people when the level of human sound decreases from high to low.

Likewise, for settings with four people, acceptability of the settings increases by at least 2.66 if the sound level decreases from low levels of human sound to natural sound.

The relationship between the level of human sound and the acceptability of the number of people in a setting

Study Question 2. Does the level of human sound in a setting affect the perceived acceptability of the number of people within that setting?

To investigate this relationship, ANOVAs were performed with the acceptability of the number of people in a setting as the dependent variable and sound level as the independent variable. Because the settings did not include combinations of high levels of human sound with zero or four people or low levels of human sound with zero people, two separate sets of analyses were run. The first set included settings with four people and the second set included settings with 16 people. By holding the number of people constant, it was possible to isolate and observe the effect of sound in the settings on the acceptability of the number of people.

Table 5 presents the mean people acceptability ratings at each sound level with the number of people held constant. It is clear by comparison of acceptability means between the settings with four and 16 people that the number of people in the settings has an effect on the acceptability of people. It is also clear, however, that the level of sound has a significant effect on mean acceptability ratings of people. Looking only at settings with four people, there is a difference of almost 1.0 between settings with natural sound and settings with low levels of human sound. This is a significant difference in means

according to an independent samples t-test, used to compare two means. The difference between the means at each sound level in settings with 16 people is also significant, according to a Bonferroni post hoc test, which is used to compare multiple means.

Table 5. Mean people acceptability rating at each sound level with number of people held constant

	Mean acceptability of 4 people	Mean acceptability of 16 people
Natural	6.97	3.93
Low human	5.98	3.51
High human		2.96

Based on these analyses, sound level does affect the acceptability ratings of the number of people in a setting. By holding the number of people in the settings constant, it is possible to observe the significant difference in the mean acceptability rating of people at each sound level.

Reliability of the Weinstein Noise Sensitivity Scale and the Outdoor Recreation Noise Sensitivity Scale

Before responding to questions 3a and 3b, factor analyses with varimax rotation were performed to test reliability for both the Weinstein Noise Sensitivity Scale (WNSS) and Outdoor Recreation Noise Sensitivity Scale (ORNSS). A factor analysis was run including all 23 items which were included in the WNSS in the survey. Results of this analysis indicate that the scale is, in fact, a uni-dimensional scale; although several components did emerge, none of the items loaded highly in any one component. The reliability for the scale when including the 23 items was alpha = 0.83. The two items added to the original 21-item scale did not contribute to the reliability of the scale. After

removing the two items, the Cronbach alpha was 0.85. The two items removed are marked with an asterisk (*) in Appendix A.

A factor analysis was performed on the 10-item ORNSS. Although this scale was designed to be uni-dimensional, measuring personal sensitivity to noise in an outdoor recreation context, two components emerged with items 1, 2, 5, 8 and 10 loading highly (greater than 0.6) in the first component and items 3, 4 and 6 loading highly in the second component. The five items which factored together all related to personal sensitivity while the other items related to expectations of others in a wildland recreation setting. The factor loading for item 7 was nearly equal in both components. The decision was made to include only items 1, 2, 5, 8 and 10 which reflect the dimensions of being bothered, goal interference, crowding and naturalness in further analysis. A factor analysis of these five items did result in only one component with a reliability of 0.82, which indicates a fairly high level of internal consistency among the items. Although the reliability for the scale was slightly higher when all time items were included ($\alpha = 0.86$), there was a clear difference among the items in each component as indicated by the factor analysis. The items excluded from further analysis either loaded very highly (≤ 0.77) in the component related to expectations of others in outdoor recreation settings or were ambiguous as to which factor they were more consistent with. The five items used in further analysis are reflective of what the scale was intended to focus on--personal sensitivity to noise.

After factor analysis was performed, participants' average scores were calculated for both scales. The WNSS scores are averages of the 21 items originally included in the scale. The ORNSS scores are averages of the five items chosen for use based on the

factor analysis. The frequencies of the average scores for each scale, presented in the histograms below, indicate that the scales identify a normal distribution of sound sensitivity within the sample population and that there is variability within the sample.

Figure 2. Frequencies of average WNSS scores

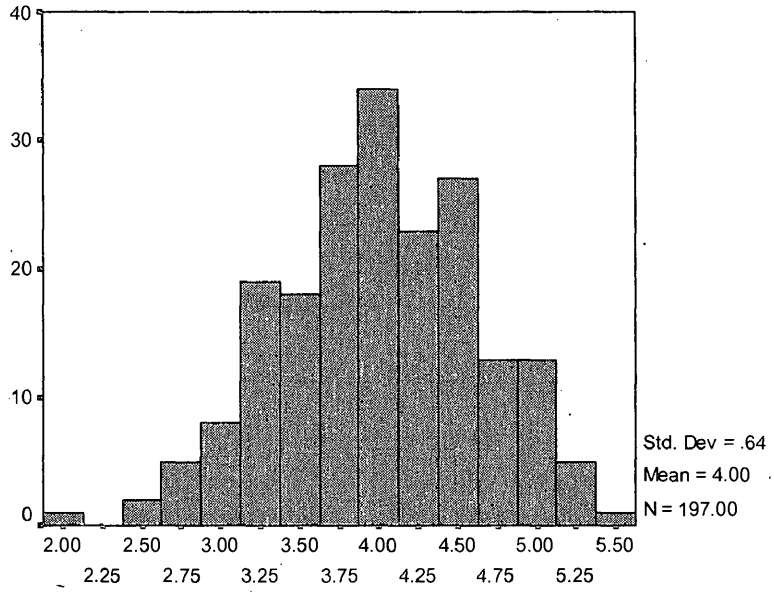
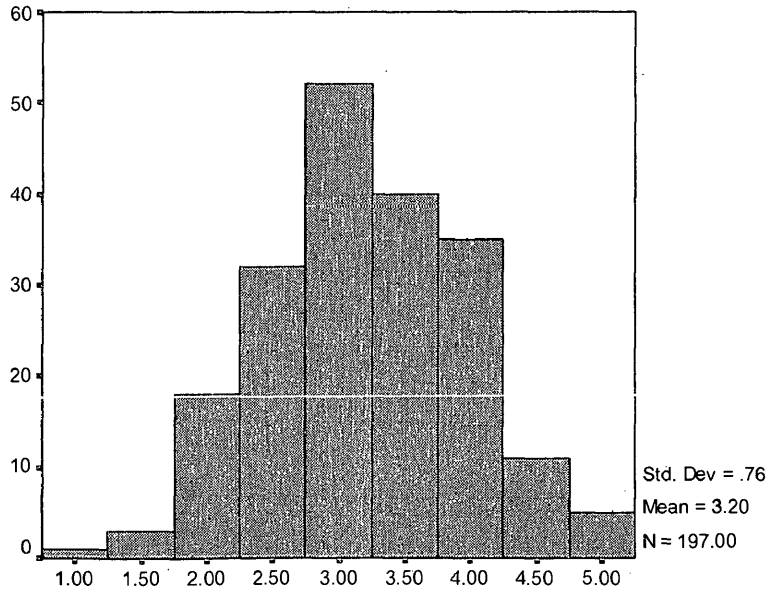


Figure 3. Frequencies of average ORNSS scores



The sample's sensitivity to sound

The sample population in this study is variable with a large range in age, majors, and park-related experiences as well as a nearly equal split between male and female participants. To look at the relationship between noise sensitivity and demographics, several analyses were performed. The type of analysis depended on the type of data collected for each demographic variable. For categorical data, t-tests or one-way analyses of variance (ANOVA) were performed, and correlation was performed on numerical data. The results of these analyses are presented in Table 2 and the paragraphs below.

Table 6. Significance resulting from one-way ANOVA

One-way ANOVA	WNSS	ORNSS
	p-value	p-value
Course (PSYC 100 or RECM 100-, 200-, 300-, or 400-level)	0.79	0.83
Gender	0.01	0.83
Camping in a national park in the last two years (yes or no)	0.18	0.03
Visit to ZNP (yes, no)	0.07	0.55
Hikes in the Virgin River Narrows (yes, no)	0.37	0.29

The results suggest that women (mean = 4.10) are slightly more sensitive to noise in a general setting than men (mean = 3.88) as represented by average WNSS scores. People who have camped in a national park during the last two years (mean = 3.29) are also slightly more sensitive to noise in a wildland recreation setting than those who have not (mean = 3.05) based on average ORNSS scores.

There is little correlation (R) between average WNSS and ORNSS scores and the number of visits to national parks during the last two years (WNSS R = 0.09, ORNSS R

= 0.20), the frequency of visits to Zion National Park (WNSS R = 0.04, ORNSS R = -0.02) and age (WNSS R = -0.01, ORNSS R = 0.03).

Sensitivity to noise in a slot canyon setting

Study Question 3a. How important are sound level and personal noise sensitivity to the acceptability of sound in a general context?

Study Question 3b. How important are sound level and personal noise sensitivity to the acceptability of sound in a wildland recreation context?

It seemed that both the level of sound and participants' sensitivity to noise would contribute to their assessments of the acceptability of the levels of sound in the settings. In order to answer questions 3a and 3b, stepwise regression was run. By performing stepwise regression, it was possible to differentiate between the contributions to explained variance of each of the independent variables. Sound acceptability was entered as the dependent variable in both stepwise regressions performed, and sound level and average noise sensitivity score (WNSS and ORNSS, respectively) were entered as independent variables. Although a regression including sound acceptability as the dependent variable and sound level as the independent variable was run for study question 1, the results are included here as well to clarify the relationship of personal noise sensitivity to sound acceptability ratings.

The results of the regression for the WNSS are listed in Table 7 below. In Model 1, only sound level was included; the average WNSS score was removed. In Model 2, both sound level and average WNSS score were included. Model 1 shows that sound level alone explains about 63 percent of the variance. In Model 2, average WNSS score

and sound level together explained about 64 percent of the variance in sound acceptability ratings. By removing average WNSS score, only about one percent of the explained variance was lost.

The slope indicates that each increase in sound level results in a decrease of 3.07 in sound acceptability rating. According to Model 2, each increase in average WNSS score results in a decrease in sound acceptability rating of 0.47. The regression equations are listed below:

Model 1: Sound acceptability rating = 6.19 - 3.07(sound level) + error

Model 2: Sound acceptability rating = 8.06 - 3.07(sound level) - 0.47(average WNSS score) + error

Table 7. SPSS output--sound acceptability (dep.), sound level and average WNSS score (ind.)

Model Summary						
	R	R^2	Adjusted R^2	Std. Error of the Est.		
Model 1	0.79	0.63	0.63	1.77		
Model 2	0.80	0.64	0.64	1.75		
ANOVA						
		Sum of Squares	Degrees of freedom	Mean Square	F	Sig.
Model 1	Regression Residual Total	16617.87 9858.56 26476.44	1 3139 3140	16617.87 3.14	5291.19	0.00
Model 2	Regression Residual Total	16899.85 9576.59 26476.44	2 3138 3140	8449.93 3.05	2768.82	0.00
Coefficients						
		Slope	Std. Error	T	Sig.	
Model 1	Constant Sound level	6.19 -3.07	0.08 0.04	77.15 -72.74	0.00 0.00	
Model 2	Constant Sound level Avg. WNSS score	8.07 -3.07 -0.47	0.21 0.04 0.05	38.26 -73.80 -9.61	0.00 0.00 0.00	

The stepwise regression run for 3b shows similar results; refer to Table 8. Model 1, again, includes only sound level, and Model 2 includes both sound level and average ORNSS score. The model including only sound level explains about 63 percent of the variance while the model including both sound level and average ORNSS score explains about 65 percent. Removing average ORNSS score from the model results in a loss of about two percent of the explained variance.

The slope indicates that for each increase in unit of average ORNSS score, there is a decrease of 0.59 in sound acceptability rating. The regression equation for each model is below:

Model 1: Sound acceptability rating = 6.19 - 3.07(sound level) + error

Model 2: Sound acceptability rating = 8.06- 3.07(sound level) - 0.59(average ORNSS score) + error

Table 8. SPSS output--sound acceptability (dep.), sound level and average ORNSS score (ind.)

Model Summary						
	R	R^2	Adjusted R^2	Std. Error of the Est.		
Model 1	0.79	0.63	0.63	1.77		
Model 2	0.81	0.65	0.65	1.72		
ANOVA						
		Sum of Squares	Degrees of freedom	Mean Square	F	Sig.
Model 1	Regression Residual Total	16617.87 9858.56 26476.44	1 3139 3140	16617.87 3.14	5291.19	0.00
Model 2	Regression Residual Total	17244.25 9232.19 26476.44	2 3138 3140	8622.13 3.14	2930.64	0.00
Coefficients						
		Slope	Std. Error	t	Sig.	
Model 1	Constant Sound level	6.19 -3.07	0.08 0.04	77.15 -72.74	0.00 0.00	
Model 2	Constant Sound level Avg. ORNSS score	8.06 -3.07 -0.59	0.15 0.04 0.04	53.72 -75.15 -14.60	0.00 0.00 0.00	

It appears that for both questions 3a and 3b the answer is the same. Sound level explains the majority of the variance in sound acceptability ratings. Participants' average noise sensitivity scores, both from the WNSS and ORNSS, have a minimal effect on sound acceptability ratings relative to the level of sound. The average WNSS scores explain about one percent of the variance in sound acceptability ratings and the average ORNSS scores explain about two percent.

Chapter 5--Discussion and Conclusions

Introduction

In this chapter the results of analysis are discussed in relation to the purpose of the study and the current state of knowledge. Possible implications for managers of wildland recreation areas are described and suggestions for future research are made. Limitations to the methods used in this study are also described. The results of the study are restated in the first part of the chapter.

Statement of results

The results of the analyses run to investigate the first study question indicate that the sound level and number of people in the settings both have an effect on acceptability ratings. The number of people in the setting explains 38 percent of the variance in people acceptability and the sound level explains 63 percent of the variance in sound acceptability. When the sound and people acceptability ratings were combined to allow for observation of trends for overall setting acceptability, sound level makes a measurable difference in setting acceptability ratings. With only one exception, the settings with natural sound had higher mean acceptability ratings than any other combinations regardless of the number of people visible in those settings. When sound level in settings with the same number of people is decreased, setting acceptability increases.

In analysis for study question 2, the number of people in the settings was held constant to allow for observation of the effect of sound level across number of people. A comparison of mean people acceptability ratings at the different sound levels showed that

sound did, in fact, have a significant effect on acceptability ratings for the number of people.

Several analyses were run for the third study question. One of these suggested that, based on the Weinstein Noise Sensitivity Scale (WNSS), women tend to be slightly more sensitive to noise than men. Additionally, people who have camped in a national park in the last two years seem to be slightly more sensitive to noise as assessed by the Outdoor Recreation Noise Sensitivity Scale (ORNSS).

Stepwise regressions indicate that very little of the variance in sound acceptability ratings can be explained by how sensitive people are to noise in either a general context, measured by WNSS, or a wildland recreation context, as measured by ORNSS, at least when compared to the influence of sound levels. Sound level explained around 63 percent of the variance in sound acceptability scores while average WNSS and ORNSS scores explained only about one and two percent of the variance, respectively.

The following section presents a more in-depth discussion of these study findings and relates these conclusions to previous research.

Discussion of results

The relationship between sounds and images

This study affirms an important connection between the visual and auditory characteristics of a setting. The findings suggest the sound levels in the settings do have an effect on the evaluations of the number of people. Relating this back to a visual research approach to studying crowding, it is evident that studies including only images

may be missing important information. The addition of sound to visual research methods is discussed further in the following section.

Adding auditory elements to visual research methods

In this study, previously used visual research methods for studying crowding were used with the addition of the element of sound to develop a multi-sensory approach. Sound proved to be an important aspect of settings as presented in a laboratory setting and contributes significantly to assessments of sound and settings overall. Additionally, adding sound to visual research methods further reduces assumptions made about visitor encounters by survey respondents. It allows for the portrayal of some visitor behaviors. This is something which has been shown to be important to perceptions of crowding and something that cannot be easily accomplished with visual research methods alone. All of these reasons, further discussed below, provide support for the use of a multi-sensory research approach.

The use of visual representations of crowding is an improvement over the previously used narrative approaches. By including visual elements, characteristics of visitors encountered can be specified and visually represented, reducing the likelihood that participants will make assumptions about the encounter. By reducing participant assumptions and ensuring that all participants are evaluating the same set of conditions and characteristics, it is likely that more reliable and realistic evaluations of crowding result. As Manning and Freimund (2004) say, "visual research methods can focus directly and exclusively on the variables under study" (2004:560). In studies of crowding, these variables can include characteristics such as group type, group size, and the type of

activity engaged in. When visual representations of settings are provided, these characteristics are presented to survey respondents and only the number of people in each image changes. Thus, visual research methods have been able to reduce participants' assumptions related to characteristics of visitors encountered.

However, the methods are still lacking and do not remove the necessity for participants to make assumptions about some characteristics of visitor encounters. One benefit of adding sound to visual research methods is that it can further reduce the number of assumptions made by respondents in crowding research for the development of standards of quality. Therefore, a multi-sensory approach may provide even more realistic and/or reliable results than visual methods alone.

Many aspects of visitor encounters cannot be conveyed through images alone, as mentioned above, but can be much more effectively illustrated through a combination of both visual and auditory representations. Adding sound makes it possible to determine if people are speaking to one another, yelling at one another, crying, laughing, or any number of other possible human sounds. It may be possible to hear a group over the ambient sounds or it may not be. If the sound of a group is not presented to survey participants, they may be imagining any one of the possibilities just mentioned. The surveyor would have no way of knowing what other assumptions about the group were made by participants while they evaluated the setting.

Also, visual research methods allow for the variation of only certain characteristics and cannot reflect many visitor behaviors. Manning and Freimund (2004) state that "outdoor recreation research suggests that perceived crowding may be influenced by visitor behavior..." (2004:561). In fact, some studies suggest that behavior

may contribute more to evaluations of crowding than do the actual number of encounters (West, 1982). Because of this and the importance of sound as evidenced by this study, the inclusion of sound is highly recommended. By the very nature of visual methods, the focus is on appearances, which may exclude the extremely important factor of visitor behavior in crowding perceptions.

For example, research has shown that recreationists are likely to give less conscious attention to people whom they perceive to be like themselves in some ways. By presenting visual images, study participants are able to see that some of the people in the images are like them in some way, and therefore may not pay attention to them. It is likely that in reality, not all of the visitors would contribute equally to perceptions of crowding as they do in narrative approaches. In visual approaches, some of the visitors depicted may not contribute to perceptions of crowding for all respondents if they appear to be similar in some way to the survey respondents.

However, focusing solely on appearance can be misleading and cause survey respondents to perceive visitors portrayed in photographs as similar to themselves when the behavior of those visitors may indicate otherwise. For example, one survey participant may enjoy spending time in quiet reflection when in wildland recreation settings. If she is presented with a photograph depicting five people, one group of two and one group of three, at a canyon overlook, she may not feel it is crowded at all. She may see that the photograph shows the people all looking out over the canyon, which she would enjoy doing herself. However, if that same photograph is presented with sound, her perception of crowding in this setting may change. She may find that one of the groups of people is shouting into the canyon to hear an echo, a behavior which cannot be

portrayed with visual depictions alone. While the photograph seemed to show visitors similar to the survey respondent, she may or may not perceive them as so if a multi-sensory approach is employed. This survey respondent might assess only five people in an area as being too crowded or not, depending on the behavior of those people.

Of course, there are some types of behaviors which can be depicted with photographs. Whether or not visitors are walking on or off trail and whether they are hiking in large groups or small groups can both be shown in photographs. Visually presenting these types of behaviors is much easier than attempting to describe them in a narrative approach and is an example of how visual approaches to studying crowding are an improvement. However, as illustrated by the example above, including sound with the images can portray settings even more realistically, including details of visitor behavior that cannot be captured with images alone.

It is not necessarily wise to assume that simply adding visual or auditory elements to studies of perceived crowding will yield more realistic results. This study shows that sound is a very important part of the settings presented. Likewise, visitor behavior is a crucial characteristic of encounters which contributes greatly to perceptions of crowding. By more accurately portraying visitor behavior and encounter characteristics through the incorporation of sound into visual research methods, even fewer assumptions will be made by survey participants, and therefore, more realistic results may be achieved.

Setting context and visitor expectations

The context of the setting which is portrayed may certainly influence whether or not survey respondents perceive settings to be crowded. If a setting is described as being

within a frontcountry zone in a place with a high visitation rate, survey respondents might not feel as crowded as if the area depicted is a backcountry area in which visitors can expect some degree of solitude.

A study described in the literature review provides further evidence of this. Respondents in the 2002 (Freimund, et al.) survey were provided with descriptions of three different types of areas in a Canadian national park reserve. The descriptions included what type of experience visitors to each area could expect. With these contexts and expectations in mind, respondents assessed how acceptable it was to hear certain types of sounds in each area. The survey respondents indicated that they would tolerate far fewer instances of hearing aircraft and motorized watercraft in wild places, the most isolated areas, than at attraction sites, which are areas of spiritual and cultural significance. Hearing aircraft and motorized watercraft was less acceptable in both of these areas than in access areas, which were described as places where many different types of visitors load and unload boats and equipment.

In this study, the context for the settings assessed by survey respondents was described in the introduction to the survey. Respondents were informed that in primitive zones such as the one depicted in the survey, visitors can expect to experience a natural landscape and feel a moderate sense of solitude. Had the context for the setting been described as a busy frontcountry zone, higher levels of human sound and crowding may have been perceived as more acceptable. In this study and the one just described, setting the context was an important element of the survey. Visitors' expectations for a setting can play a large role in how the social characteristics of the setting are perceived, so

controlling for these expectations through a clear description of the context was important in this study, and likely so in future studies using a multi-sensory approach.

Noise sensitivity and acceptability of sound

Based on the analysis of the relationship between demographic variables and average ORNSS and WNSS scores, noise sensitivity does seem to be a personal characteristic generally independent of other variables. One exception for the WNSS is gender, in which case women seem to be slightly more sensitive than men. An exception for the ORNSS is whether or not people had camped in a national park during the last two years; those who had seemed to be slightly more sensitive as assessed by this scale. This supports the findings of previous studies which have also found noise sensitivity to be a personal characteristic which may have more of an effect on noise annoyance than actual exposure to noise (Weinstein, 1978 and Zimmer & Ellermeier, 1999).

In this study, sound level explained the majority of the variance in acceptability of sound. Relative to sound, there seems to be little relationship between sensitivity to noise, in either a general context or a wildland recreation context, and acceptability of the different sound levels. With regards to annoyance as a result of noise sensitivity more than of noise exposure, the findings of this study do not support an extension of the notion to evaluations of acceptability. In this case, noise sensitivity explained very little of the variation in acceptability of sound regardless of sound level. This is contrasted with the findings of other studies in which noise sensitivity has more of an effect on annoyance than actual noise exposure. It is entirely possible that people may be annoyed by a sound but still not judge it to be unacceptable.

The lack of a relationship between noise sensitivity and acceptability of sound levels in a slot canyon may be explained by a number of things. It is possible, in the case of the WNSS, that the context was too general, and therefore, the scale is not capable of reflecting noise sensitivity that would correlate with the specific context of this setting. The WNSS was used in the Mace, Bell and Loomis (1999) study, which also had a very specific context--the effect of helicopter noise on landscape assessments of Grand Canyon vistas. In this case as well, the WNSS contributed very little to an understanding of the effect of various levels of helicopter noise on the landscape assessments (Mace, personal communication, 2004).

Another possibility is the specific focus on sound in this study. Participants were instructed specifically to evaluate the acceptability of the sounds in each setting. It may be that the explicit instructions to focus on sound negated any effect of personal sensitivity to the higher levels of human sound.

Given the context of the study, the types of sounds used may be another reason. The study focused on a wildland recreation setting and likewise, the sounds were of people recreating. This combination may have seemed perfectly congruent, and therefore acceptable even to noise sensitive people.

Considering that the sounds used in this study were either natural or the sounds of people, perhaps basing analysis on the excluded ORNSS items may have yielded different results; a stronger relationship between noise sensitivity in an outdoor recreation setting and the different sound levels may have emerged. The decision was made to include the five items that factored into one component and seemed to reflect personal sensitivity rather than the items that seemed to relate to expectations of others in an

outdoor recreation setting. However, because sounds of others were used in the study, the other items may have reflected a stronger relationship.

The levels of human sound used in this study may also have contributed to the lack of relationship between noise sensitivity and acceptability of the different sound levels. Several more levels of sound (such as a medium level of human sound) may have been effective in bringing any subtle relationship to light.

Finally, perhaps the use of an acceptability scale in this study contributed to the lack of correlation between noise sensitivity and sound level acceptability. It is possible that a relationship may have emerged if a scale such as preference was used. It may be that although some people are sensitive to noise, their sensitivity does not affect how acceptable a setting is to them. However, these noise-sensitive people may have been more critical in rating their preferences for settings. In this case, a more significant relationship between self-reported noise sensitivity and ratings of sound level preference may have emerged.

Implications for managers

There are several implications of this study for managers of wildland recreation areas. Previously, studies of soundscapes in these areas focused primarily on the sounds of aircraft and how those sounds affected visitors. While such research can be extremely useful to managers in some ways, it cannot help them to manage other aspects of the soundscape that influence visitor experiences.

This study promotes the consideration of adding a new dimension into the discussion of visitor experiences and what those experiences are about. Based on this

study, sound is a very important part of the perceived acceptability of the wildland recreation setting in a slot canyon. Although this study is of a specific place and was conducted in a laboratory setting, it can be seen that sound is one important aspect of experiences of visitors to wildland recreation areas.

If visitors have a complaint about their experiences, the sounds of their experiences should certainly be considered as something that may have had an effect. Even in fairly heavily used areas, the number of people they encountered may not be the problem so much as the sound created by the other visitors.

Another implication for managers results from the conclusion that the possibility of measuring sound acceptability in a laboratory setting is promising. Further research may support this and may also clarify whether it is also measurable in the field and develop methods for doing so. This may be important in development of indicators and standards of quality for wildland recreation areas, an important tool in monitoring visitor experiences.

Standards of quality for crowding in wildland recreation areas may be improved by the addition of sound to previously used visual methods. By adding sound, it is possible to more accurately reflect visitor characteristics that can influence perceptions of crowding, specifically behavior. The portrayal of behavior is something that visual methods alone do not permit and is an important part of perceptions of crowding. By developing more realistic standards of quality for crowding, managers will be able to do a better job of managing the experiences of visitors.

This study shows that it may also be possible to develop specific standards of quality for levels of human sound in particular areas which may be extremely useful to

managers of wildland recreation areas. Levels of human sound can be managed to some extent, versus management of sounds such as those from aircraft or nearby highways or railways. For example, the importance of sound can be stressed as part of the education provided to visitors applying for permits to use wildland recreation areas. Just as Leave No Trace ethics, the importance of safe recreation and important facts about wildlife are often explained to visitors, the importance of being mindful of the sound one creates and how those sounds can affect other visitors can be mentioned as well.

This research tells us that the sounds of other people that visitors hear are an important part of how wildland recreation areas are assessed. Managers can communicate this importance to visitors through education and interpretation materials. This may be particularly effective in places such as Zion National Park. Managers can make people aware of how their sounds may travel through a slot canyon and affect other people they cannot even see.

Sounds of visitors to wildland recreation areas certainly contribute to the soundscape of the areas. Future research can further clarify the degree of importance of sound to visitor experiences and how effectively sound acceptability can be measured in the field. Through this study it can be seen that the sounds of people are important in a laboratory setting and may contribute significantly to visitor experiences. Managers can use this information now to shape what they communicate to visitors about sound as part of their recreation experience.

This study is experimental in nature, and therefore does not only offer information, but raises questions as well. However, it is hoped that this study will prompt further research which will begin to provide information that is applicable to the real

world, perhaps resulting in better management through more informed decisions and planning.

Recommended future research and limitations of this study

The findings of this study suggest that future research on the topic of the interaction of sounds of people and numbers of people in perceptions of crowding is highly recommended. There are several ways in which this study design might be adapted to further clarify results or make them applicable to a wider variety of situations.

The study location

This study is specific to a slot canyon setting in Zion National Park. Being such a specific setting prevents the results from being directly applied to other wildland recreation settings. Conducting similar studies with a focus on other areas might offer interesting results and clarify whether these findings would translate to places other than Zion National Park.

It is highly recommended that a similar study be conducted in the field to clarify whether there is truly a difference between on-site and laboratory settings in studies such as this one. Settings can be presented in the field via headphones and photographs. If a study were conducted both on-site and in a laboratory, results could be compared to look for any significant differences in results. It is important that this research be continued in some way in the field in order to provide the most useful results to managers.

The study settings

Furthermore, a study design which includes all of the possible combinations of sound level and numbers of people is recommended. In this study, several combinations were excluded including a low level of sound paired with zero people and a high level of sound paired with zero people and four people. During analysis it became clear that presenting all possible combinations would allow for a more thorough analysis of resulting data and therefore, perhaps more definitive results. Additionally, including more variability of sound and crowding levels may provide more precise results.

Another reason to include all possible combinations of sound levels and crowding is that previous studies (Carles, et al., 1992 and Kuwano, et al., 2001) have supported a lack of congruence between images and sounds as leading to more negative evaluations, a correlation that this study does not support. A lack of congruence between sounds and images presented together can result in one of these variables seeming inappropriate. This inappropriateness seems to indicate a degraded environment to survey respondents (Carles, et al., 1999).

Participants were told that parts of the Virgin River Narrows are highly used and that because of the nature of slot canyons, it may be possible to hear people without seeing them. Therefore, participants may not have expected congruence between the level of human sound and the number of people visible. By including all of the possible combinations of sound levels and number of people it may be possible to determine if a correlation between incongruence in settings and negativity of assessments of those settings is something that would apply to acceptability of social conditions in wildland

recreation settings. By conducting a similar study in a different context, the expectation of a lack of congruence may be removed as this may be specific to slot canyon settings.

Additionally, in any future studies, researchers should consider asking participants to provide an evaluation of the setting as a whole. This type of evaluation was not asked for in this study, and the two acceptability ratings for each setting were added so that overall setting acceptability trends could be observed. Although images and sounds are perceived independently, according to Carles, et al., (1999), participants could be asked to provide their assessment of the setting as a whole, as well as for sound and people independently. It is possible that such a method would have yielded results very similar to what adding the two ratings together did, but it may have been more valid to have participants provide setting acceptability rating themselves.

There are several methods of conducting a similar study that would allow the overall acceptability ratings to be collected. Each participant could rate the setting as well as the sound level and the number of people. Also, the sounds and images could be presented individually for assessment and then in combination for an overall evaluation. Another method would have all study participants view the settings, including both sounds and images, but have part of the sample rate the acceptability of the sounds of the settings, part of the sample rate the number of people in the settings, and part of the sample rate the settings as a whole.

Noise sensitivity scales

Although there is little empirical evidence to do so, the Outdoor Recreation Noise Sensitivity Scale (ORNSS) should be tested further and possibly refined because it is an

exploratory scale. As originally developed, it consisted of 10 items. However, after factor analysis, the decision was made to include only five of the items in further analysis. This five-item scale should be included in further research similar to this study for the purpose of further validation.

Including "I don't know" as a response option on both noise sensitivity scales proved to be a bit problematic. The Weinstein Noise Sensitivity Scale (WNSS) did not originally provide this option. Because "I don't know" was available but did not have a corresponding numerical value for inclusion in the score, both the WNSS and ORNSS had to be reported as average scores. The average scores were based on the number of items each participant answered excluding "I don't know" answers. Although slightly problematic, the "I don't know" option was dealt with systematically and should not have significantly affected survey results.

The usefulness of an "I don't know" option as part of the ORNSS scale is questionable. It is suggested that in future research including the ORNSS, the response option "I don't know" be provided to only half of the survey participants to allow for comparison. If no significant difference between the two data sets is found, it is recommended that "I don't know" not be included in the future so that the scale can be used as an additive scale.

Inclusion of the WNSS in future research is not recommended. The WNSS did very little to contribute to the understanding of sound or setting acceptability in this study, similar to the Mace, et al. (1999) study (Mace, personal communication, 2004). Further testing of the ORNSS should be done before determining its usefulness as a way to measure noise sensitivity in a wildland recreation context. Future testing may include a

larger sample size, a sample including participants other than college students and perhaps items based on other dimensions.

Sample population

Although previous research has supported the use of college students as a study sample representative of the general population, it is possible that this was not the case in this study. There is a possibility that the survey sample was not from a broad enough range of students to adequately simulate a general population. Different types of people may respond to similar surveys differently. In the future, similar studies should try to include other groups of people in the sample population as well.

Other considerations

There are other questions inspired by this study which could be addressed with future research. One of these questions relates to the use of a dynamic variable (sound) with a static variable (pictures) and whether such a combination has an effect on the assessments of the variables. Future research could further investigate this, perhaps by isolating the effect of sound in some way or by using video rather photographs. Other research could investigate how things such as expectations and recreation experience level of survey respondents influence perceptions of crowding in multi-sensory research approaches. Still other studies could look into what personality characteristics lead some respondents to dislike or be annoyed by certain types of sounds (e.g. children laughing) in wildland recreation settings while others find the sounds pleasant or agreeable. There are many different directions that research extending from this study could go.

Summary

This is an experimental study which investigates sound in a wildland recreation setting in a way that has not been done before. There have not been studies which focus on the sounds that visitors themselves contribute to the soundscape of an area and how those sounds affect other visitors. Particularly in heavily used and frontcountry areas, this contribution to the soundscape may be much more important than the contribution of things such as aircraft overflights.

This study illustrates the importance of the sound of people in a wildland recreation setting, at least in a laboratory setting. It seems that these sounds contribute at least as much to visitor experiences as other factors such as numbers of other visitors encountered. The findings of this study are significant enough to warrant further research of sound as an aspect of social conditions in recreational settings.

Also, this study added sound into visual research methods that have been used in studies of perceived crowding to create a multi-sensory approach. Such an approach can allow for a more realistic representation of reality which can include portrayals, to some degree, of visitor behavior. Behavior can be very important in perceptions of crowding, and visual methods alone exclude it. By including visitor behavior and providing a more realistic representation of setting conditions, it may be possible to develop even better standards of quality for crowding. It may also be possible to develop standards of quality for levels of human sound, something that would be very useful to managers.

The importance of sound as an attribute of visitor experiences, as well as a lack of empirical research regarding sounds of visitors in wildland recreation settings, calls for further research to be conducted. Likewise, a multi-sensory approach to developing

standards of quality for crowding should be validated. It is hoped that this experimental study will prompt further investigation which will lead to a deeper understanding of the social conditions in wildland recreation settings. A deeper understanding of these conditions can lead to better management of recreation areas based on well-informed decisions and planning.

Appendix A - Survey response form

Social Conditions in Zion National Park, Utah

♦ Please evaluate the following settings from Zion National Park. ♦

Each setting represents conditions you might actually encounter. Please rate each setting by indicating how acceptable you feel the amount of human sound and the number of people are in a primitive area. A rating of -4 means the amount of human sound or the number of people is very unacceptable, and a rating of +4 means the amount of human sound or the number of people is very acceptable. (Circle one number for each setting.)

Three Practice Settings

	Acceptability								
	Very Unacceptable								Very Acceptable
Practice 1: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Practice 1: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Practice 1: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4

	Acceptability								
	Very Unacceptable								Very Acceptable
Setting 1: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 2: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 3: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 4: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 5: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 6: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 7: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 8: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 9: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 10: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 11: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 12: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 13: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 14: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 15: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4
Setting 16: Amount of Human Sound	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of People	-4	-3	-2	-1	0	+1	+2	+3	+4

♦ Please evaluate the following six photographs from Zion National Park. ♦

You will view a series of six photographs twice. First, you will see the photographs briefly without rating them. Next, you will see them more slowly with time to rate each one. Please rate each photograph by indicating how acceptable you feel it is based on the people shown. Imagine that you are in a primitive area. A rating of -4 means the scene is very unacceptable, and a rating of +4 means the scene is very acceptable. (Circle one number for each photograph.)

	Acceptability								
	Very Unacceptable								Very Acceptable
Photo 1.	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 2.	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 3.	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 4.	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 5.	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 6.	-4	-3	-2	-1	0	+1	+2	+3	+4

♦ The following items will help us understand how you feel about noises when you are recreating in a national park, national forest, state park, or recreation area. ♦

Please mark the number that corresponds to how often each item does/should occur.
1 = Always, 5 = Never, X = Don't know

	Always	Most of the time	Sometimes	Seldom	Never	*Don't know*
1. When I am outdoors, it bothers me to hear human-caused noise from a nearby road.	1	2	3	4	5	X
2. Hearing other people interferes with my enjoyment of the outdoors.	1	2	3	4	5	X
3. I mind if people yell or laugh loudly while they are outdoors.	1	2	3	4	5	X
4. If I am being quiet while I'm outdoors, other people should be quiet too.	1	2	3	4	5	X
5. Hearing aircraft interferes with my enjoyment of the outdoors.	1	2	3	4	5	X
6. At night, people should be quiet while they are outdoors.	1	2	3	4	5	X
7. If there is human-caused noise in the area, I am likely to go someplace else.	1	2	3	4	5	X
8. Even if I can't see people but I can hear them, I feel like there are too many people in the area.	1	2	3	4	5	X
9. I can only experience solitude in quiet places.	1	2	3	4	5	X
10. If I can hear human-caused noise in an outdoor area, it makes the place seem less natural.	1	2	3	4	5	X

♦The following items will help us understand how you feel about noise.♦

Please mark the number that corresponds to how strongly you agree or disagree with each statement below. 1 = Strongly disagree, 6 = Strongly agree, X = Don't know

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree	*Don't know*
1. I wouldn't mind living on a noisy street if the apartment/house I had was nice.	1	2	3	4	5	6	X
2. I am more aware of noise than I used to be.	1	2	3	4	5	6	X
3. No one should mind if people turn up their stereos full blast once in a while.	1	2	3	4	5	6	X
4. At movies, whispering and crinkling candy wrappers disturb me.	1	2	3	4	5	6	X
5. I am easily awakened by noise.	1	2	3	4	5	6	X
6. If it's noisy where I'm studying, I try to close the door or window or move someplace else.	1	2	3	4	5	6	X
7. I get annoyed when my neighbors are noisy.	1	2	3	4	5	6	X
8. I get used to most noises without much difficulty.	1	2	3	4	5	6	X
9. It wouldn't matter to me if an apartment I was interested in renting was located across from a fire station.	1	2	3	4	5	6	X
10. Sometimes noises get on my nerves and I get irritated.	1	2	3	4	5	6	X
11. Even music I normally like will bother me if I'm trying to concentrate.	1	2	3	4	5	6	X

(Continued on next page)

	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree	*Don't know*
12. It wouldn't/doesn't bother me to hear the sounds of everyday living from neighbors (footsteps, running water, etc).	1	2	3	4	5	6	X
13. When I want to be alone, it disturbs me to hear outside noises.	1	2	3	4	5	6	X
14. I'm good at concentrating no matter what is going on around me.	1	2	3	4	5	6	X
15. In a library, I don't mind if people carry on a conversation if they do it quietly.	1	2	3	4	5	6	X
16. There are often times when I want complete silence.	1	2	3	4	5	6	X
17. Vehicles should be required to have quiet mufflers.	1	2	3	4	5	6	X
18. I find it hard to relax in a place that is noisy.	1	2	3	4	5	6	X
19. I get mad at people who make noise that keeps me from falling asleep or getting work done.	1	2	3	4	5	6	X
20. I wouldn't mind living in an apartment with thin walls.	1	2	3	4	5	6	X
21. When I'm trying to concentrate, I turn on music to block out other noise.*	1	2	3	4	5	6	X
22. When I go out with friends, I would rather spend time in a quiet place (coffee shop, restaurant, etc) than a loud place (bar, club, etc).*	1	2	3	4	5	6	X
23. I am sensitive to noise.	1	2	3	4	5	6	X

Demographic Questionnaire

1. What is your age? _____

2. What is your gender? M □$_1$ F □$_2$

3. What is your major? _____

4. How many times, in the past two years, have you visited a national park?

□ 0$_1$ □ 1-4$_2$ □ 5-9$_3$ □ 10 or more$_4$

a. Have you camped overnight in a national park during the past two years?

Yes □$_1$ No □$_2$

5. Have you visited Zion National Park before? Yes □$_1$ No □$_2$

a. If yes, how many times?

□ 1-4$_1$ □ 5-9$_2$ □ 10 or more$_3$

6. Have you hiked in the Virgin River Narrows before? Yes □$_1$ No □$_2$

Appendix B - Survey script and introduction

Thank you for participating in this study of social conditions at Zion Nation Park.

Your participation in this study is voluntary. Information gained through this survey will be included in a master's thesis and may be published. All responses are confidential.

Solitude and natural quiet are important values in many of our national parks. The intent of this study is to evaluate the effect of people and their related sounds on other visitors.

To get your opinion we will show you scenes from the Virgin River Narrows, a popular slot canyon in Zion National Park. You will also hear varying amounts of human sounds while you see the pictures. The volume has been adjusted to reflect the range of sounds that really occur in the canyon. The pictures and sounds presented represent actual conditions you might encounter while in the area. You will evaluate the acceptability of encountering the number of people and the acceptability of hearing the amount of human sound in each setting. Next, you will view images from the same area depicting different levels of crowding and evaluate the acceptability of those scenes.

Zion National Park is located in southwestern Utah and is characterized by a desert climate and towering canyon walls. Many people visit the park to hike among the many canyons and climb trails along the steep sandstone walls to reach overlooks atop high mesas.

Zion Canyon, which was cut over millions of years by the Virgin River, is the most frequently visited area in the park. During the months from April to October, the scenic drive through Zion Canyon is accessible only by riding the park's shuttle busses. The shuttle bus system was implemented in 1997 to deal with the increasing amount of traffic and the parking and pollution problems associated with it. The last shuttle stop along the scenic drive, at the northern end of the canyon, is the Temple of Sinawava. This picture shows the shuttle stop at the Temple of Sinawava. From this point, the popular Riverside Walk, a one-mile paved trail, begins and runs adjacent to the Virgin River.

At the end of the paved trail, the Virgin River Narrows begins. Many people who walk along the River Trail enjoy stepping into the water to cool their feet, even if they don't plan to hike any further up river. The Narrows, as most people call the area, is a slot canyon and, therefore, most of the hiking in The Narrows is done in the river itself. Hikers follow the riverbed into the canyon and must walk through water that might be only several inches deep in some places but waist deep in others. In some areas, the slot canyon is quite narrow and the canyon walls can reach over 2000 feet. The river winds its way through The Narrows and in some places there are sharp turns and blind curves in the canyon.

The park is managed to provide a variety of opportunities for visitor experiences. Various activities are allowed within different areas of the park. In this study, please imagine that you are in a primitive area of the park. Primitive areas in Zion National Park allow visitors to experience wildlands with very little development and only narrow, unpaved trails. Camping is permitted at designated sites. Individual groups are limited to twelve people and visitors can expect to feel that they are in a natural landscape with a moderate sense of solitude. The part of The Narrows we are examining is in a primitive area.

In this study, we are interested in your opinion of the amount of human sound that you hear and the number of people you see while observing the settings from the Virgin River Narrows. We ask that you imagine yourself in the setting while looking at a series of pictures and listening to the accompanying sounds. About half way through the time that each setting is displayed you will be prompted to indicate how acceptable the amount of sound and number of people are in the setting. First, indicate the acceptability of the sounds you hear, and second, indicate the acceptability of the number of people you see on the form provided. Please circle only one number to rate the amount of human sound and one number to rate the number of people for each setting.

- The following three settings are for practice. These settings have combinations of different amounts of human sound and different numbers of people that you might actually encounter in the Narrows. We are interested in how acceptable you find the setting based on the amount of human sound and the number of people in a primitive area.
- A rating of -4 means the amount of human sound or number of people is very unacceptable, and a rating of +4 means the amount of human sound or number of people is very acceptable.
- First, circle one number for the amount of sound and then circle one number for the number of people for each setting. You will have 15 seconds for each setting.

You will now observe and rate 16 settings.
Each setting represents conditions you might actually encounter.

- Please rate each setting by indicating how acceptable you feel the amount of human sound and the number of people are in a primitive area.
- Remember, a rating of -4 means the amount of human sound or the number of people is very unacceptable, and a rating of +4 means the amount of human sound or the number of people is very acceptable.
- First, circle one number for the amount of human sound and then circle one number for the number of people in each setting.

For the next part of this study you will evaluate six photographs of the Narrows. First, you will see the photographs briefly without rating them. Next, you will see them more slowly with time to rate each one. Please rate each photograph by indicating how acceptable you feel it is based on the people shown. You will not be evaluating sound. Imagine you are in a primitive area.

A rating of -4 means the scene is very unacceptable, and a rating of +4 means the scene is very acceptable. Circle one number for each photograph when prompted.

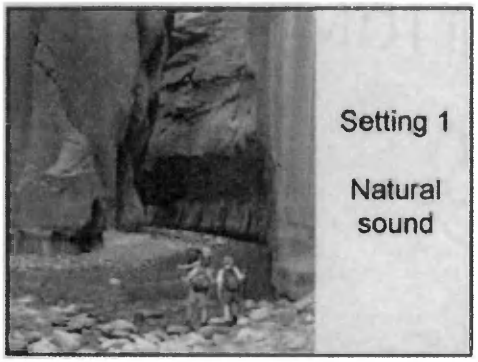
- The photographs will not be in the same order as previously shown.
- You will have about 6 seconds to observe and rate each photograph.

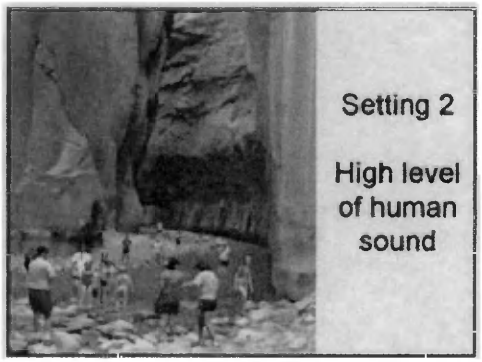
For the last section of the study please fill out the remaining questionnaire. Please carefully read each set of instructions and complete each question.

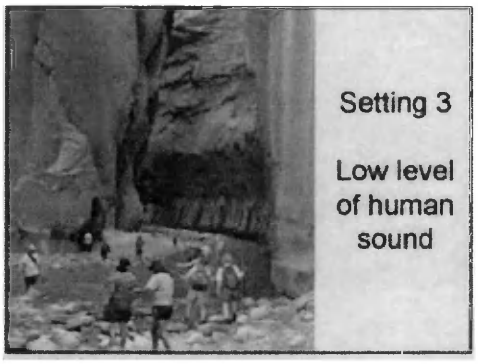
Appendix C - College majors of survey respondents

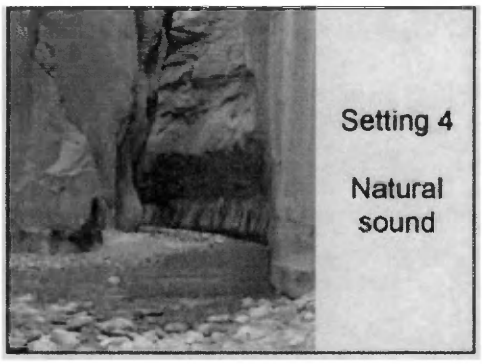
Recreation Management	1	Athletic training	20
Environmental Studies	2	Archeology	21
Resource Conservation	3	Anthropology	22
Wildlife Biology	4	Sociology	23
Forestry	5	Psychology	24
Range Management	6	Social Work	25
Botany	7	Criminology	26
Ecology	8	Education	27
Geography	9	Language (Spanish)	28
Chemistry	10	Communications Studies	29
Micro-biology	11	Journalism	30
Human biology	12	Political Science	31
Pre-med	13	Business	32
Nursing	14	Marketing	33
Pharmacy	15	Computer Science	34
Radiology	16	Art	35
Physical Therapy	17	Drama/Dance	36
Exercise Science	18	Undecided/General	37
Health and Human Performance	19		

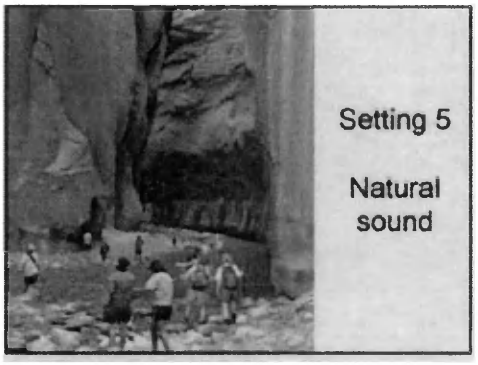
Appendix D - Survey settings

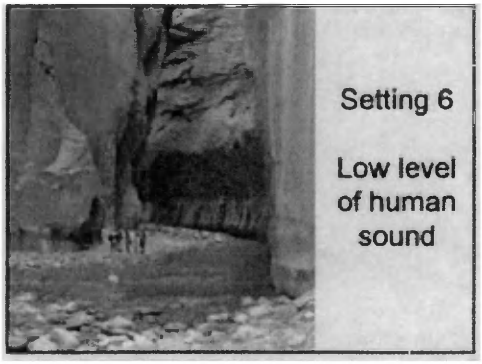


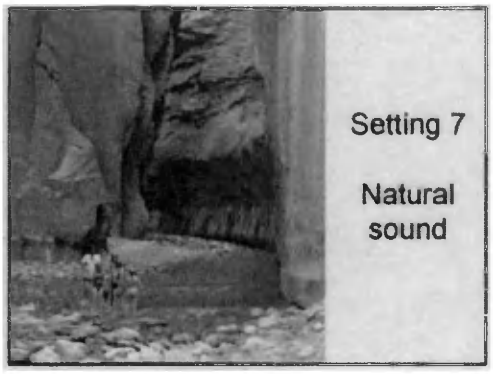


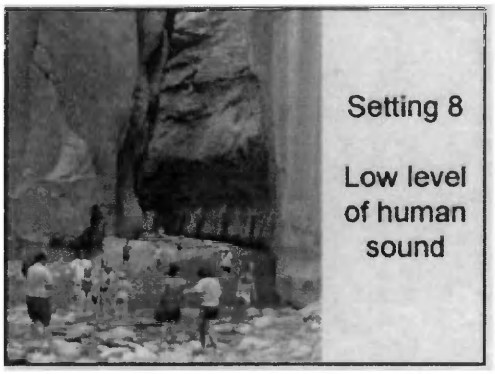


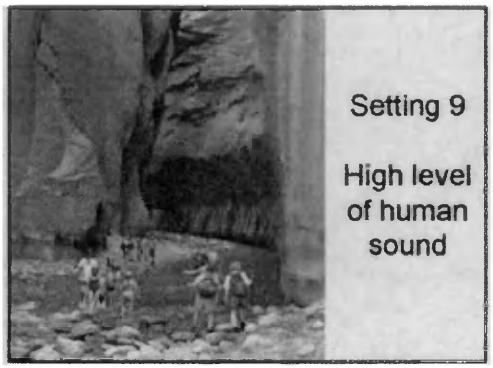


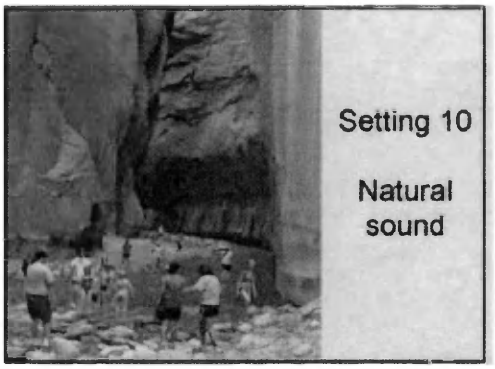


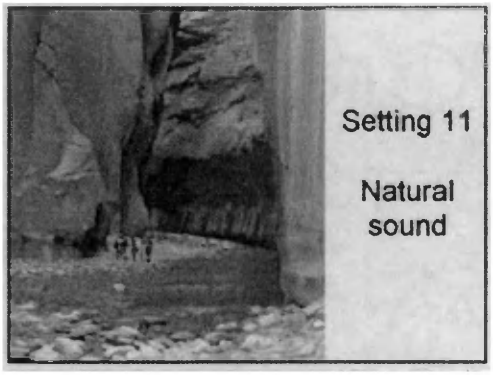


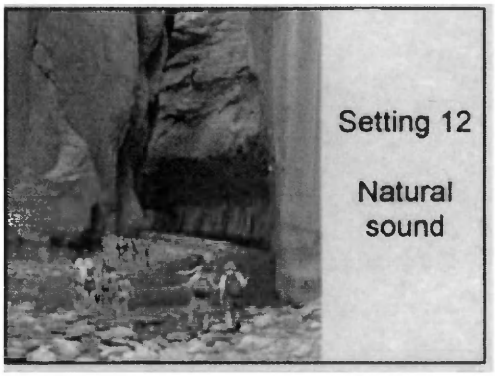

Setting 7
Natural sound

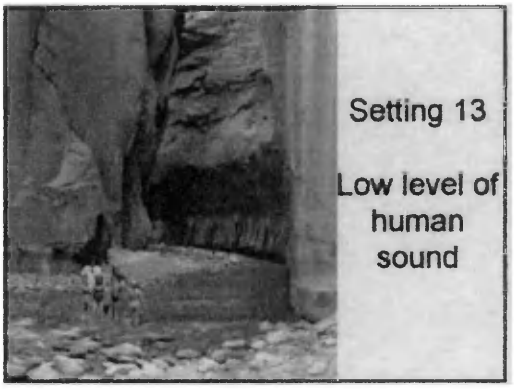

Setting 8
Low level of human sound

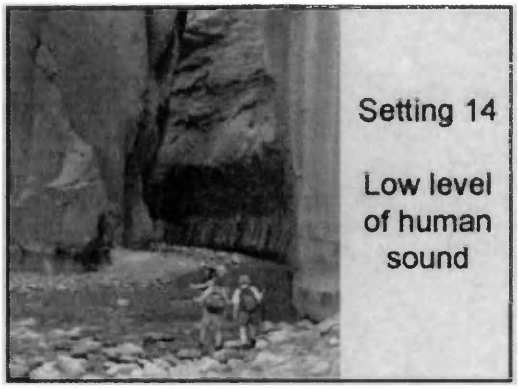

Setting 9
High level of human sound

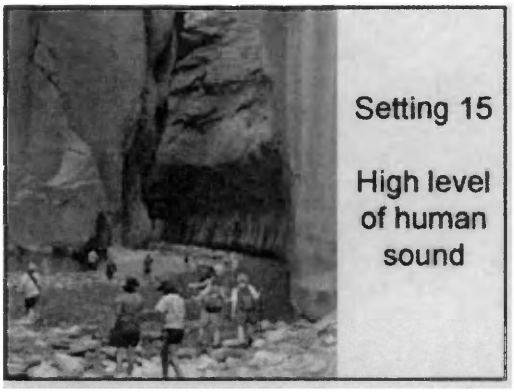

Setting 10
Natural sound

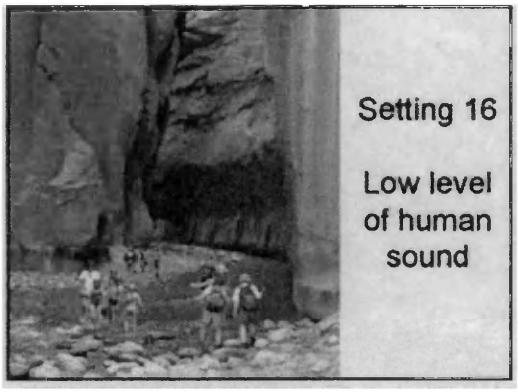

Setting 11
Natural sound


Setting 12
Natural sound

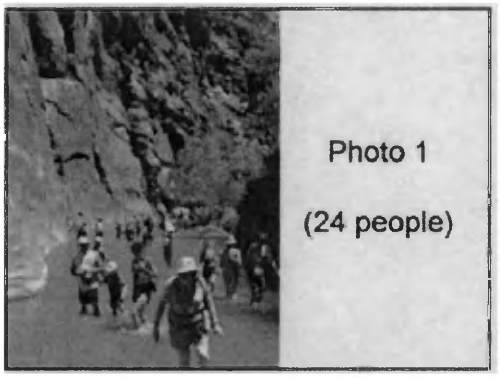

Setting 13
Low level of human sound

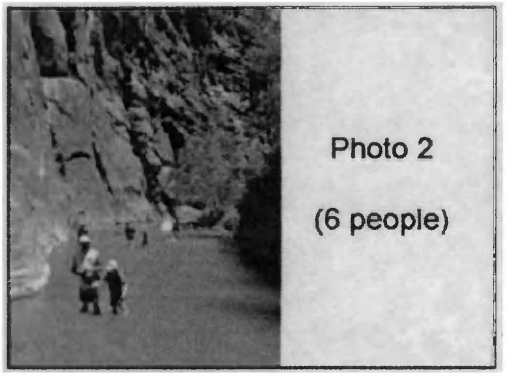

Setting 14
Low level of human sound

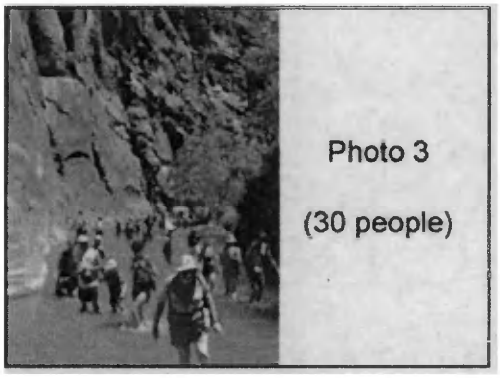

Setting 15
High level of human sound

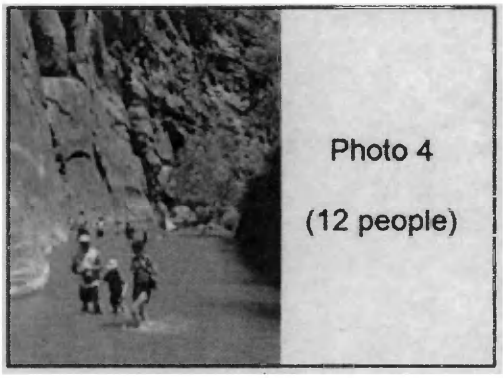

Setting 16
Low level of human sound

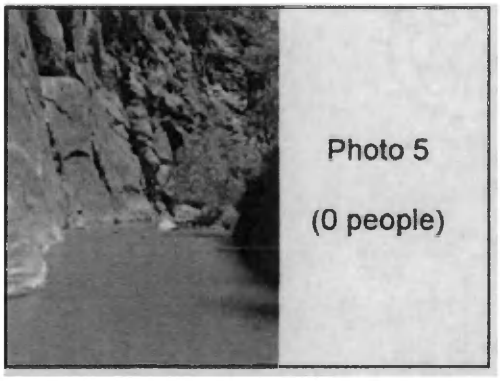
Appendix E - Crowding series of photographs

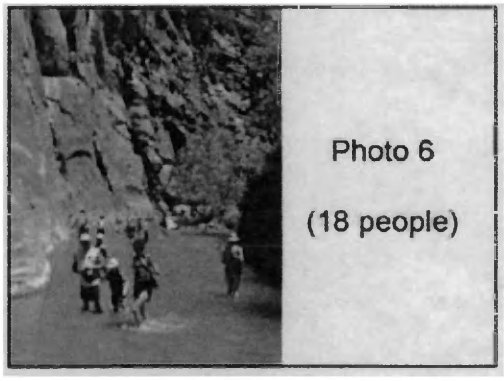












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