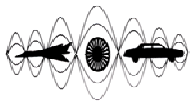
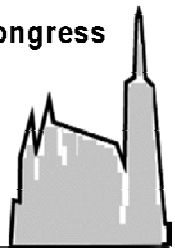
ICSV13 - Vienna
The Thirteenth International Congress on Sound and Vibration
Vienna, Austria, July 2-6, 2006





THE IMPORTANCE OF VISUAL AND ACOUSTIC FACTORS IN DETERMINING TRANQUILLITY FOR USE IN LANDSCAPE MANAGEMENT AND PLANNING

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Abstract

The word tranquillity appears in numerous policy and planning documents and is frequently cited as a vital indicator of environmental quality. However, no quantifiable or structured mechanism exists which enables subjective assessments of visual and acoustic factors that affect tranquillity to be factored into landscape management and planning decisions. This is largely due to the fact that within the context of a 'tranquil environment', little is known about the interaction of different sensory modalities and how they influence the construction of tranquil space. A study was conducted that utilized photographic and video stimuli which were collected from a sample of five contrasting urban and rural environments. Data in the form of still and recorded images were presented to subjects who were required to make assessments about the perceived level of tranquillity and the influence upon tranquillity of natural and manmade sounds. This work marks the first step in a much wider study of the contribution and interaction that visual and auditory elements make to the overall perception of tranquillity. The initial findings show that a clear correlation exists between the percentage of natural and manmade features in landscape settings and the perceived level of tranquillity. This work will be of particular interest to those charged with large-scale landscape management, such as the National Park Authorities, Regional Councils, and other agencies concerned with providing and maintaining public amenity in both urban and rural environments.

INTRODUCTION

The ever increasing speed and intensity of modern life is placing unprecedented pressure on areas that have traditionally been valued for their peace and quiet. As more greenfield sites are brought into development and areas of inner city green space lost, the ability of people to seek out the type of environments that aid recovery from the sensory overload of everyday urban life becomes compromised. Such restorative tranquil environments have been described as providing 'soft fascination' [1], which is deemed to occur when there is enough interest in the surroundings to hold attention, but not so much that the ability to reflect and relax becomes impeded. In comparison, locations that provide 'hard fascination', or sensory overload, are so intense that they leave little or no room for reflective thought. Therefore, protecting existing, and creating new tranquil environments, becomes an important aspect of landscape management and design. However, we can only begin to move towards an engineered solution to this challenge by understanding both the objective and subjective qualities that make these environments so valued in the first place. For the purposes of this project, the extent to which a place is considered to be tranquil is defined by how much individuals think a particular setting is a quiet peaceful place, i.e. a place to get away from 'everyday life' [2].

When constructing such 'tranquil space', people draw upon a complex array of emotional, experiential and sensory inputs. However, despite considerable research being undertaken by scientists to determine how visual and auditory modalities work together [e.g. 3], it is still uncertain how they combine and interact to bring about a state of tranquillity. This is supported in part by findings from the field of acoustics, which has established that there is a link between the perceived degree of noise annoyance and specific visual settings [4,5,6]. These studies significantly contribute to the current understanding of tranquillity assessment and link directly to this multidisciplinary study, which seeks to investigate in a real world setting how the auditory and visual modalities influence the construction of tranquil space.

The initial work undertaken in this study involved a ranking exercise of perceived tranquillity and the use of video footage to provide visual stimuli in an exercise designed to assess the soundscape quality of a variety of different landscapes. The video footage gathered during this initial phase will also be reused in a later series of subjective assessment exercises where both visual and auditory stimuli will be presented together. These experiments will be reported on at a later stage in the project.

DATA COLLECTION

The 100 images which were ranked from the most to the least tranquil by fifty subjects, utilized scenes selected from a database of 360 photographs that were taken from across England during the summer of 2005. The data set included 20 colour images from each of the following five generic landscape classifications: mountainous and wilderness; coastal; parks and gardens; rural; and urban. These 15cm x 10cm images were randomly selected to cover a range of tranquillity ratings

and included a broad spectrum of landscapes that were identifiable, if not familiar to, the subjects taking part in the experiment. The chosen angle of view was generally suitable for taking typical landscape views, i.e. telephoto shots were avoided.

RANKING EXERCISE

The primary aim of the ranking exercise was to develop a systematic approach to identifying landscape types which, through engineered solutions, have the potential to facilitate tranquillity, in order that they could be filmed and used as representative samples during the main subjective assessment experiments. This will comprise the next phase of the study. This filtering process may be novel as previous papers [2, 5] that have used still images to determine how quiet a particular scene is perceived to be, have not provided sufficient details of the selection criteria. The secondary aim was to use the photographs to calculate the percentage of natural and anthropocentric space occupied in each image, in order to determine if a positive correlation existed between this and the image's ranked position in terms of its perceived tranquillity.

The ranking exercise involved subjects ranking 100 photographs in terms of tranquillity; however, it was left to each individual participant to decide the sorting process they adopted. The instructions were as follows: "Please examine these photographs and sort them in terms of your assessment of the tranquillity of the area where the photographs were taken". The results were statistically tested by calculating the degree of agreement between the subjects using Kendall's coefficient of concordance and a relatively high score of 0.67 ascertained. This correlation is highly statistically significant at the 0.1% level and clearly indicates both a good measure of agreement between the participants and that the subjects were using similar criteria in assessing tranquillity.

OBJECTIVE MEASURES

In addition to the ranking exercise, objective measures of the scenes reproduced on the photographs were also taken. Figures 1 and 2 show two of the images included in the exercise and Table 1 provides a breakdown of the percentage of space occupied in each image by natural features, people and manmade objects, and fauna (this includes wildlife and livestock). The number of people contained in each image is also included. The percentage composition of each photograph was determined by overlaying a 10 x 10 grid and manually estimating the area occupied by each of the 3 categories, whilst the number of people present in any scene was simply counted.

Figure 1 North Cornish Coast

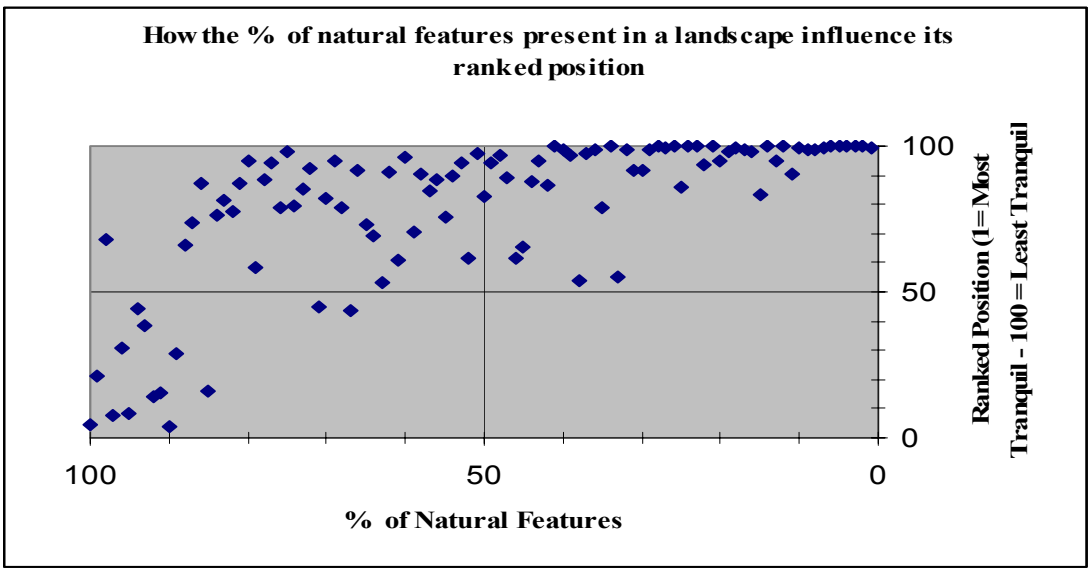
Figure 2 Swanpool Beach – Cornwall

Table 1 The percentage composition of natural features, manmade objects and people, plus the number of people present in Figures 1 & 2

Fig No	Ranked Position	% of manmade objects and people	% of fauna	% of natural features	Number of people present
1	1st	0	0	100	0
2	87th	26	0	74	>100

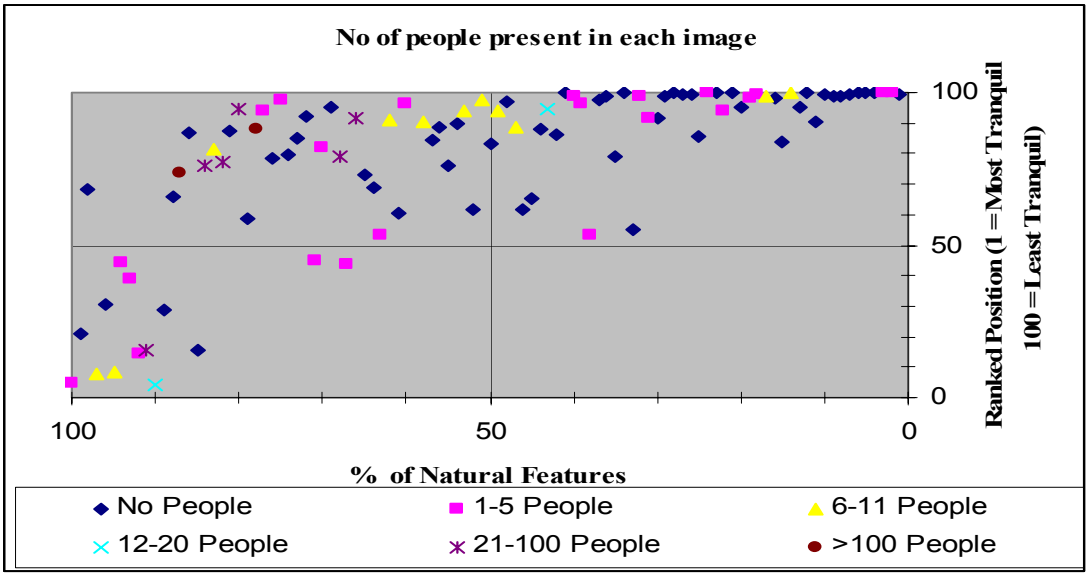
By using data from all 100 images, it has been possible to indicate graphically the perceived tranquillity as a function of naturally occurring and manmade features. This is shown in Figure 3. This graph shows that one aspect of an engineered solution to creating tranquil space, might be as simple as increasing the percentage of natural features in any given scene, which in turn could bring about a perceived dB gain. This is an important factor as 89% of the subjects taking part in the ranking exercise, recorded on their questionnaires that the imagined type of soundscape at each location had significantly influenced the order in which the images had been ranked.

Figure 3 The % of natural features per image plotted against the ranked position



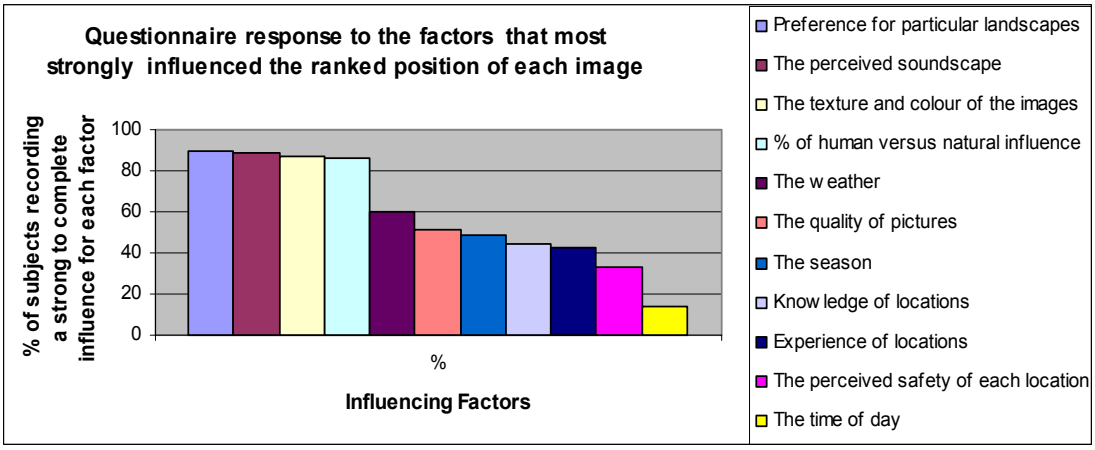
It is clear from the graph that several of the images comprise a high percentage of natural features yet rank quite poorly and this may be because they contain people, (Figure 4). The types of landscapes that typify those images falling into the upper left hand quadrant of the graph are of most interest, as they offer the greatest potential to develop an engineered solution to increasing the amount of tranquil space.

Figure 4 Ranked positions of images containing people



Previous studies [7] have indicated that the presence of people disrupts tranquillity, more than any other factor. However, it can be seen from the graph that approximately 75% of the top 20 ranked images contain up to 21 people. This coupled with the data shown in Figure 3 suggests that the percentage of natural features has a far greater impact on perceived tranquillity than human presence.

Figure 5 The factors that most influenced the ranked position



Additional influencing factors recorded in the questionnaire that accompanied the ranking exercise showed that the amount of water present and the mood of the subjects at the time of ranking were also significant factors.

PROPOSED METHODOLOGY FOR SUBJECTIVE ASSESSMENT

This primary aim of the subjective assessment exercise is to gauge how the various types of sounds that comprise the soundscape of a particular environment contribute to the construction of tranquil space.

During the experiment, subjective assessments will be made of the soundscape of 10 venues based on the information presented in the form of video data streams shown on a laptop with corresponding sound played through headphones. Subjects will be asked to assess the 'loudness' of the five categories of sounds listed in Table 2 whilst at the same time making an overall assessment of the perceived tranquillity of each location. This information will then be correlated with the results of a laboratory analysis of each recording, in order to determine the impact of various natural and manmade noises upon tranquil environments.

Table 2 Five sound source categories to be used in the subjective assessment exercise

Sound Source	Definition
Human	Sounds made by people including musical instruments
Mechanical	Sounds emitting from anything manmade, excluding musical instruments and water features
Wind	Sounds made by the wind e.g. wind in trees, telegraph wires
Water	Sounds made by water e.g. rapids, waves, rain, fountains,
Biological	Sounds made by living organisms excluding human beings e.g. farm animals, bird song, humming bees

Figures 6 & 7 show how the subjective assessment results will be recorded. In order to provide visual context, this data is accompanied by a still image taken from the video footage used during the pilot study.

Figure 6 Re-development of Forster Square, Bradford, England

	Human	Mechanical	Wind	Water	Biological
Loud		● π			
Moderately Loud	●				
Moderately Quiet	π				
Quiet			●		● π
Silent			π	● π	

Figure 7 Lake District National Park, Cumbria, England

	Human	Mechanical	Wind	Water	Biological
Loud					
Moderately Loud					
Moderately Quiet			π		● π
Quiet	●		●	● π	
Silent	π	● π			

The assessments shown as a ● bullet point for each example were taken from the field log and represent the photographer's best estimation of the actual soundscape at the time of capturing the image. Those marked as $\boldsymbol{\pi}$ are an actual example of the expected soundscape for each image based on visual information only. These were taken from a small sample used in a pilot study.

SUMMARY

The aim of the research undertaken thus far on the 'Noise and Tranquillity in Urban and Rural Environments' project, has been to gain a better understanding of the effect of a single modality on the perception and expectation of tranquillity, based on the use of still images only. The results of this work have enabled a more detailed experimental strategy to be developed that will explore the relationship between the subjective assessment of a soundscape and the objective measurements taken in the laboratory.

CONCLUSIONS

This research represents the first step to characterize the contribution and interaction of visual and auditory elements to the perception of tranquillity. It has shown that a positive correlation exists between the expected level of tranquillity and the percentage of natural and manmade influences within any given landscape, and that a significant influencing factor in the construction of tranquil space is the perceived soundscape. The data presented in Figure 3 shows that when the proportion of natural features within a landscape drops below 50% the perceived level of tranquillity falls significantly, and Figure 4 clearly shows that in environments that comprise a high percentage of natural features, the presence of other people does not necessarily disrupt tranquillity. The subjective assessment pilot study has also identified that subjects are able to make a reasonable estimation of the soundscape of a location based only on visual data and this work will now be extended to a much larger sample.

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