S O N I C E X P E R I E N C E S I N T H E E N V I R O N M E N T:

SOME EXPERIMENTAL STUDIES USING SIMULATION TECHNIQUES

by

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SONIC EXPERIENCES IN THE ENVIRONMENT:

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Submitted to the Department of Architecture on June 14, 1971, in partial fulfillment of the requirements for the degree of Master of Architecture (Urban Design).

ABSTRACT

The study examines the way in which commonly heard sounds are experienced in the environment using two simulation experiments.

The problem area is initially defined from the relevant literature and a short field study of the Boston soundscape. A number of preliminary conclusions are reached which form the basis from which the study is developed. The conceptual form of a sonic experience is seen to be a particular interaction between a sound (or sounds) and a person in a place and these become the three basic experimental variables. The relative merits of real-world and simulation techniques are considered, with simulation favoured for present purposes principally for ease of control.

The design of two experiments is described and their associated technical problems. These experiments enable five hypotheses which developed from the preliminary work to be tested.

The first experiment uses sound stimuli only, and sequentially presents a set of thirty stereophonic taped-recorded common sounds or short sound sequences taken from the environment to subjects through headphones. Each sound stimulus is used to trigger-off a recollection of a past experience a subject may have had in which such sounds played some part. Responses are gathered on a standardised-format question sheet.

The second experiment takes a set of ten sounds from the original thirty and sequentially presents these as before to subjects who are simultaneously projecting themselves into a given "place" by viewing a colour slide of an unfamiliar environment. This procedure is repeated for each subject using the same sounds with two other "places". The responses, again on a standard question sheet, are related to how appropriate and informative the individual sounds appear to subjects in the given settings.

The experimental findings generally suggest that the sounds used in the experiments are often highly meaningful to subjects and

past experiences in which they were involved can sometimes be vividly recalled. Subjects were also highly perceptive of sounds when these were presented with "places" and consistently searched for congruity between the sound and its setting.

The success of the techniques used is evaluated after experiment and suggestions made about how similar future methodology might be improved.

Some perceived implications of the study are briefly discussed and recommendations made for future research in this area.

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INTRODUCTION

Consider the following pieces which describe two situations with sound in the environment. One was written in the nineteenth century by the pastoral poet John Keats about one aspect of a particular seasonal event in rural England. The second is the remarks of contemporary experimental composer John Cage on some of his perceptions of a modern American city:

(1) "Then in a wailful choir the small gnats mourn
Among the river swallows, born aloft
Or sinking as the light wind lives or dies;
And full-grown lambs loud bleat from hilly bourne;
Hedge crickets sing; and now with treble soft
The red breast whistles from a garden-croft;
and gathering swallows twitter in the skies."[1]

(2) "There are three spectacular sound experiences in New York city that I have met: one is at East 12th on 5th Avenue by Longchamps Kitchen where the sounds are comparable to a Balinese orchestra.
Another is at East 14th Street near the river where I have heard a throbbing of sounds. The third is in Brooklyn on the roofs overlooking the Battery where base sounds are muted, and the dominant sounds are clearly separated, like stars."[2]

Both are portraying circumstances where distinctive and identifiable sounds in the environment can become particularly meaningful and by so doing enrich one's total perception of a place. Such occurrences, of which we are directly aware, however, may happen only infrequently in the day-to-day life of the urban dweller.

Cities roar with noise to which we become oblivious and only hear on a tape recording. Yet everyone has experienced, at one time or another

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[1]John Keats, "Ode, to Autumn", (third stanza).

[2]John Cage, Remarks made in a discussion with Professor György Kepes and Kevin Lynch of M.I.T.

as a pedestrian, the pleasure of entering, for example, the oasis of some small plaza in the heart of a city which is protected from the din of traffic by enclosing buildings. Here, fountains may tinkle, and the sound of human voices and footsteps blend with bird-song. For a few fleeting moments the city is forgotten and one is carried away in thought to some remote place or event by the sounds which are heard there.

Our ears, unlike our eyes, are always open and receiving information from the world about us. It may well be that the lack of such "experiences" with sound is therefore a significant kind of deprivation for those who use the city. On the other hand, their occurrence could also be an important aspect of environmental reinforcement which at present is frequently absent in urban settings.

The intention of this thesis, therefore, is to explore the significance for people of certain sounds which commonly occur in the physical world by specifically studying what has been termed a "sonic experience".[3] This has been attempted through the relevant literature, field study and by developing and running two experiments using a group of subjects which seek to clarify this particular aspect of the part played by sound in the environment. While the findings of this exploratory investigation can only be partial (and give no indication as to the possible effects when environments lack sonic quality) it demonstrates that even commonplace sounds can have an important role in certain circumstances.

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[3]That is, an experience in the environment where sound plays an important part.

[A] PRELIMINARY WORK

1. POINT OF DEPARTURE: BACKGROUND RESOURCES

Since only a general understanding of what, in detail, constitutes a "sonic experience" was perceived at the outset of this study, the preliminary search for further directives necessarily encompassed a fairly broad spread of sources. In the literature, these ranged from technical texts on physical acoustics to selected works of English literature.

The following listing represents the areas of source material which appeared to have relevance for the present study. Some of these have been valuable in focussing the area of concern and developing the experiments which are reported later while others provided a general background. Briefly, they were as follows:

(1) Text books and papers on various aspects of physical and psycho acoustics.

(2) Existing research on perception of sound in the environment, including also studies with the blind and deaf.

(3) Any writings describing other people's observations on meaningful sounds in the environment and experiences with sound.

(4) Material on human factors in the perception of music.

(5) Some texts on information theory, particularly where this relates to the carrying of messages by sound.

(6) Relevant parts of the general literature of psychology.

(7) Sources on methodology in experimental psychology.

(8) Books and papers on the measurement of "meaning" and "meaningfulness" as a guide to designing response formats for the experiments.

(9) A film-maker's notes on his experiences in designing and recording sound-track material for a particular documentary film.

These nine areas were further supplemented by:

(10) The author's personal experience, introspection and observations about the sonic environment (including a short exploratory field study of selected parts of Boston).

(11) Discussion with persons whose knowledge or experience might be helpful in developing the study.

At this preliminary stage, the search for directives was kept fairly broad so that the study might develop from a comprehensive base. However, Michael Southworth's M.I.T. investigation of the soundscape of Boston[1] - the only systematic research apparently done to date on the native sounds of large-scale environments (urban or otherwise) - was a particularly useful reference.

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[1]Michael F. Southworth, "The Sonic Environment of Cities", M.C.P. thesis, Department of Urban Studies and Planning, M.I.T. (1967).

2. DEFINITION OF THE PROBLEM AREA

While the interest was in experiences with sound in all environments, the urban environment was perhaps of most interest and was selected as the initial frame of reference for three reasons:

(1) Research had already been made on the soundscape of the city specifically.

(2) The findings of the present study could perhaps ultimately have urban design implications (and it had been this possibility which had prompted the author's interest in the subject originally).

(3) All environments were too many to adequately cover within the scope of this research.

From this point, two of the resource areas cited in Section A.1 appeared especially promising and these were initially examined as a guide to clarifying the problem area as follows:

FIELD STUDIES

M. Southworth found that the sound of vehicles predominated in the city and that much of the soundscape was undifferentiated and lacking in identity. Very few sound settings were especially unique or informative. Those which were generally contained at least one or more meaningful sounds which stood out and contrasted with the general ambient background. In these cases the absolute levels appeared to be unimportant provided there was sufficient contrast between the dominant and background sounds. Therefore, settings with low sound ambience such as quiet alleys where, for example, footsteps, bird song

and other "small" sounds could be clearly heard or those where a policeman's whistle, crackling paper bags and individual human voices were audible above a general blended backgrounds of cars, people and activity were both judged by subjects as the most informative. Settings of this type were also the most preferred and memorable to subjects.

The author's own exploratory field survey covered most of the same study area and some additional sections of Boston's hub. This involved observing the sonic characteristics of many settings on foot at different times of day and days of the week. In general, Southworth's findings were confirmed by the author. The city soundscape was dominated by traffic and aircraft sounds, and places with any sort of intrinsic interest sonically were the exception. Furthermore, since the author, like Southworth's subjects, was sensitized to and was "listening"[1] for the sounds about him, it is doubtful if few of the settings studied would ever catch the attention of a person in the normal situation of pursuing his business in the city. Settings where place-specific sounds might be expected (such as perhaps the sounds of water, gulls and boat hooters at the waterfront) were often found not to contain them and generally sounds were only loosely correlated to physical form.

Within the limits of the field study, therefore, it would appear that urban environments (insofar as Boston is typical) offer

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[1]The distinction between "hearing" and "listening" is explained later in Section B.3.

few situations where native sounds seem to significantly contribute to one's perception of the environment and that the city soundscape generally lacks inherent interest and contrast.

GENERAL LITERATURE

Cage's remarks[2] seem to support the belief that a contrastful differentiation between dominant sounds and their background is first necessary before a sonic experience can occur. The examples he cites all contain dominant sounds which are distinguishable and which have novel spectral and temporal characteristics with respect to their settings.

Others writing about sounds they have noticed in the city speak similarly of clearly identifiable sources such as "... the wailing of sirens on the river, the swishing of the late trains, the groan of an early cat..."[3] or, in turn-of-the-century London, "...the creaking and groaning and chirping and rattling of vehicles...; the jangling of chain harness..."[4]

Turning to sounds in the rural environment, literature contains many examples of sound situations reported in the solitude of the country. There, natural sounds predominate - wind and weather, animal sounds, birdsongs, the gurgling of a brook - and the many delicate nuances of tiny sounds may be clearly heard because of the absence of the blurring background of the city.

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[2]See INTRODUCTION.

[3]Lawrence Durrell, "The Spirit of Place", p. 182.

[4]H.B. Cresswell, Quoted in: J. Jacobs "The Death and Life of Great American Cities", p. 342.

Natural sounds, like natural textures or shapes, seem to have a deep significance for humanity which is reflected in the pastoral tradition in literature and the arts from Virgil to the "reflective" poets such as Shelley, Keats, Arnold or Wordsworth. A bird's song or a croaking frog was enough to make Emerson write: "Do not these suffice? Here is... a new experience."[5] Such an experience is well illustrated in Keats' "Ode" already quoted:[6] a blend of many identifiable and evocative sounds which even by reading can build an image and perhaps evoke an association with some past event in the mind of the reader. The ability of particular sounds to stimulate such associations may be a significant issue in the study of sonic experiences and is looked at more fully below.

OTHER OBSERVATIONS

"Sound and Association"

Associations with sound at a trivial level occur even in the metaphors of everyday language where we speak of the "howling" of the wind or the "singing" of a kettle and are taken for granted. Bachelard[7] describes how the sound of his neighbour hammering nails into the apartment wall reminds him of the woodpecker at work in a tree outside his house in the country and he makes similar associations with other common sounds. Cage and Durrell both use the analogy of an "orchestra" when describing their own particular experiences with

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[5]Ralph W. Emerson, Quoted in: P. Bliss (Ed.) "The Heart of Emerson's Journals", p. 73.

[6]See INTRODUCTION

[7]Gaston Bachelard, "The Poetics of Space", p. 97.

with sound in the city - a useful image since it conveys a total sense of the experience by association more meaningfully than possible through description alone.

From available evidence these associations appear, at least, to link either with other sounds which are physically similar or to some past experience in which such sounds have played a part. Lawrence Durrell again writes how to him "...the wheels of a taxi on the smooth black road never made anything but the sound of a choir of gnats, even in wet and frosty weather...."[8] and Freya Stark describes how she "...first noticed how the sound of water is like the talk of human voices and would sometimes wake in the night, thinking that a crowd of people were coming through the woods."[9]

"Sound and Purpose"

One further issue which was believed might have some bearing on sonic experiences (but for which no information was at this point available) was the influence of an individual's purposes at a given moment on the way he perceived sounds in the environment. The sources in literature gave few clues as to the situation of the writers at the time they had experienced sounds they were describing although Stark spoke of hearing a brook when in bed and Durrell the sounds of the city when out strolling late at night - both presumably then in a "receptive" state of mind. Neither field study provided

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[8]Durrell, Op. cit., p. 183.

[9]Freya Stark, "The Journey's Echo," p. 55.

any further guidance since both had involved observers who were unnaturally focussed on sound. It was therefore decided that the possible influence of "purpose" should be examined with reference to the relevent specialized literature and that later development of experimental studies should in some way take account of it, if only indirectly.

Reviewing the position reached at this point, the preliminary investigation seemed to suggest that at least the following "hunches" about sonic experiences might be significant and should be borne in mind as the research proceeds:

(1) Sonic experiences which are sufficiently vivid for one to be aware of and can be recalled readily are quite rare events.

(2) They appear to be linked to the presence of a particular dominant/ambient sound combination where a discernable contrast exists between the dominant sounds and their background.

(3) The dominant sound(s) always appear to be informative and meaningful sounds although there is no conclusive evidence as to whether the sound source(s) need also to be recognized.

(4) There is nothing to suggest that a single dominant sound heard against an ambience of other sound would not be sufficient stimulus to give rise to a sonic experience.

(5) An important component may be the associations relating to the sounds which occur for the perceiver. Since such associations could be affected by his make up and past experience, sonic

experiences relating to given sounds may vary considerably from person to person.

(6) A sonic experience, either because of the physical characteristics of the constituent sounds or the associations they evoke, could be a pleasant or unpleasant event for the person who perceives them.

(7) The exact role of "purpose" is unclear but it may have some influence on how (or even if) sound is experienced in the environment.

(8) An important distinction exists (which should be emphasized) between the actual sound stimulus situation which gives rise to a sonic experience and the particular mental (and physical?) response to those sound(s) by the person who perceives them, which constitutes the "experience" itself. Therefore, what essentially is being investigated are the specific responses of people when excited by given sonic stimuli.

(9) While a sonic experience may result from the interaction between a person and a sound, insufficient evidence has been found to suggest to what extent (if any) aspects of the physical setting in which that experience took place played a part.

3. STATEMENT OF OBJECTIVES FOR THE RESEARCH

On the basis of preliminary work completed this far, the general objectives for the development of the research and the direction of subsequent effort were drawn up as follows:

(1) To attempt to explore in some detail what has already been termed a "sonic experience".

(2) To examine its meaningfulness for a group of subjects under controlled conditions.

(3) To investigate how experiences resulting from given sonic stimuli display similarities and differences between a number of subjects under controlled conditions.

(4) To restrict the study to examining only the effects of certain recognisable and informative ("hot") sounds from the environment, but by so doing to also learn something of the significance of these specific sounds for this group of people.

In addition to this major emphasis, experimental techniques would need to be developed in order to carry out the investigation. While these would become the means through which the research might proceed, it was anticipated that the experience of designing and operating the experiments could provide useful methodological feedback for future studies.

The design, development and use of experimental methods to gather data and the further definition of sonic experience were seen

as concurrent and interrelated processes. It was therefore inevitable that the present study could be only partial and this should be acknowledged at the outset. Before this work could proceed, however, it was necessary to probe more deeply into some of the matters which were seen to be relevant for the present area of focus. These are now looked at briefly in the following section.

[B] DEVELOPMENT

1. MEANINGFUL SOUNDS

Auditory stimulation occurs when the compression waves from a vibratory event ("sound") are picked up at the ears of a receptor and converted into a response in his brain. This wave "train" is specific to the event in its simultaneous mixture of frequencies and sequential time structure ("transients"). It also has a specific total length in time ("duration") corresponding to that of the event. The amplitude of the wave train at any point is not specific to the vibratory event and carries no perceptual information about it. The simplest wave form possible is a pure sine wave of given wavelength and amplitude and the resulting auditory sensation is a meaningless tone[1] of a certain "frequency" (corresponding to the wavelength) and "loudness" (corresponding to the amplitude).

Meaningful sounds, however, vary in much more elaborate ways than by simple frequency, loudness and duration alone. Instead of a single frequency, they are a scramble of many frequencies, often in complex relationships to one another. Instead of simple loudness, they vary in directions and rate of change of loudness; and instead of simple duration they have elaborate temporal structures of rhythm and and repetitiveness.[2] Together, such subtleties can combine to yield higher-order variables of great complexity but it is just these complexities which are specific to that sound source. Such patterns are

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[1]This is because stimulus energy, unless structured, contains no information.

[2]James J. Gibson, "The Senses Considered as Perceptual Systems," p. 87.

readily discriminated by the auditory system, however, and make it possible to perceive events - whether it be the sawing of wood, breaking glass or flow of liquids.

Aesthetic interest also seems to be synonymous with the complexities of sonic structure and one peculiarity of music is that its richness of form transcends the listener's perceptual capacity. Fritz Winckel remarks that in music it is "...a richly, colorful life (of sound) which generates atmosphere and awakens associations with earlier experiences, which can arouse religious feelings and stimulate the imagination and spirit."[3] "Melody", on the other hand, impoverishes a musical message while at the same time giving it intelligibility.

In the environment, few sounds have simple acoustic structures and in nature, seldom remain constant in pitch and tone color for more than a moment. Evens horns and sirens have tone spectra (rather than pure tone structures) which are peculiar to these sources. Beston, in comparing the sounds of rain, wind and sea, chose the ocean as the one he liked best because it was the most "awesome, beautiful and varied."[4]

The link between sonic complexity, aesthetic interest and natural sounds may be important to consider in studying sonic experiences and is perhaps quite distinct from any associations these sounds may evoke

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[3]Fritz Winckel, "Music, Sound and Sensation," p. 3.

[4]H. Beston, Quoted in: Schafer, E., "The Perception of Natural Environments," ENVIRONMENT AND BEHAVIOR, June 1969, p. 72.

in the mind of the perceiver. This notion appears to be supported by the following remark from Freya Stark, who has noticed:

> All really good sounds are composite - even the song of birds which is helped and varied by the air it floats in; and the noise of crowds, and voices of wind, with sobs and lighter squeaks and whispers in it; the single human being's speech, made out of all his ancestors and all his past; and the sounds of water, moorland streams and alpine brooks, the waves on sand or shingle or the drone of the waterwheels of Hama.[5]

In general, the literature was rather unhelpful about clarifying whether certain environmental sounds are meaningful only because of their distinctive acoustic structure and ability to stimulate associations and images. It would appear, however, that a particular sound, when heard in the environment, may sometimes serve in several categories of meaning simultaneously, as suggested by Philip Thiel:

> The sound of a locomotive whistle, for example, may denote the presence of an edge, indicate the use of a space, recall an association with the space, operate as an element to determine the character of an area and cause one to reflect on the wider implications of time, space and movement.[6]

It seems, therefore, that while we may have some partial insights, there is no direct and simple explanation as to <u>exactly</u> what makes a sound meaningful. In all probability much of the answer may lie in aspects of perceptual processes which at present we do not fully understand.

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[5]Stark, <u>Op. cit.</u>, p. 55.

[6]Philip Thiel, "A Sequence Experience Notation," <u>TOWN PLANNING REVIEW</u>, April 1961, p. 48.

2. DOMINANT/BACKGROUND SOUND

Sounds in the environment are never heard with a totally silent background but always against an ambience of other sound, no matter how faint or unobtrusive. In urban environments, the ambient level, resulting principally from vehicles, may be sometimes very high. This often obliterates more informative sounds which are only heard at weekends when fewer vehicles are in the city, as the field studies have already shown.[1] Even in the country the song of a bird, for example, is frequently heard against the blended murmur of droning insects, chirping crickets, rustling leaves and the distant sound of a car, a human voice or barking dog.

The literature indicates that for a particular sound ("signal") to be differentiated from a context of other, irrelevent sound ("noise"), sufficient contrast must exist between the signal and the noise. This requires that, in principle, the signal sound must have dissimilar spectral and temporal characteristics from the background sounds and should be clearly differentiated from them in level. For this differentiation to be maintained, the relative (not absolute) levels of signal and noise are critical. If the noise is more intense than the signal sound at those particular frequencies, then the signal will be submerged in the noise ("masked") and the ear unable to detect it.

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[1] See Section A.2.

The greatest interference between signal and noise occurs when both have similar wave forms and when the background sounds are highly competing in message content. Hearing is such, however, than perceptual choice favours structured forms over amorphous messages.

3. THE PERCEPTION OF SOUND

The nature of hearing and the perception of sound cover a broad field of which most is not of direct concern. However, a brief look was taken at the literature on how the perceptual system functions in relation to sonic stimuli and the influence of a person's purposes on his perception of sound since both have a bearing on how we experience sounds in the environment. The findings from this are set out below.

THE RELEVANT THEORY OF AUDITORY PERCEPTION

The psychology of hearing has been usefully explained by regarding it as though operating on three discrete levels:[1]

(1) A "symbolic" level: that is, at the level of language, where words have symbolic meaning for things and events in the real world.

(2) A "signal" or "warning" level: a level below (1) where sounds are direct signs or signals of events around us. Here it is the actual sound of a whistle, for example, to which we respond and not the word "whistle" which is merely a symbol of that object.

(3) A "background" or "primitive" level: at this most basic level, sound serves neither as a symbol or warning but simply as the auditory background of every day living. We are not consciously aware of sounds at this level but through them maintain a feeling

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[1] D. Ramsdell, "The Psychology of the Hard-of-Hearing and the Deafened Adult," in H. Davis (Ed.), "Hearing and Deafness," pp. 461.

of contact with the world around us. Studies with the newly deafened[2] have shown that the loss of this most primitive level resulted in depression and feelings of isolation from reality, emphasising its important function.

Normal hearing is a combination of all three processes which are operating simultaneously but may vary independently (sometimes with one predominating). Usually, however, there is an interweaving contribution from each in the total pattern of hearing.

At levels (1) and (2), sound conveys both factual information through language, and knowledge of what is happening in the environment within audible range. Backgrounds sounds, however, are only consciously heard when one may vary and attract our attention. When this occurs, it is no longer operating at the primitive level but moves up to a higher one. Thus the ticking of a clock or hum of a machine drops quickly from our consciousness and may be noticed again only when it stops, because that moment represents a discontinuous transition between two states. An example of how an unvarying sound in the environment may sink to the primitive level of hearing is illustrated by Beston when he remarks that he grew unconscious of the constant roar of the ocean's surf and "listened" only when there was a change in the sound.[3]

The distinction between "hearing" and "listening" is an important one which should be emphasized. Auditory perception is a combination

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[2]Ibid., p. 462.

[3]Beston, Op. cit., p. 72.

of both "hearing" (which is essentially a direct reaction of the auditory mechanism to the sound stimulus) and "listening" (which is selective and determined mainly by the qualitative differences of stimuli in relation to certain predispositions of the listerners).[4] One explanation of the functioning of hearing has already been given.

The selectivity of listening is not fully understood but the human organism possesses the ability to "listen" to a particular message even against competing other messages of similar loudness and content which might appear to conflict with the "masking" concept discussed earlier. The so-called "cocktail-party effect"[5] (which enables one stream of speech to be selected from many concurrent streams in a room full of speakers) is a specific example of the selectivity of listening. This capacity has been explained by suggesting that minute differences in direction, intensity and arrival time of sound from several sources as well as selection at nerve centers make such discrimination possible.

THE INFLUENCE OF "PURPOSE" ON PERCEPTION OF SOUND

Research has shown that the capacity of man's sense-systems is limited and that a "filter" is placed early in the nervous system which selects out and passes only part of the information reaching his sense-organs. Therefore not all of a stimulus is ultimately converted into a response.[6] The filter normally passes whichever information is

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[4]F.C. Bartlett, "Remembering," p. 190.

[5]See, for example: Colin Cherry, "On Human Communication," p. 280.

[6]D.E. Broadbent, "Perception and Communication," pp. 85-86.

necessary for the task a person may be performing and is therefore governed by his mental "set" at a particular moment in time. It also has a bias towards passing certain kinds of stimuli and with sound, this bias favours those which are intense, of high-frequency or novel. The filter, therefore, operates in two ways simultaneously, having a predisposition which is more or less permanent to sounds with particular physical characteristics but another which shifts according to the state of the person.[7]

Instances of both functionings of the filter on sound can be readily cited from experiences in the environment. The "fixed" bias towards certain kinds of sounds is seen, for example, with motor horns and other warning signals of high intensity and frequency (particularly in relation to other vehicle sounds) which demand attention without having any direct significance for the activities of the perceiver. However, since horns and sirens are heard so frequently in urban environments, their novelty with respect to other sounds is lost and we frequently become oblivious to their presence.

Examples of individual purposes influencing perception of sounds in the environment could be almost infinite, but consider how the striking of a public clock may be noticed only when one's parking meter has expired or the rumble of a subway only when rushing to catch a train.

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[7] Ibid., pp. 191-92.

Reviewing the relevant aspects of the perception of sound, one is presented with a complex array of issues. What seems clear, however, is the partiality of the ultimate response to sound stimuli and that this is accounted for both by attributes of the sounds themselves and the persons who may be perceiving them. Filter theory suggests that both "hearing" and "listening" are selective, and while "listening" is clearly itself a purposeful activity, what one actually "hears" in an incidental manner is also dependent on the orientation of the person. An important matter to bear in mind, it would seem, is that any sound must initially pass the fixed and variable biases of the filter before being either "heard" (at any level) or consciously "listened to" by the human organism.

4. AUDITORY-VISUAL INTERACTION

The influence of the physical context in which a sonic experience might occur was not fully clear at this point. For one thing, the writings about experiences with sound in the environment already reviewed gave little information about the places where these sounds had been heard. However, the possible effect on perception of sound by the visual qualities of a setting seemed to warrant its consideration for two reasons which were:

(i) Since the total capacity of our sensory systems is limited, the attention demanded by the visual qualities of different settings might vary and therefore influence how much attention was also paid to sounds.

(ii) Interaction between audition and vision was known to occur (explained by the anatomical proximity of auditory and visual nerve pathways) and this effect had been examined experimentally in some detail.

The limited ability of the human sensory system to process information was demonstrated in Southworth's study where blindfolded (hearing only) subjects noticed many more sounds around them than those who were also receiving stimuli through normal vision as well.[1] Settings where sound correlated well with spatial form and activity were also more striking than those where strong pairing between sound and sight did not occur.[2]

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[1] Southworth, op. cit., Appendix B.

[2] Ibid., p. 56.

Experiments have indicated that simultaneous presentation of information through visual and auditory channels can cause reinforcement of a message if the two are congruent but interference when they are not. Others have shown that the visual content of a setting also helps in the hearing of sounds which are congruous and fit what is seen, based on learned expectations.[3] Being able to see the source of a sound therefore helps in hearing it if otherwise it is not prominent against its background. Channel interference, on the other hand, occurs when the visual signal is paired with incongruous or irrelevant sounds, especially when these are irregular and highly demanding of attention. According to the filter theory, the filter under these conditions selects the sound and so neglects the visual information.[4] However, when incongruous sounds do occur, these are apparently less annoying if they can be identified and localized.[5]

While most of the available evidence was based upon rather specific laboratory experiments, the effects of auditory-visual interaction do have implications in the real world as the Southworth study variously showed. However, what was still unclear was the extent to which the visual aspects of a setting might influence the form of a sonic experience.

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[3]Broadbent, op. cit., pp. 91-96.

[4]Ibid., p. 101.

[5]Ibid., pp. 95-100.

Since the study is being restricted to recognizable and informative ("hot") sounds, it was expected that the issue of congruity of these with settings might be important. Whether sounds were actually perceived or not in given contexts was of less interest because the research was only concerned with the effects which occur when (and not if) a certain sound or sounds are experienced. It was decided, therefore, that the role of "place" should in some way be accounted for in any experiments which were developed. What contribution it makes to a sonic experience, however, could perhaps be difficult to project with certainty.

5. A REVIEW OF THE POSITION REACHED

By this point in the development of the study, it was very apparent that many sets of variables could enter into how certain sounds were experienced in the environment and that what was being researched was a complex area. The results of limited field studies, writings from fairly diverse sources and several observations by the author had already provided a groundwork for the study. This pulling together of helpful material had also provided insight into at least some of the issues which appeared to be directly significant and had enabled a set of preliminary "hunches" to be drawn up.

A closer look at the specific factors which needed further clarification was possible from the various specialized literature. Meaningful sounds were shown to be meaningful because of their elaborate physical structures and their learned associations at least but that exactly how they functioned globally was not fully understood. Certain physical conditions were also seen to be necessary for certain sounds to be heard against others although the functioning of auditory perception indicated that one could consciously "listen" to a particular sonic message under theoretically adverse conditions.

How sound in general was actually perceived by the human organism turned out to be an involved matter which theory could only partially explain. It was shown that not all sonic stimuli which reach the ears become processed by the brain. Those which do must first pass the filter which selectively shifts according to the mental "set" of the

person and this "set" is related to what he might be doing at the moment the stimulus arrives. However, sounds with particular physical characteristics would be more readily accepted quite independently of "set". Human hearing was also shown to operate on several levels simultaneously and that the physical properties of sounds also governed at which level those which get through the filter might be heard. It was further seen that because of the multi-level nature of hearing we actually accept far more sonic stimulation from the environment than we are aware and this had been conclusively demonstrated with studies on the deaf.

In conclusion, the investigation indicated that because of sensory interaction, experiences with sound cannot be realistically studied in isolation from other senses. Since the total capacity of all sensory channels is limited, selectivity occurs between each as well as between different stimuli which might be arriving via a single channel. Filter theory again provided an explanation of how this actually operates and indicated the conditions of visual and auditory information which govern such selective functioning.

It was now decided that attention should be turned to setting up the experimental situations to be examined. These might work from the real world to a point where a viable set of experiments would attempt to study some important variables seen to relate to sonic experiences. How this was done is set out in the next section.

[C] PRELIMINARIES TO EXPERIMENTAL WORK

1. VARIABLES FOR AN EXPERIMENTAL STUDY TO CONSIDER

While it was clear that many sub-variables could influence how a particular person experienced sounds in the environment, all the evidence to date suggested that these might be grouped under three main variables only which were:

(1) Attributes of the sounds themselves - that is the stimuli.

(2) Attributes of the person who would receive this stimulus and of whose response at least part would constitute what has been termed a "sonic experience".

(3) Attributes of the "place" - that is, the context in which the sonic experience would occur.

(1) THE SOUNDS

Since a secondary interest of the study was to obtain information on how people reacted to a number of specific environmental sounds[1] as well as studying the more general issue of sonic experience, it was decided that aspects of the sounds themselves should be the least compromised. For a real-world situation, at least the following sub-variables were seen to exist:

(i) Single sounds[2]

(a) Sounds with physical structures ranging from very simple (approaching a sine-wave) to highly complex. (Inherent in this would be the issue also of aesthetic content,

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[1]See Section A.3.

[2]Both "natural" and relating to the activities of man in any way.

which was shown to relate to acoustic "richness" of structure.)[3]

(b) Individual sounds,which because of their spectral, temporal and loudness characteristics,range from highly "pleasant" to highly "unpleasant".

(c) Individual sounds which are readily source-identifiable to those which are ambiguous or hard to identify.

(d) Individual sounds which are commonly heard in the environment to those which are rare and few people performing the experiments might have experienced.

(e) Individual sounds which potentially could have few to very many associations for those who perceive them. (These associations could vary in <u>type</u> as well as in number.)

(ii) <u>Group of sounds</u>[2]

(a) Groups which contain few to many sounds, and which could be aggregated from categories (a) to (e) above in varied combinations and where individual component sounds range from being highly discernible within the group to highly undiscernible.

(b) Groups of sounds from (a) with many absolute and relative levels of loudness.

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[3]See Section B.1.

(iii) Dominant/Background sound configurations

(a) Single and group dominant-sound situations incorporating all the variables in (a) and (b) of (ii) above set against a background of almost zero ambience to highly competing, and where the background (if present) could comprise few to many constituent sounds. These themselves could vary along all the dimensions for the dominant sounds covered in (i) and (ii) above.

(b) Dominant/background sound configurations at many different absolute and relative levels of loudness.

In selecting the sound-stimulus situations for any experiments which might be set up, an attempt would be made to cover at least the extremes of as many of the above categories as possible. Since the focus was on "hot" sounds only, some of these sub-variables might therefore be eliminated automatically. In any case, it would never be possible to truly isolate them as discrete entities or ascertain how they might interact. Nevertheless, the above listing would provide a useful "check-list" when designing the range of stimuli for experimental study. This selection procedure is covered later in Section D.4.

(2) THE PERSONS

While many different personal factors might influence how subjects perceive sounds in the environment (such as age, sex, attitudes, emotions, past experiences and a host of others), these would not be examined in the study as distinct sub-variables as such. This seemed

justified on the grounds that one could never ascertain what these factors were precisely but even if this were done, would complicate the research beyond a point which the present study could reasonably handle. This decision in any case seemed somewhat incidental to a general understanding of how certain sounds were experienced in the environment. Furthermore, universality of response would have more ultimate relevence for urban design since the individual make-up of user might only be known in the grossest terms even for specific environments.

However, since a stated objective[4] for the research was to investigate similarities and differences in responses between a group of people, searches for patterns of agreement and disagreement within response data could also suggest what had caused these patterns to occur. Consequently, some informal notions about which aspects of the person influence his experiences with sound in the environment might be gained in the process.

(3) THE PLACES

The sub-variables of "place", like the sounds, could be listed for a real-world environment although one could not again be certain that such a list was exhaustive nor that its categories were mutually exclusive. However, the field studies and introspection suggested that the following could be significant for a physical setting with respect to the sounds which were heard within it:

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[4]See Section A.3.

(i) The characteristics of its spatial form.

(ii) Its apparent function(s).

(iii) Attributes of other users (if any) who were also there.

(iv) The extent and type of visible activity.

(v) Whether it was set in an urban or rural location.

(vi) Any aesthetic judgments made about it.

(vii) The degree of familiarity a person might have with this place (or with generic places of a similar kind) and the expectations which would accompany it.

(viii) The existence and extent of any ambiguity or uncertainty about particular aspects of the place in the mind of the person.

In setting up any experiments where the physical setting in which sounds were heard was included, some or all of this group of "place" sub-variables would need to be accounted for. How this process was undertaken with respect to the specific contexts later used is covered in Section D.5.

2. A SIMPLE THEORETICAL MODEL TO CLARIFY EXPERIMENTAL DESIGN

Taking the conceptual basis of a sonic experience as a particular type of interaction between a person and sound(s) in a place, the following definition of such an experience could now be stated for experimental purposes as:

> "A particular stimulus-response situation where a sound (or sounds) is perceived by a person and elicits a significant mental (or mental and physical) response."

Such a definition would comply with traditional stimulus - response ("S-R") theory. However, modern literature suggests that the simple S-R model has been shown to be an over-simplification and that the inclusion of an intermediate stage ("mediation") presents a more accurate representation.[1]

The principal relationships, conceptually, as seen at the start of experimental design are diagrammed in fig. 1. Here, a sonic stimulus of finite duration is perceived by a person with a particular mental "set" at that moment which allows him to hear the sound,[2] and therefore a response can occur. This interaction between the person and the sound takes place in a setting. The setting, it is postulated, has only an indirect relationship to the basic interaction. This is seen as being related to the sound in that the latter is actually heard in that place; to the person in that his activity

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[1]Many sources support this view. See, for example, Creelman, p. 177.

[2]See again, Section B.3.

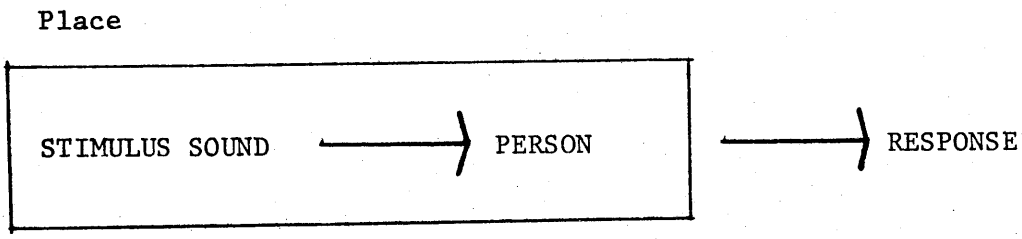

FIGURE 1

and/or purpose[3] may be a function of why he happens to be there at that moment; and to his response because visual information from the setting could influence how he also perceives the sound.

Figure 2 shows an adaptation of S-M-R theory which accepts this basic model. Here, more exactly, both dominant and ambient sound are components of the stimulus. "Mediation" occurs after stimulation and before response. Both mediation and mental response are processes which occur within the person but only physical response (if any) may be externally manifested. (Physical response to sound in any case is not of concern in the present research.) Since this entire interaction process occurs within the setting, "place" provides the context in which this happens as shown.

The functioning of the mediation phase of the cycle was not studied experimentally since only the response ("sonic experience") was of interest. The relevant literature, however, indicates that little is known in detail about the mediation process and that many theorists are content to regard it as a "black box".[4] Filter theory has suggested that filters other than those which influence sensory perception also exist at this stage and it is these collectively which may modify a person's eventual response to stimulation. What exactly these are and how they function need not be of concern here.

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[3]Activity/Purpose influence which sounds are selectively processed by the brain, it will be recalled.

[4]See, for example, Creelman, p. 212 et seq.

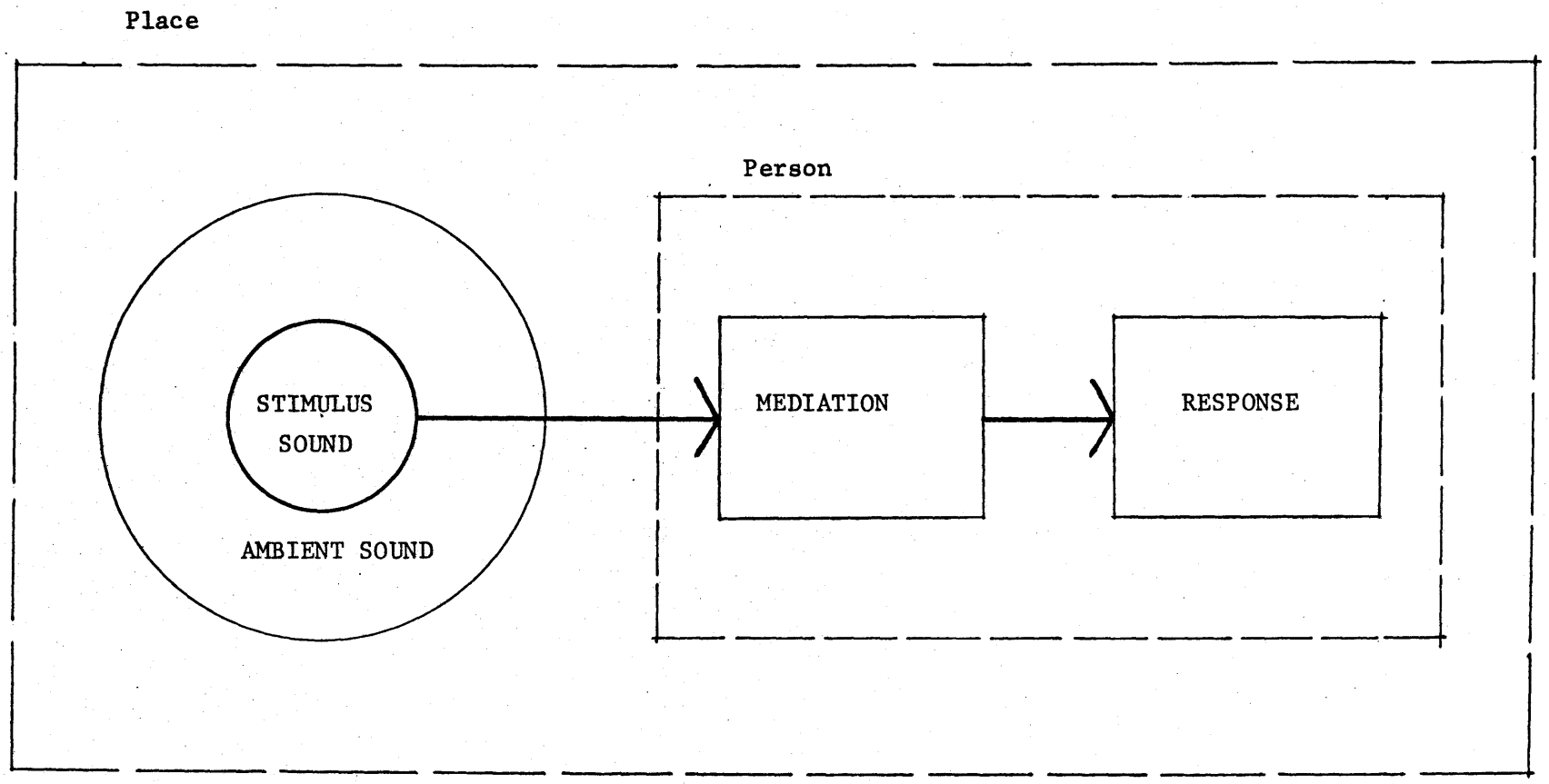

Place
Person
STIMULUS
SOUND
AMBIENT SOUND
MEDIATION
RESPONSE

FIGURE 2

3. SELECTION OF EXPERIMENTAL METHODOLOGY: REAL WORLD v. SIMULATION

At this point is was decided that a choice must be made about the experimental methodology to be used since this decision would impose different limitations on what an experiment might aim to achieve and therefore influence experimental objectives.

It was accepted at the outset that responses should be gathered from real subjects: the issues relating to this decision were therefore (i) what should be the sound stimuli used to generate these responses and (ii) what should be the nature of the responce format. The broad choice was seen to be between either taking subjects out into the real world or creating a simulated situation under laboratory conditions and accepting the inherent limitations of which method was selected.

The advantages and disadvantages relating to the alternatives were seen to be as set out in Tables C.1 and C.2.

Taking the advantages and disadvantages of both real-world and simulated displays, on balance it seemed that the main advantage of real-world stimuli was the realism of the test situation while the corresponding disadvantages were seen as finding real environments with a suitable selection of sounds (and which were reliable or constant enough for experimental purposes) and the entire problem of control, but especially that of controlling the many variables relating to the sounds themselves.

TABLE C1

REAL WORLD

Advantages:	Disadvantages:
Sonic experiences take place in the real world and ultimately it is this which is our concern.	The soundscape of the real world is transitory and therefore it is possible to exert little control over the stimulus configurations being used.
Since real world stimuli are being used, the validity of experimental findings are therefor not questionable.	The possible complexity of sonic situations occurring in the real world was already apparent from the previous field work. Because of this complexity and the transient nature of environmental sounds, it would be very difficult to attribute with precision the exact cause of observed effects (that is, the subjects' responses).
Should it be that an experimental format requires subjects not to be aware of what is being tested, then the true purposes of such an experiment could be better concealed in a real rather than "staged" situation.	
If the effects of sensory interaction were to be tested, then this could be done very readily. For example, for auditory -visual interaction, subjects would see the real, living environment.	The influence of other sensory stimuli would be included in with auditory stimulation and could spuriously "contaminate" the responses due to sound alone. (Blindfolds and nose-clips could be used to eliminate visual and odifourous stimuli, for example. Thermal and tactile sensations would be more difficult to avoid.)
	Subjects would have to be transported to different environmental locations, and to avoid pre-conditioning, would have to travel in a sensorially neutralized condition-blindfolded and deafened, at least.

TABLE C2

SIMULATION

Advantages:	Disadvantages:
More complete control is possible over the experimental variables being examined.	There are, at best, certain losses in any simulated environmental display and these inevitably reduce the realism of the situation being observed.
The exact nature of the stimuli being used can be controlled and varied at will.	Technical problems are introduced by the need to adequately simulate the aspects of the environment to be observed.
Main variables can be held constant as required and the effects of changing independent variables readily observed.	If the effects of sensory interaction are to be tested, then the mounting technical problems of adequately simulating two or more senses would need to be considered and satisfactorily overcome.
Since some form of recording technique is used, the environmental display may be re-run any number of times. Therefore, subjects may be tested serially whereas in a transient, real-world situation all subjects should respond at one given moment if the comparative effects of specific stimuli are being tested.	Subjects inevitably have to make a psychological adjustment to the fact that they are experiencing a representation of an environment and not that environment in reality.
Convenience of presentation. Subjects would be responding under comfortable conditions and short-term effects such as fatigue, mood, etc. would not vary between responses. Weather and similar extraneous factors beyond the experimenter's control would also be removed.	There may be greater difficulty in concealing the purposes of the experiment from subjects if this is necessary. (What <u>exactly</u> the experiment is attempting to examine may still be quite readily concealed, however.)
	There is no opportunity to observe certain effects which are linked to the activity a person may be about in a real-world situation.

For a simulated experimental situation, the main advantages were seen as the ability to obtain sound-stimuli with selected attributes to be examined under experiment; the ability to relate cause and effect directly and make inter-subject comparisons; the ability to alter experimental variables at will; and the general advantage of ease of control. In relation to the specific area being studied, the principal disadvantages were seen as a possible loss of some reality and with representing adequately the visual aspects of environments in any auditory-visual experiments.

Since the advantages of simulation generally appeared to outweigh its disadvantages and also the advantages of real-world situations for the present interest, a decision was made to select some form of simulation technique with which to study sonic experiences. The ability to accurately select the sounds used for experimentation and to control variables at will were seen as particularly advantageous.

At this point, therefore, it only remained to define the objectives of the experiments to be set up and develop the necessary experimental techniques before data gathering could begin.

4. DEFINITION OF EXPERIMENTAL OBJECTIVES

On the basis of the foregoing development the objectives were taken as to design experiments which would:

(1) Attempt to examine sonic experiences in two independent ways:

(i) By getting subjects to regenerate previous experiences they had had resulting from particular sounds or sonic events.

(ii) By presenting subjects with several environmental displays which include sonic stimuli and attempt to generate a sonic experience experimentally, examine it and its inter-subject similarities and differences.

(2) Examine the role of the setting in which a given sonic stimulus situation is experienced, the influence it has (if any) on the nature of the response and variations in responses among subjects.

(3) Be unrestricting upon subjects in the design of the response format so that as much additional information of any kind about sonic experiences may be obtained. This would then allow further pointers to emerge as to what exactly constitutes a sonic experience and what might be other aspects of it which at this stage have not been fully perceived but which could provide valuable further insight in this or future research.

[D] EXPERIMENTAL DESIGN, DEVELOPMENT AND OPERATION

1. THE SCOPE OF THE EXPERIMENTS

EXPERIMENTAL AREA 'A'

The main set of tests would make a sequential presentation to subjects of tape recorded sonic stimuli (ranging from individual sounds to short "sound events"). Each sound stimulus would be used to "trigger-off" a recollection of past experiences each subject may have had where such sound(s) played some part. By the use of a sufficiently open-ended response format, it would be possible to allow subjects a good deal of freedom in the way they answered. However, the need for several generalized response questions under which subjects should group their remarks was considered important. Such structuring seemed necessary both as a check to guarantee that certain aspects of the sonic experience which the author considered important were explicitly covered by the subjects and to also facilitate inter-subject comparisons in the responses. The risk of slight redundancy between questions (which did in fact occur during experimentation) could be regarded as desirable since it would help avoid any gaps being left whereby perhaps important data might never be elicited from the respondent.

EXPERIMENTAL AREA 'B'

The second set of tests would take a limited number of the sound stimuli used in the first experiment and by sequentially presenting these to subjects who were simultaneously projecting themselves into a given "place" context (by viewing a colour slide of a specific

environment), would attempt to generate "sonic experiences" for subjects under these experimental conditions. This would be possible, theoretically, on the basis of the deduction already made that a particular sort of sound stimulus being perceived by a person in a place are the three basic components required for a sonic experience to occur. The interaction of sounds and places and the influence of both on the form of the sonic experience could be thus directly examined. Inter-subject comparisons would also be possible where both sounds and context are thus controlled.

2. EXPERIMENTAL HYPOTHESES

Several hypotheses had emerged during the development of the work to date and could be examined within the framework of the two experimental areas already outlined above. These were derived principally from the author's and Southworth's field studies but also from personal introspection after working on the problem area up to this point. They are stated below in relation to the experimental areas to which they directly refer:

EXPERIMENTAL AREA A

1.(a) It is expected that certain meaningful environmental sounds have commonly-held stereotyped associations for people (e.g. "desolation" being associated with the howl of a wolf). However, these associations do not have to result from previous direct experience with a sound in the environment provided a person has learned of such associations by other means.

(b) Associations which occur as a result of real world encounter with a particular sound will be more detailed and highly personalized than those derived only from indirect experience with that sound.

2. Certain sounds have commonly-held ties with specific classes of environments which subjects will frequently mention (e.g. foghorns associated with harbours and the sea) while others are heard almost universally in the environment and will not be repeatedly associated with any one type of place.

EXPERIMENTAL AREA B

In judging the appropriateness of a given sound for a given place, the following conditions will be observed:

1. A person will find the sound/place match appropriate if either (or both) of the following conditions are met -

(a) The probable source of the sound is seen, and identified as such, within the visual field.

(b) While the source may not be apparent, the sound nevertheless appears to fit the expectations a person might have formed about the character, location and probable uses of the place from visual and other clues.

2. The more the spatial field of a setting is limited, the fewer will be the sounds which appear incongruous there because of the possible diversity of sources and sound-producing activities which might exist around the place outside the limits of the spatial field.

In judging the informativeness of a given sound for a given place, the following condition will be observed:

3. Sounds are expected in a setting which originate from visible sources and activity within it. However, the same sounds would be judged more informative if they were generated by activities outside the spatial limits of the place and supplied extra information about its surroundings which might not otherwise be known.

3. THE EXPERIMENTAL METHODS

After a brief pre-test, the experimental methods for both experiments were finalized as set out below. An outline of the response format design and the pretests for these will be covered later in Section D.6.

EXPERIMENT 'A' (A(1); A(2); A(3))

Thirty short stereo tape recordings of environmental sounds or sound events were serially presented from a SONY Type 770-2 studio tape-deck operated by the author under laboratory conditions to a subject who was wearing isolating headphones. After each sound sample was played, the machine was stopped and the subject completed a number of questions relating to what he had just heard on a standard-format response sheet. This procedure was repeated until the full set of thirty sound samples had been played through and each one responded to in this way. The author noted any verbal remarks made by the subject during the running of the experiment and when the run was completed looked through the subject's answer sheets and queried any responses which seemed unclear, ambiguous or abnormal. The experiment was run a total of fifteen times in all - subdivided as set out below. In each case, only one subject performed the experiment at a time.

Sub-Categories of Experiment A

A(1): Nine subjects performed this first variant of the experiment which was exactly as above, with the tape replay set at normal level.

A(2): One subject only performed this second variant of the experiment which used the procedure as A(1) above and the standard experiment A response format except that the questions were put to the subject verbally. Her spoken responses were tape-recorded and the author informally queried these as they were given in an attempt to understand why she had responded to each question in the way that she did. The tape reply was kept at normal level as for A(1).

A(3): Five subjects performed this third variant of the experiment which was identical to A(1) in every respect except that the tape replay level was lowered by about 50% by resetting the playback gain control.[1]

EXPERIMENT 'B' (B(1); B(2))

Ten of the original thirty sounds were serially presented through isolating headphones as before to a subject who was simultaneously viewing a colour slide of an unfamiliar environment. The experiment instructions asked him to imagine he was not looking at a representation

[1]While performing experiment A(1), subject no. 9 had frequently complained that the sources of many sounds presented on the tape were heard in an unnaturally close relationship to the listener. In an attempt to reduce this effect and make these sounds appear more distant, the tape replay level was considerably lowered for the final group of five subjects. This variant was then taken as experiment A(3).

See also Section F.1.

but was actually in the place he could see in the slide as the sounds were being presented to him. The subject was allowed to study the slide for about a minute before the experiment began so that he might be familiar with the place as he heard the sounds. After each sound had been played, the tape-deck was stopped and the subject completed a number of questions related to what he had just heard on a standard format response sheet similar to that used in experiment A. The subject was allowed to look back at the slide if he wanted while completing his answer sheet.

This procedure was repeated until the full set of ten sound samples had been played through and each one responded to in this way. When this task was complete, a second, and then a third slide were substituted for the original and the entire procedure repeated over again each time. A total of thirty sheets of responses were thus obtained from each subject by presenting the set of ten sound samples with the three different colour slides. As before, the author noted any verbal comments made by the subject during the experiment.

When the run was completed, the subject was verbally asked whether he recognized the places shown in the slides or if he didn't, what briefly could he say about them from what he could see. The author looked through his answer sheets as before, and queried unclear or unusual answers. The experiment was run a total of five times in all, subdivided as set out below. In each case, again only one subject performed the experiment at a time.

Sub-Categories of Experiment B

B(1): Three subjects performed this first variant of the experiment which was exactly as above, with the tape replay set at normal level.

B(2): Two subjects performed this second variant of the experiment which was identical to B(1) in every respect except that the tape replay level was lowered by about 50% as in experiment A(3).

Experiments A and B together were run twenty times, using a total of seventeen subjects. Three subjects performed variations of both experiments A and B for cross-comparison purposes as follows:

Subjects nos. 4 and 9 performed A(1) and B(2).

Subject no. 10 performed A(2) and B(1).

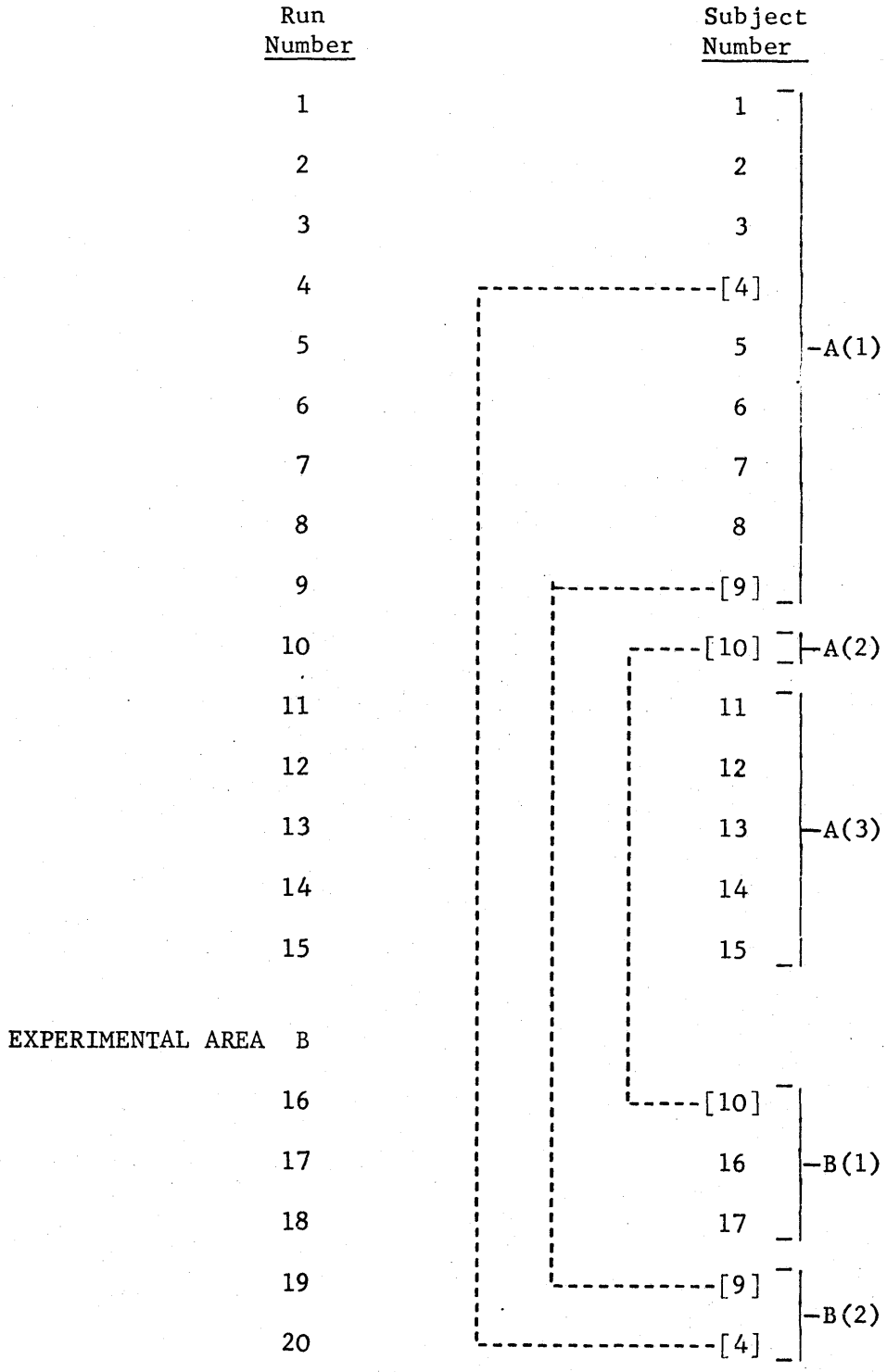
Table D1 shows which subject responded for each experiment. A full listing of all seventeen subjects and details about each appears in Appendix II.

THE RUNNING TIME OF THE EXPERIMENTS

The sequential method of presentation of the sound stimuli adopted for both experiments meant that the time required to replay a set of sound samples to a subject and obtain his responses from each could exceed a point where the total running time of the experiment became excessively long. This was considered undesirable for two reasons:

TABLE D.1

EXPERIMENTAL AREA A



(1) There was a courtesy factor involved in asking too much time and effort from voluntary subjects.

(2) Fatigue and diminishing motivation to continue with the experiment could result in declining attention to the task being undertaken. This might affect the experimental responses obtained from subjects.

An initial estimate of one hour total running time was taken as a reasonable limit. This proved more or less correct in practice with experiment A and was about the length of time subjects could concentrate on what they were being asked to do. A maximum of thirty responses per subject per experiment was therefore the limit also placed on the selection of sound samples and place context for experiment B.

It was decided that the set of sounds used for experiment B should be taken from the larger set for cross-comparison purposes. Since the second experiment was fundamentally investigating the effect of visual context on response to environmental sounds (and it was the subjective responses to the sounds which were of interest), the minimum number of places sufficient to vary the context was taken as three. This allowed as many sounds per place as possible to be studied while still keeping within the total limit of thirty responses.

4. THE SOUND STIMULI

METHOD OF RECORDING AND PRESENTING THE SOUNDS

While the decision taken earlier to use a simulation format[1] required that a magnetic tape recording and presentation method be used, there remained the following technical decisions to be made about how this should be actually done. The issues affecting this were seen as:

(1) Whether mono or stereo sound recordings should be used.

(2) Whether these should be custom selected and prepared by the author or taken from existing recordings.

(3) Whether serial replay of recordings through isolating headphones to one subject at a time or group replay through loudspeakers to several subjects collectively should be used.

The ultimate decision involved all three issues together since in this case these happened to be interrelated.

Stereo rather than mono techniques were favoured because these give far greater realism than can be obtained with single channel recordings. The necessary equipment for replaying stereo tapes was available but not for recording these in the field. Technical means for making single-channel recordings with portable equipment, however, was readily available.

The lack of a sufficient range of easily accessible sound settings which might be suitable for use in the experiments was indicated by the preliminary field study reported in Section A.2. The shortage of time

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[1] See Section C.4.

also did not permit the extensive search for suitable sound samples in the real world which would have been necessary even before recording could begin. It was decided, therefore, to re-record sounds onto a tape from the wide range of commercially available "sound-effects" long-playing stereo discs. These were also found to offer an excellent selection of sounds for the present experimental purposes. By doing this, high-quality stereo tapes of a suitable range of environmental sounds could be prepared in a short period of time.

The decision about replay was made in favour of presentation through headphones using only one subject at a time. This provides greater binaural realism than using a pair of loudspeaker units and isolates intrusive local background noises which could interfere with judgments about the taped sounds themselves. Since close monitoring of each subject was considered important, presentation through headphones seemed to warrant the extra time spent in gathering the data.

SELECTION OF THE SOUND SAMPLES

The preliminary and development work (Sections A and B) had given sufficient insight to make it clear that the thirty sound samples which were used in experiment A could not hope to cover in any comprehensive way the all potential sub-variables which were even perceived to exist as stated in Section C.1. However, since it was already acknowledged that this exploratory study could only be partial, the decision taken at the outset to focus on sounds with potentially strong

stimulus content ("hot" sounds) seemed to be justified for the following reasons:

(1) It was felt necessary to consider sound stimuli which might elicit sufficiently strong responses from subjects for clearly defined conclusions to be drawn, and therefore for the most to be learned about the nature of sonic experiences by taking vivid situations in some depth.

(2) Since it was acknowledged that there would be some loss of realism even by using the stereo technique described, this should be minimized by having sound samples which were sufficiently potent to stand such losses in reproduction.

(3) There was a large enough range of "hot" environmental sounds available which was sufficiently interesting to justify not examining potentially less revealing cases within a limited study such as this.

(4) Writings in literature prompted by experiences with sound in the environment had (in almost all cases) identified the component sounds and these had been "meaningful" sounds.

The sounds which were chosen for the tape enabled the following broad categories to be covered:

(1) Single and groups of dominant sounds.

(2) Natural sounds and sounds generated primarily by man.

(3) Single sounds and short sound sequences which relate to a specific identifiable event.

(4) A range of sounds going from those which, while identifiable, were expected to carry few associations to those which might be highly evocative and carry many associations for subjects.

(5) A range of sounds going from those which people were expected to have few feelings about to those which might elicit very many or strong feelings (both positive and negative).

(6) A range of sounds going from those which are fairly universal and non place-specific to those which usually are rooted to certain kinds of environments.

(7) A range of sounds going from those commonly heard in urban environments with which subjects would be familiar to those which are rare and few, if any, subjects may have experienced directly.

The problem was seen to exist in covering the above categories that a good knowledge about the subjects would be required when setting up the ranges of sounds under (4), (5) and (7). As all subjects were at least fairly close friends of the author, it is believed that this was done reasonably satisfactorily.

THE SELECTED SOUNDS - EXPERIMENT A

While environmental sounds can be classified in several different ways,[2] the selected samples were sounds (or contained component sounds) which came under at least one of the following source groups:

(1) Sounds produced by any form of human activity.

(2) Sounds produced in any way by the human voice.

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[2]Such as source, physical characteristics, etc.

(3) Sounds giving purposeful information (Bells/Horns/Sirens).

(4) Sounds produced by any mode of transportation.

(5) Sounds produced by any form of mechanical device or mechanical action.

(6) "Natural" sounds (including those of animals, weather or water).

The full set of thirty sound samples, in the randomized order in which they were presented appears in Table D.2.[3] The "sequences" were short sonic events (such as the passing of a railway train or a car skid and crash) in which several dominant and background sounds may be included and where the total event had a finite duration. Single sounds (such as the cock crowing or gun shots) were heard against a completely silent background in some instances or a low level of related ambient sounds in others.

The total length of each sample varied considerably (from 1 to 90 secs). In the case of an instantaneous event (such as the breaking of glass) the duration was set by the sound itself. For others - including the sequences - the total length was set on the basis of the author's judgment as to the fixed time needed for subjects to become saturated by the sound stimulus. The sounds were always presented to subjects in the same order.

THE SELECTED SOUNDS - EXPERIMENT B

The ten sound samples selected from the original thirty to be used in experiment B appear in Table D.3 and were in no way altered

[3]A fuller description about each is included in the response analysis sheets in Appendix I.

in content, sequence or duration from experiment A. In order to avoid improbable juxtapositions between sound and vision, all sound sequences were eliminated as they would not relate to the environments shown in the slides. Since the urban environment was of most interest within the context of the research as a whole, fairly universally encountered sounds which would not be totally improbable in any of the three environments displayed were included in the set of sounds. This was adjusted finally to ten sounds only so that exactly thirty sets of responses would be gathered from each subject, as already discussed.[4]

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[4]See Section D.3.

Table D.2

FULL SET OF THIRTY SOUND SAMPLES USED IN EXPERIMENT 'A'

Sequence of Presentation/ Sound Sample Number		Duration (secs)
1	Steam Train Sequence	40
2	"BIG BEN" (London) Striking Six O'clock	40
3	Coyote Howling Three Times	15
4	Female Laughter	15
5	Breaking Glass	1
6	Thunder and Rain Sequence	70
7	Foghorn Blowing Five Times	45
8	Passing Motor Vehicles on Highway	35
9	Small-Calibre Gun Shots	10
10	Church Bells Ringing	8
11	Dogs Barking	5
12	Diesel Train Sequence	65
13	Cock Crowing Three Times	4
14	Car Skid and Crash	15
15	Rain Running in a Gulley	40
16	Young Baby Crying	20
17	Marching Band Passing	90
18	Police Whistle Being Blown Vigorously	8
19	Mockingbird Singing	35
20	Motor-Cycle Starting and Riding Off	25
21	Children Playing in School Yard	50
22	Seagulls Crying; Waves Breaking	65
23	Passing Ambulance and Police Car Escort Sirens	15
24	Female Screams	10
25	Passing Troop of Horses	25
26	Firework Display	75
27	Angry Cat Growling	20
28	Passenger Liner Departure Sequence	50
29	Construction Site, with Piledriver	20
30	Fairground Sequence	45

Table D.3

REDUCED SET OF TEN SOUND SAMPLES USED IN EXPERIMENT 'B'

Sequence of Presentation	Sound Sample Number	Sound Sample Name	Duration (secs.)
1	5	Breaking Glass (one crash)	1
2	9	Small-Calibre Gun Shots	10
3	11	Dogs Barking	5
4	14	Car Skid and Crash	15
5	15	Rain Running in a Gulley	40
6	16	Young Baby Crying	20
7	19	Mockingbird Singing	35
8	20	Motor-Cycle Starting & Riding Off	25
9	21	Children Playing in School Yard	50
10	25	Troop of Horses Walking on a Cobbled Street	25

5. SELECTION OF THE "PLACE" ENVIRONMENTS FOR EXPERIMENT B

The three contexts selected for experiment B are reproduced in Fig. 3 as they appeared to subjects. Only urban settings were used for the reasons already given.

Although the places were not identified to subjects during experimentation, their true locations are as follows:

3(A) is Yorkville, the "hippie" district of Toronto, Ontario.

3(B) is a three-quarter life-size reconstruction of a section of New Orleans' "French Quarter" in "Disneyland", Anaheim, California.

3(C) is a rear courtyard within the seventeenth century Spanish Governor's Palace close to the centre of downtown San Antonio, Texas.

Each was selected loosely in accordance with the "place" variables already identified in Section C.1. The principal reasons behind the choice of these three settings were therefore as follows:

(1) All three differed in their spatial form:

- Yorkville, from the slide, was apparently a straight street with buildings probably also occupying the side which couldn't be seen. (This was so in the real place but no direct clues were available to support this belief in the slide.)
- The "French Quarter" was a narrow cul-de-sac pedestrian street from which only sky was visible because of enclosing buildings.
- The Governor's Palace was a walled court but above the continuous walls some other buildings and a street light-standard could be seen.

Yorkville,
Toronto

FIGURE 3(A)

Disneyland,
Anaheim

FIGURE 3(B)

Spanish Governor's Palace,
San Antonio

FIGURE 3(C)

(2) All three differed in their apparent function:

- Yorkville was apparently a principal street with shops and perhaps apartments above in an uptown Victorian neighbourhood which had declined and now was frequented by a "hippie" class of young adults.
- The "French Quarter" was apparently a historic tourist place with curio shops, which attracted families with children. (It was thought that most subjects would recognize this setting as New Orleans.)
- The Governor's Palace might have been part of a secular, military or ecclesiastical complex of an identifiable period. However, no reliable clues were available to indicate its real function. It seemed probable that it would be some sort of historic monument now. The style of architecture and the vegetation might indicate a Southern location.

(3) All three differed in the amount and type of visible activity they contained:

- Yorkville was the only setting which contained cars and the group of youths visible appeared to be loafing in the afternoon sun.
- The "French Quarter" contained flocks of adults and children who appeared to be out sightseeing and enjoying themselves.
- The Governor's Palace contained no visible activity and the only clue as to the sort of people who might use that place was the girl relaxing at the edge of the pool.

(4) All three differed in their aesthetic qualities

- Yorkville, it was thought, could differ in how subjects would evaluate it in this respect. The change which had clearly come over the place in turning, perhaps, from a once-fashionable residential area could be considered as "blight" by some. Others, however, might see it as a humanising and softening of a dull and repetitive line of mean unfashionable old houses.
- The "French Quarter" with its distinctive French style architecture and cast-iron balconies was, unlike Yorkville, well maintained and inviting. The people visible in the setting were innocuous families and the place was expected to appeal to the great majority of subjects.
- The Governor's Palace was a primitive adobe which, while historic like the French Quarter, dated from an earlier period when structural massivity was necessary in part as security against outside attack.

OTHER FACTORS

All three places apparently differed in their geographical location from the style and period of the architecture although the "French Quarter" and Governor's Palace might conceivably be in a similar (or even the same) Southern town to the uninformed.

Since it was expected that the Disneyland reconstruction might be confused (as it was) with New Orleans itself, subjects could

therefore have certain expectations about the place. The Governor's Palace was not expected to be recognized directly though places of this type, with lush vegetation might be associated, correctly, with the Mexican influenced part of the country.

Each of the three settings contained some uncertainties for the author when selecting the slides and it was felt that perhaps these (or others) would also be apparent to the subjects:

For Yorkville, the total spatial form of the place and adjoining areas was not totally clear, nor was its geographical location although it seemed likely be part of an inner suburb of a northern city from its general character. It was also unclear from the slide whether the area was simply decayed but friendly or actually frequented by dangerous groups of lawless youths.

The Disneyland setting was thought to be the least ambiguous of the three since it appeared to be old New Orleans with which almost everyone is familiar, if only indirectly. Therefore a consistency of character might be expected beyond the immediate visual field, with further similar narrow streets and pedestrian spaces, since the physical contiguity of the real vieux carré is well known. It was thought unlikely that subjects would detect the reduced scale of the buildings, however, in this reproduction of the original.

In the case of the Governor's Palace, the exact uses of the place, where it might be located, and what could be happening outside the courtyard walls all seemed potential areas of doubt.

6. THE RESPONSE FORMATS

There were two similar response formats, one each for experiments A and B and these are shown, as presented to subjects, in figs. 4 and 5. The introduction of reduced level tape-replay in experiments A(3) and B(2) did not alter the formats in any way and once finalized these remained unchanged throughout the data gathering. The design of each is covered briefly in the following sections:

EXPERIMENT 'A' (A(1); A(2); A(3))

Experiment Instructions and Notes

The basic purpose of these was to put the subject in a frame of mind to receive the sonic stimulus as similar as possible to how would be if actually in the real world. Initially he was asked to imagine himself out of doors "in some place" (carefully not specified since whether or not subjects identified places of their own accord was of interest in the questions which followed). This instruction was also stressed again in the notes since not all sound samples were exclusive only to the outdoor environment.[1]

The phrase "when the sound or sounds catch your attention for some reason" was included as one possible way of at least nominally accounting for the selectivity of hearing. In other words, it would be assumed that the sonic stimulus had passed the "filter" for any or all of the possible reasons which allow this to occur as already discussed in Section B.3.

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[1]Despite this instruction, experiences with sounds indoors were mentioned quite frequently by subjects.

See also Section F.1.

INSTRUCTION SHEET AND RESPONSE FORMAT -- Experiment A (Sounds only)

INSTRUCTIONS:

In this experiment you are going to hear a number of common sounds or sound-sequences with which we are all familiar to some degree.

In each case I want you to imagine yourself not in this room listening to a tape but in some place in the EXTERNAL ENVIRONMENT when the sound or sounds catch your attention for some reason.

In that frame of mind I'd like you to respond to the following questions in the way I will describe.

Please try to be uninhibited and to "be yourself" when responding.

NOTES

1. TRY TO DISREGARD THE ACOUSTIC QUALITY OF THE SOUND SAMPLES. SOME WERE OBVIOUSLY RECORDED IN A ROOM BUT I WANT YOU ALWAYS TO IMAGINE YOURSELF HEARING EACH SOUND WHEN OUT OF DOORS.

2. USE A NEW NUMBERED PAGE FOR EACH SOUND SAMPLE.

QUESTIONS:

Q 1. -- What was it you heard?

Q 2. -- What thoughts, associations and images does the sound-sample bring to mind?

N.B. DON'T STRAIN TO THINK UP IDEAS WHICH DON'T COME READILY TO YOU.

Q 3. -- How do you feel about what you heard?

Q 4. -- Outline, briefly, a specific event you can recall where such a sound played a part.

FIGURE 4

INSTRUCTION SHEET AND RESPONSE FORMAT -- Experiment B (Sounds and Slides)

INSTRUCTIONS:

In this experiment you are going to hear a number of common sounds or sound sequences with which we are all familiar to some degree.

In each case I want you to imagine yourself not in this room listening to a tape but actually in the place you see in the slide when the sound or sounds catch your attention for some reason.

In that frame of mind I'd like you to respond to the following questions in the way I will describe.

Please try to be uninhibited and to "be yourself" when responding.

NOTES:

1. PLEASE LISTEN CAREFULLY TO EACH SOUND SAMPLE. ONE OR TWO OF THE SOUNDS MAY SEEM MUCH MORE FITTING TO AN INDOOR ENVIRONMENT BUT IT WANT YOU TO ALWAYS IMAGINE YOURSELF HEARING EACH SOUND WHEN OUT OF DOORS IN THE PLACE SHOWN IN THE SLIDE.

2. USE A NEW NUMBERED PAGE FOR EACH SOUND SAMPLE.

QUESTIONS:

Q 1. -- What was it you heard?

Q 2. -- What thoughts and associations does the sound-sample bring to mind in the context of this place?

N.B. DON'T STRAIN TO THINK UP IDEAS WHICH DON'T COME READILY TO MIND.

Q 3. -- What does the sound tell you about the place?

Q 4. -- How do you feel about what you heard ?

FIGURE 5

Having, therefore, given the subject only minimal instructions and no real clues as to the objective of the experiment he was then asked to respond to four questions as follows:

Question No. 1

The purpose of this question was to see how readily different sound samples could be identified on the basis of the sound or sounds alone and without any other clues. It was expected that certain single sounds would be highly identifiable (such as the cock crowing) while perhaps unfamiliar sequences or events which contained less distinguishable sounds might not be.

It was also considered necessary to see how to misinterpret the sound sample influenced responses to the later questions. A previous study[2] had indicated that judgment about sounds do vary according to how an individual identifies them and this was also of relevance here. What did seem of particular interest was how incorrectly identifying a sound sample might influence the associations it had for a given subject and therefore the nature of the "experience".

Question No. 2

This question allowed the subject to present any ideas which the sonic stimulus had brought to mind and was considered the key question of the whole response sheet. Associations with sounds, it will be recalled, appeared to be an important aspect of sonic experiences in the preliminary investigation (Section A).

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[2]Jean S. Kerrick et al., "Multiple Ratings of Sound Stimuli," J. Acoust. Soc. Am., 45, 1014-17 (1969).

"Thoughts" and "Associations" were taken as more or less synonymous terms and were both included to be certain the subject knew what was required in his response. "Thoughts", it seemed, would also indicate that even trivial ideas should not be discarded in the event that "associations" had suggested only the more coherent and elaborate ideas were required. "Images" seemed perfectly clear and was intended to give subjects an opportunity to present complete "pictorial" associations if these occurred.

Since the basic interest of the research was to examine the "response" to a given (sonic) "stimulus", it was important that only immediate reactions were given to the sounds as would occur in the real world. Consequently, it was necessary to ensure that no unnatural "chains" of association occurred, with one association itself acting as secondary stimulus for another which might be unrelated to the sound. In an attempt to avoid this, subjects were instructed not to strain with their responses. During the running of the experiment, a subject was asked by the author to move on to the next question when it was apparent he was pausing to think up ideas which hadn't arrived spontaneously.

Question No. 3

It was expected that at least some of the samples would be quite strongly liked or disliked by many people, both because of the stimulus quality of the sounds themselves and the associations they might carry. The question was also phrased somewhat ambiguously by asking how the subject felt about "what you heard" rather than about

"the sound or sounds". This was done deliberately to see if any comments would also be made about the taped sample as a whole and therefore provide some insight about the success or otherwise of the presentation technique being used.

Question No. 4

This question was considered important since it was hoped it would indicate several things at once. First, it would enable a coherent total experience with a given sound (if any had ever occurred) to be presented by the subject. Second, it would expose only events which were sufficiently memorable to be recalled and this automatically filter out less meaningful experiences. Third, it would give some indication about the still-uncertain role of "place" in sonic experiences by seeing if and how places where such experiences had occurred were mentioned. Fourth, it could give some indication as to what the person was doing at the moment he experienced the sound and therefore the kinds of situations where such experiences occur. It was further thought that by only asking for one such event to be described per sound that subjects would present only their most memorable experiences and would have enough time to do so in some detail.

BI-POLAR ADJECTIVES

These do not appear on the formats shown in figs. 4 and 5 since they were abandoned during pretest as being generally unuseful.[3]

[3]See Section F.3.

Two such pairs were used, based on Osgood's[4] seven-point scales. These were as reproduced below:

	EXTREMELY	QUITE	SLIGHTLY	NEUTRAL	SLIGHTLY	QUITE	EXTREMELY	
UNPLEASANT	_	_	_	_	_	_	_	PLEASANT
UNINFORMATIVE	_	_	_	_	_	_	_	INFORMATIVE

The purpose of the scales was to attempt an absolute measure of subjects' judgments about two selected aspects of each sound sample. The scales would enable direct comparison to be made between the sounds for a given subject and between subjects for a given sound. They were intended to complement the more open-ended data obtained from questions 1 to 4 described above.

EXPERIMENT 'B' (B(1); B(2))

Experiment Instructions and Notes

These were modified from 'A' only as necessary so that subjects would be responding under similar directives for both experiments. Here, the context for the person/sound interaction to occur was given and subjects instructed to imagine themselves being in the place shown in the slide. In all other respects the instructions were unchanged.

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[4]Charles E. Osgood et al., The Measurement of Meaning, pp. 28-29.

The notes were modified slightly to emphasize to the subject that he should always respond to the sound as though he were in the given setting. This was thought necessary to avoid the risk of the subject's mind wandering during experiment and therefore his frame of reference possibly reverting partially back to that of experiment A.

Question No. 1

The intention of this question was to see how given "place" information influenced the identification of the sound samples between sounds and subjects as before but also between places for a specific sound and subject. It was also of interest to see how perhaps some sounds might now be identified differently because of the visual information supplied.

Question No. 2

As before, an opportunity was provided here for subjects to present any ideas generated on hearing the sound except of course these would now occur with reference to the three given contexts. "Images" was omitted from the question in this experiment because the contexts were already provided.

Question No. 3

The concern here was to ascertain what new information would be conveyed about a setting (if any) when each of the various experimental sounds were heard there. It would also show how the presence of each sound might modify impressions which a subject had already formed about the place from what he could see in the slide alone.

Question No. 4

It was expected that a subject's feelings would be expressed here principally about hearing a sound in the given context but perhaps also his reaction as to how appropriate the sound appeared there. The question purposely contained no mention of "place" so that comments also about the sounds per se or the taped samples might be made, as before, if such feelings were dominant.

EXPERIMENTAL PRE-TEST

This was done for both experiments in such a way that no data would be totally wasted even from the very start. This seemed particularly necessary because of the comparatively few subjects who performed the experiments. It was also important that as many different responses were obtained as possible because the analysis method to be used would search for patterns of similarity within these between subjects.

Experiment A

The initial format used here differed slightly from the final one as presented in fig. 4. The instructions and notes were the same and so were questions nos. 1, 2 and 3. Instead of question no. 4, two other questions were included. These were:

Q 4. "If you heard this sound (or sounds) in a particular place, what would it tell you about that place?"

Q 5.(a) "What action, if any, would you want to take on hearing this sound (or sounds)?"

(b) "What situation did you consciously or semi-consciously imagine yourself to be in when you answered 5(a)?"

Both these questions were found to be unsatisfactory during pre-test with the first subject. Apart from the content of the responses, the total running time of the experiment was excessively long - two hours - by the end of which the subject was very fatigued.

Questions nos. 1 to 3 produced very much the kind of responses which were expected, although sometimes questions nos. 1 and 2 over-lapped a little. Question no. 4 proved a considerable problem for the subject who found it almost impossible to give an answer when no "place" was provided to which the sound might be referred. This question had originally been included in an attempt to see whether meaningful sounds consistently supply information about environments in a non place-specific way. It would seem from the pre-test that generally they do not. In the few instances where a coherent response was given for this question, similar ideas had already been expressed under "Thoughts, Associations and Images". The howling coyote (no. 3) and foghorn (no. 7), for example, fell within this category - sounds very much known to be rooted in particular kinds of environments.

Question no. 5(a) was intended to see whether, in a general sense, a subject could identify his possible physical reaction to the sounds. This only managed to produce very trite answers such as "look for the source of the sound" or in the case of the breaking glass (no. 5) or crashing car (no. 14) to "take evasive action". Clearly, without the subject being in a purposeful situation in a real place the question had very little meaning.

Question no 5(b) was more successful and showed some promise. Certain sounds produced responses which described "generic" situations in which the sound is experienced, such as "being caught out in the open" for the thunder and rain sequence (no. 6) or "being at a rifle range" for the gun shots (no. 9). However, certain sounds triggered off recollections of some specific experiences in the mind of the subject. Examples of these included being "out camping as a Boy-Scout in the West Texas desert" when hearing the coyote howling (no. 3); being "in bed and sleeping further at our farm" for the cock crowing (no. 13), and having "watched horses and wagons go by in Chicago" for the passing horses sequence (no. 25). Responses of this kind suggested that perhaps this part of the question should be retained in the final format and expanded so that subjects were always asked to recall, if they could, some specific past event they had experienced in which the sounds had played a part. To do this would perhaps give valuable clues as to how certain sounds are experienced in the environment in a real-life situation and allow subjects to provide their own details about these experiences. This question was therefore retained in a modified form in the final response sheet as question no. 4 while the original questions nos. 4 and 5 described above were abandoned.

Experiment B

Since experiment A was run in its entirety before moving to experiment B, a good deal of experience by this time had been gained

about how subjects were responding under the experimental conditions. As a result, the response format for experiment B was designed with this experience in mind and was found to work well even in pre-test. It was therefore used without further modification being necessary..

[E] EXPERIMENTAL RESULTS

The main body of data from experiments A and B was systematically tabulated on the basis of recurrent words, phrases, and themes used by subjects in their responses to each sound sample. A summary of this analysis appears, sound by sound, for the two experiments in Appendix I and the reader is referred to this material directly.

Perhaps, ideally, a systematic statistical analysis of the response material would have enabled more variables to be handled at once than the simple order-by-inspection method which was used here. However, the author did not have the training to carry out such an analysis, and in any case it was thought to be beyond the scope of the present exploratory study.

The findings from the two experiments are presented as follows. Section E contains a presentation of the results in relation to the experimental hypotheses for each experiment and to the response format questions. Significant other findings are also included. Later, the general conclusions of both experiments and their implications are briefly discussed.[1]

1. EXPERIMENTAL AREA 'A'

Hypothesis 1(a)

In general, the experimental data appears to support this hypothesis. The sounds which carried stereotyped associations were

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[1] See Section G

either those which were well known to be "rooted" in particular classes of environments or those which infrequently, if ever, are experienced at first hand by subjects. "Rooted" sounds are covered in hypothesis 2 so will not be discussed in detail here. Sounds which had not been encountered directly in the environment were associated both with the type of environment in which they were known to exist (e.g. the howling coyote (no. 3) linked with desolate rural environments, often at night) and also the media through which such sounds had been experienced. Consequently, mentions of indirect knowedge from films, T.V. and to a lesser extent plays here was frequent. Examples in this latter category included the howling coyote (no. 3), again, experienced through films; the female laughter (no. 4) linked with films or radio plays; and the car skid and crash (no. 14) associated also with films and T.V. events. These were often the more "dramatic" sounds.

The experimental evidence therefore seems to indicate that our first-hand experience with sounds is supplemented extensively through indirect means and that experiences gained this way can also be memorable.

Hypothesis 1(b)

Again, the evidence from responses supported the hypotheses, although not without exception. As far as the limited data will allow, it seems that it is the impact of the experience for a person as well as the characteristics of the sound in question which is also

significant here. A quite commonplace sound can become highly meaningful, therefore, for a person when linked with a particular dramatic event. For example, the breaking glass (no. 5) recalled a vivid experience for one subject where drunks had shattered the bedroom window at night and showered his bed with glass - a strong contrast to the commonplace "bottle breaking" images of others.

Sound samples which consistently carried very many associations for subjects had all been experienced at first hand. Conversely, sounds which had generally not been met in real life (such as the car skid and crash (no. 14)) stimulated trivial associations.

One notable exception to this hypothesis was seen with the sound of the coyote howling (no. 3) where only two out of the fifteen subjects had ever experienced this sound at first hand in the environment, both when camping out. Nevertheless, their associations were not discernibly different, nor any more detailled, than those from subjects who had only gained these from exposure through films and T.V. Clearly, as presented through the popular media, the howling of a coyote is a very image-evoking sound.

Hypothesis 2

This appeared to only partly supported by the experimental data since also another issue emerged here which had not been covered. As expected, certain sounds were repeatedly associated with particular classes of environments in which they were rooted and had been experienced. The flowing rain water (no. 15) and mockingbird song (no. 19),

for example, were both associated with rural settings; similarly, the construction-site sequence (no. 29) and ambulance/ police sirens (no. 23) had strong and consistent links with the city. "Natural" sounds were frequently related to rural environments and "man-made" sounds to urban or suburban areas, though not exclusively so. What appeared often critical here was not where such sounds were known to occur but rather where they were most commonly experienced. While normally sounds are heard in the same physical context in which the sources occur, this need not be so.

For instance, while foghorns were exclusively associated with harbours and the sea, they were frequently reported as being heard when in bed - a totally unrelated situation. Similarly, barking dogs (no. 11) though heard almost universally, were associated with farms and being out in the country for some subjects but with the local neighbourhood for others - presumably according to where the bark of dogs had had the greatest impact for a particular person.

Of the thirty sound samples, the thunder and rain sequence (no. 6), being weather, was truly universal to all environments. Not unexpectedly, no generic connections with "place" were made. Nevertheless, specific situations were thunderstorms are often vividly experienced (such as sitting in a car or lying in a tent) were mentioned several times.

The above evidence seems to suggest that the hypothesis needs to be extended for certain sounds to include the situation of the person at the time they were experienced as well as the environments in which sounds may be known to be rooted. While there is some evidence of apparent universality for both, no direct link between them need exist.

OTHER EXPERIMENTAL FINDINGS

Identification of the Sound Samples

Performance in correctly identifying the sound samples varied quite considerably both collectively by the subjects for different samples and across all the samples for individual subjects. The factors which seemed to influence how a particular sound sample was identified by subjects came under at least one of the following five headings, as follows:

(1) The distinctiveness of the sound or sonic event.

(2) The degree of familiarity relating to how commonly such sound or sounds are experienced in the environment or to an individual's particular familiarity with them for whatever reason.

(3) The part played by supporting sounds (particularly the ambient background in the case of single sounds).

(4) The interpretation placed on a sound or sound event which, while generically identifiable, could originate from one of a number of specific sources.

(5) The ability of subjects to identify the component sounds of a sonic event while being unable to collectively name the whole.

Subtleties in the sound samples sometimes passed unnoticed and lead to errors being made in identifying the sounds or sonic event. For example, the rather indeterminate array of sound in the construction site sequence (no. 29) was taken as a mill or industrial plant by those

who did not identify the rhythmical clank of the piledriver - an important clue for several subjects. On the other hand, the rather dissimilar peal of bells (no. 10) and "Big Ben" striking the hour (no. 2) were both identified as church bells by three subjects, with one believing he had actually heard the same sound sample over twice.

Seemingly less easily confused sound sequences were also misinterpreted. For example, one subject mistook the thunder and rain (no. 6) as the crash of waves on a beach, and was then surprised when the actual seagulls and waves sequence (no. 22) came up later. Another, while correctly identifying no. 22 mistook the very first wave crash as thunder and then expressed surprise when no sound of falling rain was heard on the water.

These examples suggest that while small clues can be missed altogether, others can be ambiguous or misleading. Both cases do indicate the attention which <u>is</u> paid to these, however.

The influence of a person's familiarity with sounds or sonic events sometimes appeared to influence how these were identified. The ship-departure sequence (no. 28) was unfamiliar to some and for one subject became half-time at a football match because of the brass band and mingled voices. Single sounds, on the other hand, were generally less often misinterpreted, but the growling cat (no. 27) was variously mistaken for another animal or crying baby by the uninitiated.

Supporting or background sounds were used by subjects to give additional information about a sound sample when there was some uncertainty about either the sound itself or its context. Single sounds such as breaking glass (no. 5), and the police whistle (no. 18), for example, because of the silent background became, respectively, vandalism (since the silent background was interpreted as night) and a sports-field whistle or doorman calling a cab (since several subjects said they would expect a traffic policeman to be set against vehicle sounds). The passing horses sequence (no. 25) was interpreted as being set in an urban environment because of the faint traffic background about which several subjects commented. In experiment A(3), however, where the reduced level eliminated this weak ambience, a night context was also assumed here by one subject.

The matter of background sound could not be allowed for in designing the tape, unfortunately, since sound samples had to be taken as they were from commercially-made discs. However, the importance of ambience in our relationship with sounds in the real world is clearly reaffirmed by the above examples.

Sounds which, while generically recognisable, could originate from several different sources were variously identified by subjects within their generic category. The flowing of water (no. 15), for example, while actually rain water running in a gulley, was never interpreted as such but became almost universally a flowing brook or stream and even a waterfall and fountain. Breaking glass (no. 5)

was taken for smashing bottles, accidental or deliberate breaking of windows (burglary as well as vandalism) and domestic accidents with fragile objects. The light cracks of the gunshots (no. 9) were not only recognized as a firearm but also became children with fire-works and a whip cracking. Such errors might be expected with single sounds since those with which they were confused are very similar, suggesting the limits in our ability to discriminate between comparable sounds, at least when taken out of context.

Sound events were also generically misinterpreted. This seemed to be because the composition of sounds of the total event were confused with others which are generically similar or by an error being made in identifying a single component sound which was then used as a clue to the whole event. In the first category, for example, the explosions of the firework display (no. 26) and the shouts of the crowd were mistaken for a riot or war, with rampaging or fleeing crowds heard against explosions and gunfire. Others who correctly identified this sound sample nevertheless remarked that at first it was unclear whether the voices were frightened, hostile or happy. In the second category, the guns of the shooting gallery in the fairground sequence (no. 30) were identified as the cracking ringmaster's whip in a circus by some and so the whole event became a crowded circus tent, not improbable because of the mingled happy voices and gay music.

Only two of the sound samples were consistently misidentified as a whole when component sounds could be generally correctly named. These were the ship departure (no. 28) and the construction site sequences (no. 29). Both of these have been discussed earlier. It seems in these instances that when the identity of the event wasn't immediately apparent subjects attempted to match the composition of sounds, incorrectly, with their nearest own experiences. However, it was ultimately the missing of small but important sonic clues which were specific only to the real events which allowed such errors to be made - the distinctive clank of the piledriver and a voice saying "bye-bye" amongst the many other sounds.

Thoughts-Associations-Images/Events Recalled

Although the presentation of thoughts-associations-images and the outline of a personal event were two spearate questions on the response format, the answers to both overlapped considerably in their content. To avoid the risk of repetition, therefore, the other findings from these two will be discussed together.

The number of associations which each sound sample evoked varied considerably. However, within the conditions discussed under the hypotheses, subjects in general were remarkably consistent with these both in number and content for each. Those sounds which generated many descriptive associations enabled quite detailled composite images to be assembled of either environments or events which were repeatedly associated with those sounds.

There were three notably detailled generic environment images which emerged in the responses and all were of natural settings. The sound of running water (no. 15) presented a fast-flowing clear brook with mossy banks and a rocky bed - maybe running in a ravine - in the midst of leafy green trees which overhang the water. The place would be cool, calm and peaceful and would be associated with being out hiking in the country. Several subjects linked the sound to more mountainous and barren terrain without trees.

The second rural image, even more intricately described, was evoked by the singing of the mockingbird (no. 19). Here the associations were somewhat more diverse; mainly linked with woods, trees and streams again but also with open fields and meadows. There was a predominant emphasis on still, brilliantly sunny spring or summer days when walking, picnicing or vacationing in the country.

The third image, related to the seagull and waves sequence (no. 22) was highly uniform if less descriptive. Typically, one would be walking alone, perhaps deep in thought, along a wide deserted beach (often with rocks) by the crashing surf and being greatly aware of the expansiveness of the view across the sea, and of the sky. Specific beaches were often named by subjects here.

The vividness and uniformity of descriptive associations with these three sound samples is interesting. For one thing, they suggest that writings in the literature about the sounds of natural environments may be the result of similar experiences by the writers and not merely poetic fabrications. They also seem to reaffirm the special significance of natural sounds raised earlier.[2]

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[2]See Sections A.1 and B.1.

One possible (if partial) explanation as to the descriptive detail which appears here may be that each of the three was experienced when the person was recreating - even daydreaming - and therefore he would be in a non purpose-orientated and receptive state of mind. Filter theory would then explain that under these conditions the person would discard only a low percentage of information received by the sense organs.

Sounds which were associated with spectacular and colourful events which again had been experienced during or as recreation were rich in their descriptions of these aspects of the experiences. Therefore, the marching band (no. 17) presented a generalized image which contrasted the precision and bright uniforms of the marchers with the massed excited crowds of spectators. This would have been experienced either as a spectator, or as a participant in high school or college parades, on some special holiday or occasion. Similarly, the fairground sequence (no. 30) evoked detailled images of the thronging, colourful, noisy kaleidoscope of days out in state and county fairs and amusement parks.

All of the foregoing examples do suggest that certain sounds heard in the environment are highly meaningful[3] and provide a strong and consistent link with past experiences. While the sample may be very small, it does appear that collectively:

(1) The person was in a receptive situation when these experiences occurred.

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[3]The number of responses to a particular stimulus in free association during a fixed period of time has been used as an index of "meaningfulness". See Clyde E. Noble, "An Analysis of Meaning," Psychological Review, 59, 421-30 (1952).

(2) The visual aspects of the experience were very important and were noted and remembered in considerable detail.

(3) It was the total event which was recalled, not just its sonic aspects although in each instance it seems that the sound(s) played an important part within the whole.

In contrast to sounds linked to the most meaningful events, single sounds which were either commonplace or somewhat anonymous and heard in isolation were weakest in association unless linked by a subject to a particular memorable event.[4] Of these, the breaking glass (no. 5) evoked the fewest and most trivial associations generally. The rather "constant" sound of passing motor vehicles was also weak in associations for subjects - an almost everyday experience for urban dwellers. The female laughter (no. 4) was similarly weak for most subjects but because highly meaningful for three who each associated the sound sample with a particular woman known to all three with a similar laugh. These subjects reacted very positively - again illustrating how very much personal experience can influence the meaningfulness of sounds.

Several sound samples appeared to fall into an intermediate situation between the most and least imageable by generating comparatively few associations but ones about which subjects agreed almost unanimously. These were: the cock crowing (no. 13), eliciting principally "morning"

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[4]See example for sound sample no. 5 cited in discussion of Hypothesis 1(b) earlier.

(and "getting up"), "farms" and "farmyards", "vacations", "hen-houses", "rural settings" and "childhood"; the car crash (no. 14) which stimulated multiple references to "fear" and "fright", "films/T.V.", "bodily injury", "speeding" and "skidding" and the firework display (no. 26) which prompted "crowds", "4th of July", "celebrations" and "organized events" but also "riots and demonstrations". These sounds additionally seemed to have had a dramatic impact on subjects.

When sound samples were incorrectly identified by a subject, the associations evoked and event he described almost always related to what he thought the sound or sounds had been. Therefore, when the thunder and rain sequence (no. 6) was mistaken for the crash of waves on a beach, the subject's associations were "an impression of solitude and openness",[5] and he recalled walking on beaches on Plum Island. Similarly, another who mistook the passing motor vehicles for a low flying helicopter associated the sound with aircraft spraying crops vaguely recalled seeing this being done in Minnesota (his home).

These two examples are of isolated errors which were each only made by one subject. Nevertheless, when the construction site sequence (no. 29) was repeatedly misinterpreted as a mill or industrial process, subjects' associations were consistently descriptive of the heavy, rhythmical pounding of machines or presses in a factory shed.

Occasionally, the associations and events recalled did not correspond to how the sound sample had been identified. For example, two

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[5]His associations then closely resembled those of other subjects for the real seagulls and waves sequence (no. 22).

subjects identified the howling coyote (no. 3) as a barking dog but still associated the sound with coyotes under the moon in lonely desolate places like other subjects. Another identified this sound correctly but associated it with staying on his grandmother's farm out in the country in the summer as a small child where the wind howling in the pine trees had made a similar sound.

There were a few other instances of associations being made with sounds which were physically similar to those on the tape. When this happened, as in the example above, it appeared that the sound sample was sufficiently similar to one related to a memorable personal experience for that experience to be recalled even though the subject might have recognized the sound sample, correctly, as something different.

Non Audio/Visual Sense Associations

Reference was made to smells (and occasionally to thermal sensations) in association with several sound samples. The smell (and feel) of the rain, the smell of the grass and the coolness were mentioned for the thunder and rain sequence (no. 6). The unpleasant smell of traffic fumes was mentioned once for the passing traffic sequence (no. 8). The smell of farms and the "good fresh smell" of the country were mentioned once, respectively, in samples no. 13 (the cock crowing) and no. 19 (the mockingbird song). The smell of salt air came up both for the foghorn (no. 7) (where the feel of the wet fog was also mentioned) and for the seagull and waves sequence (no. 22). The smell of popcorn at fairgrounds was also referred to once.

Childhood Associations and Experiences

Recollection of events from childhood were linked with ten of the sound samples and with several of these recurred frequently. These were no. 1 (the steamtrain sequence), no. 13 (the cock crowing), no. 17 (the marching band), no. 19 (the mockingbird song) and no. 30 (the fairground) which each had four or more references: the childhood associations with steamtrains usually related to being out watching trains, perhaps with an adult. The crowing cock was almost universally associated with vacationing on a farm, and the marching band with watching or taking part in parades, often linked with the person's home town. The mockingbird song was generally associated with childhood picnics, camping and summer vacations, but also (by two subjects from the rural South) of playing at home out of doors as a child. The fairground sequence (no. 30), perhaps not surprisingly, recalled childhood experiences for several subjects.

Although the sample here is small, it does seem that childhood experiences with certain sounds can be important. Perhaps significantly, those identified by subjects all related to some memorable event. While, say, fairgrounds or vacations on farms might be experiences a person had not had since childhood, it could be expected that the singing of a mockingbird had been meaningfully encountered in many situations since then and that one of these more recent experiences might have been recalled instead.

While the author does not feel qualified to say exactly why childhood experiences are so recurrent, Bruner also asks: "... does

the dominance of visual and auditory cues in early life operate by a channeling of attention, by selectivity of memory or how?"[6] It does seem possible that the young child, in constantly gaining knowledge about his surroundings, is highly receptive to new and novel situations which can be committed to permanent memory if sufficiently unique.

Feelings Expressed about the Sound Samples

The question "How do you feel about what you heard" (no. 3 on the response sheet) was interpreted in several ways by subjects as anticipated. For example, the female scream (no. 24) stimulated "emotional" reactions of horror and fear generally, but also an "attitude" comment only indirectly related to the sound - "I feel helpless about conditions in society" - from one particular subject. Attitude comments were also made for other sound samples by this and other subjects on a number of occasions.

Some sound samples were sufficiently evocative to generate spontaneous expressions of feeling even under question no. 2 ("Thoughts - Associations - Images"). These included the example above but also the crying baby (no. 16) which prompted "unhappiness", "tension" and "irritation", and the marching band (no. 17) which gave "nostalgia", "cyncial amusement", "embarrassment for the marcher" and "quasi-patriotic pride". These spontaneous expressions fell both within the emotional and attitude categories. Emotional reactions generally displayed greater consistency between subjects than attitudes (when expressed) which seemed to be more closely related to the biases of an

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[6]Jerome S. Bruner, "Studies in Cognitive Growth", p. 3.

individual subject. Nonetheless,attitudes could also be quite consistent within the group of subjects. The sound of the motorcycle (no. 20), for example, was clearly offensive to several subjects because of the crude display and unpleasant "Hell's Angels'" image of the people who ride motorcycles.

Responses under question no. 3 were also frequently a direct expression of whether the sound sample was liked or disliked by a subject. While there was some variation between objects for particular sounds, groups of sounds were more or less unanimously liked or disliked.

Those sounds which were explicitly stated as being liked were the "nostalgic" steam train sequence (no. 1) (but not the diesel train), the foghorn (no. 7), churchbells (no. 10), crowing cock (no. 13), running rain water (no. 15), marching band (no. 17), mockingbird song (no. 19) and the seagull and waves sequence (no. 22). Those which were disliked were the dogs barking (no. 11), the car crash (no. 14) and the motorcycle (no. 20).

The dislike expressed for the motorcycle does seem quite interesting in the way it appeared to function. It was clear in the responses that no-one liked the sound of the motorcycle. Several, of course, also disliked the traditional motorcycle "image" as well. However, not all subjects felt this way and four were torn between simultaneously disliking the "Hell's Angels" aspect but liking the exhilaration, fun and sense of freedom of motorcycling which was closely linked to the new "Easy Rider" film-image of motorcycling.

The apparent lack of dependency between the sound itself and attitudes about it or what it stands for also appeared several times elsewhere. For example, subject no. 6 indicated for the children playing (no. 21) that the sound was liked only because of what it represented. She remarked: "nice sound - i.e., I'm glad the kids are having a good time but I don't want to have to hear it for too long". Similarly, the same subject responded positively to the sound of the steam train (no. 1) "because I like trains". Since she doesn't state so explicitly, it is not clear to what extent her judgment here reflects feelings about the actual sound. However, her responses to the mocking-bird song (no. 19) and the passing horses (no. 25) both prompted: "I like the sound", suggesting that it was the sound only that she was judging in these instances.

To summarize the findings at this point about the sounds used in the experiment, the following remarks might be made. It first seems that certain environmental sounds are quite strongly liked or disliked. Within this over-all judgment about a sound or sonic event there can be several discrete categories of "feelings" at work. One relates purely to the physical sensation stimulated by the sound and how pleasant or unplesant that may be. Another is dependent not on the sound directly but on a person's attitude to what that sound may stand for. This attitude was sometimes seen to reflect the bias of that particular person. A third category, only apparent for certain sounds, is an emotional response which, if sufficiently strong, can be expressed

quite spontaneously. In the analysis of the responses, however, there were other factors which seemed to influence subjects' feelings about the sound samples and these are discussed below.

The circumstances under which certain sounds were experienced in the environment appears to further influence the kind of feelings subjects have about them. This was seen, at least in part, to be linked to the situation in which one might be (or have been) when the sound was experienced. For example, a sound which could relate to danger or a threat, such as the foghorn (no. 7), was without exception liked by subjects who had heard the sound passively when out walking or lying in bed but evoked a strong feeling of helplessness and anxiety for two subjects who had had unpleasant experiences on ships stranded in fog. The thunder and rain sequence (no. 6) was also judged as pleasant if one were protected from the storm and the thunder was not too near but threatening if stranded out in the open without shelter.

Subjects' feelings were also influenced by how they had interpreted a particular sound sample and several were "uneasy" about those they could not identify for certain. Similarly, sounds which could be identified were sometimes subject to different "contextual" interpretations which in turn influence the judgments which were made about them. Thus, subjects who thought the female laughter (no. 4) was normal and associated it with humour found the sound "happy" (if perhaps a little irritating). Those who associated it with insanity, however, found it bizarre and felt very uneasy.

Some evidence also seen in how feelings about certain sounds can change with age and experience. One subject, for instance, said how he recalls finding the howl of a coyote (no. 3) frightening to him as a child but now it was "a lonely sound". Experience (or familiarity) is seen also to affect feelings about sounds which may be heard very frequently in the environment. There are certain "constant" sounds which may be intrinsically annoying but to which we become acclimatised. This effect was apparent for the passing police and ambulance sirens (no. 23). While many subjects found them frightening and annoying, one remarked: "So omnipresent that I no longer have a feeling about it" and another expressed both feelings together: "It's a very unpleasant sound - one that you hardly notice in the city because it's so common".

The intended ambiguity in the phrasing of this question[7] also prompted comments about the actual taped samples, as was expected. These are discussed later in Section F.1 since they related to technical aspects of the presentation.

In summary, the responses to question no. 3 indicated that feelings about environmental sounds, as suspected, polarize between aspects of the physical attributes of the sounds and the associations which they carry for different people. However, as shown by the foregoing discussion, there are quite a number of factors which can influence

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[7]See Section D.6.

non-physical judgments about environmental sounds. These, at least, would have to be accounted for if making projections about the way people might respond given sounds in real environments.

2. EXPERIMENTAL AREA 'B'

Hypotheses 1 and 2 ("Appropriateness" of Sounds in Settings)

The experimental data from experiments B(1) and B(2) would appear to generally support hypotheses 1 and 2. Nevertheless, the situation here is seemingly more complex than presented in these hypotheses alone.

Strictly speaking, none of the ten sounds could be directly attributed to visible sources within the three slides presented. Cars (which could be involved in street accidents) appeared in place A and a small fountain (which might relate to the sound of flowing water) appeared in place C. However, barking dogs - a fairly universal sound in urban environments - could quite easily be heard in any of the places; a crying baby might be related by some to the families in place B and since there were other vehicles on a street, a motorbike could very possibly also be heard in place A. All other sound/place juxtapositions were not governed by sources which were directly visible.

Taking first the sounds which might relate to possible sources contained within the slides. The car skid and crash (no. 16), for example, is seen to fit all parts of hypotheses 1 and 2 in the subjects' responses. For place A (Yorkville) the crashing car sound was almost taken for granted - two subjects suggested that there may be an intersection/stop light somewhere just outside the visual field where this accident was occurring. All five subjects thought that it would be a not unexpected sound in that place.

Taking the same sound in place B (reconstruction of New Orleans French Quarter), one subject thought the sound suggested that cars do pass through this quiet alley, and apparently accepted its presence there, but the other four were disbelieving of that sound in that place. They more or less agreed (from what they know of the consistent spatial character of New Orleans - they way they had interpreted the place) that the streets were too narrow and congested with pedestrians for a car to run up and skid at such an apparently high speed.

The crashing car in place C (Governor's Palace courtyard, San Antonio), while not visible, was accepted readily by all subjects who believed a traffic street must therefore run close by the place somewhere just beyond the walls. No subject recognized the place exactly and presumably neither the slide nor foreknowledge provided any information to suggest whether or not such a spatial configuration might exist outside the courtyard.

Setting C, therefore produced responses which most closely matched hypothesis 2 in this way since subjects were also able to accept the existence of a range of sound-producing uses and activities that might be occurring outside the visual field but nevertheless very nearby. When sounds were heard which did not match what was seen, they reinforced a belief that the courtyard must be a haven from diverse (and sometimes unpleasant) things which were taking place around it.

These examples show that an unfamiliar setting which has a confined spatial field can retain congruity with quite a wide range of

sounds provided these could have originated from unseen sources outside the place. However, when there is some foreknowledge of its environs, this limits the range of sounds which are accepted because a person knows more exactly what could or could not be happening round about it.

The sound of flowing water (no. 17) in place C was identified by all five subjects as a fountain. Four of those emphatically believed the one they could see had too small a flow to match the sound and that another larger fountain might be just outside the visual field since there was already this one visible. For all subjects, therefore, the sound was considered quite appropriate.

The same sound was not considered inappropriate either in place B. Three subjects thought again it might be a fountain in some square or court nearby and two felt it could even be a small canal and weir or a brook running through this part of the town. The two other subjects believed it might be, instead, a running fire-hydrant which had been turned on (perhaps illicitly) for people to cool themselves in this hot southern city[1] but nevertheless not an unlikely event.

In place A, however, all subjects thought the sound very much out of context. Fountains seemed highly improbable and only one suggested with certainty that it might be a hydrant. Others identified the sound as diversely as "a leaking water main", "a tap running ("maybe") in a nearby house", and "a brook running beside the street". It seemed, therefore, that this sound did not meet the expectations subjects had had about the kinds of sounds they might reasonably find in this place.

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[1]That is, New Orleans.

The data would suggest that in judging whether a sound is appropriate in a specific place, subjects search for congruity between the sound and the setting. Sometimes this search will pick up very small clues from within the visual field in an effort to seek an explanation for the source of the sound when this is not immediately apparent. (For example, seeing the small Christmas tree in place A when breaking glass had been identified as perhaps the tinkling of ornaments). If the source (or apparent source) can be identified, that sound is taken as highly congruous and reinforces the link between what is seen and heard.

When a sound has some universality and is known not to be only rooted in a specific class of environment, then it may not be judged incongruous even though the apparent source is not visible. The crying baby - a fairly universal sound in populated environments - was considered congruent in place B (where two subjects connected the sound with the baby carriage visible in the slide). It was also accepted in place A which was seen to be filled with people. Here it was assumed by all subjects to be a child in a carriage out walking or shopping with its mother and that because of the sound the neighbourhood must be residential (not altogether apparent in the slide, perhaps). In place C, where the possible source was not visible in the slide, subjects still did not think the sound out of context but took the crying baby to be with a family out strolling somewhere in the place or coming from a residential neighbourhood outside. Barking dogs (no. 11), like the baby crying, are almost universal and were therefore similarly accepted in all three settings.

These two examples contrast sharply with the sound of flowing rain water which had been identified as an ornamental fountain in the "picturesque" environments (places B and C) but which could not be readily identified in the busy street (place A) since it was unexpected and therefore difficult to account for.

It would also appear that visibility of a source may lead to immediate expectations about what should be heard in a place.[2] However, ultimately what is more important is the probability (or even the feasibility) in the mind of the person that such a sound could be heard there. The experimental data indicates that this judgment is influenced by how a particular person interprets the sound in that context. The gunfire in place B was quite congruous to those who thought the sound was coming from tourist shooting galleries nearby but a subject who took the sound to mean violence was puzzled. Similarly, the passing horses were accepted as normal in place A if taken for mounted police but incongruous to those who interpreted the sound as a group of riding-school horses, which were associated with rural or better quality areas. This effect was also seen with several other sound samples.

In reviewing what appears to make a sound appropriate in a given setting, the following matters seem to be important. Sounds which can be attributed to visible sources are both accepted and expected in a place. If the source cannot be identified but the visual field of the place is restricted and the environs are unfamiliar, then quite a

[2]One subject (no. 9) repeatedly commented on the lack of sound from other sources visible in the slides during experiment and felt this lack of other sound (and ambience) bizarreand unreal.

diverse range of sounds may be still judged as congruous. However, if something is known about the immediate surroundings, then this range of potentially congruous sounds may be considerably reduced.

When the sound source is not visible, judgments about the congruity of the sound with a place appear also to be governed by a person's expectations as to the kind of sounds he might encounter there. Sounds which appear to "fit" are accepted while those which cannot easily be accounted for raise doubts. How the sound is identified within its generic category is seen to influence this judgment and universally-heard sounds are the least likely to be judged incongruous for all settings when the source cannot be seen.

Hypothesis 3 ("Informativeness" of Sounds in Settings)

Hypothesis 3 was consistently and reliably supported by the experimental data. There were also several links with how appropriate a sound was in a setting. This hypothesis is really only concerned with congruous sounds since those which are incongruous could be considered negatively "informative" and their presence lead to uncertainty and confusion when they exist.

While sounds which could be related to possible sources were accepted by subjects, they were also largely redundant since they only supported what could already be seen and supplied little new information. Therefore, in the responses, the car crashing in place A, the baby crying in place B or the sound of water flowing in place C only confirmed what was already more or less known about these settings.

On the other hand, while accepting the conditions for congruency already discussed, almost all of the sound samples gave some new information about each of the three settings when the probable source was not apparent in the visual field. In some cases hearing the sound only confirmed what could more or less be guessed simply from looking at the slide. For example, the sound of dogs barking (no. 11) heard with place A suggested to one subject that the "students" visible in the setting also kept dogs and to another that "it was the sort of neighbourhood where people let out dogs". Similarly, hearing the song of the mockingbird (no. 19) suggested to several subjects place C that there may be further gardens nearby and so the courtyard must be in some old city - not improbable from what could be seen.

When a sound was heard which did not relate to a visible source, subjects used it to seek out further information about the setting even when the sound was not particularly unique. The juxtaposition of a sound with a place seemed to be important so that the same sound might appear more informative with one setting than another. The mockingbird song, for example, which said little new about setting C, was a pleasant surprise to two subjects in juxtaposition with setting A. It suggested to several that there must be trees and gardens nearby or that perhaps the place was much closer to the countryside than its appearance would indicate. The barking dogs (no. 11) was also generally uninformative for setting A but suggested the adjacency of residential areas for settings B and C.

Particular sound/place juxtapositions were also seen to influence judgments made about the places which might not have been made if certain sounds had not been heard. Therefore, hearing the sound of flowing water (no. 15) with place B suggested the proximity of picturesque courts and squares with fountains but the motorcycle with the same setting indicated to several subjects that the place must also attract undesirable groups and therefore cannot be as pleasant as it first appeared. Conversely, the unexpected mockingbird song (no. 19) lead subjects to interpret setting A more favourably when seen in juxtaposition with that sound.

The findings relating to hypothesis 3 may be briefly summarized as follows. Sounds which could in any way be attributed to visible sources (or potential sources) in the settings were generally uninformative. If a sound was heard which appeared to originate from outside the place, it invariably contributed some new information to subjects about that setting. The degree of informativeness of a sound was found to be dependent on its juxtaposition with a place. Therefore, sounds which were unique and supplied additional clues about the place quite unrelated to what was seen were the most informative. The presence of certain sounds could also influence a person's judgment about settings and modify opinions he had formed from visual impressions alone.

The above findings serve to confirm, as expected, the importance of certain auditory information in influencing the way the physical environment is perceived.

OTHER EXPERIMENTAL FINDINGS

Identification of the Sound Samples

All the sound samples were at least generically correctly identified by subjects although the breaking glass (no. 5), gun shots (n. 9) and flowing rain water (no. 15) were interpreted variously within their generic grouping as had happened in experiment A. In their search for congruity between sound and setting, subjects identified these three sounds according to which interpretation might best fit each place. Examples of how this took place have already been given in relation to hypotheses 1 and 2 and need not be looked at again. The remaining seven sound samples were unambiguous, and whether judged appropriate or not for each setting were correctly identified in all instances.

Thoughts - Associations in Context

Unlike those for the corresponding question in experiment A, subjects' responses here were much less diverse and generally were related to the sound heard with respect to the given context. The responses fell into two distinct types which will each be discussed briefly and these were as follows:

(1) Comments connected in any way to fitting the sound to the place and finding an explanation for its presence (the majority).

(2) Associations made with the sound alone which were independent of the given setting.

(1) These responses generally were concerned with identifying the source, confirming what was already apparent or obtaining more information than what alone was seen. Taking the sound of breaking glass as an example (no. 5), one subject in place A suggested someone had thrown a bottle into the street but another, in place B, took the sound to mean that the place was frequented by excited young people - not apparent from the slide.

One subject (no. 4) aggregated the total information supplied by the set of ten sounds in relation to each setting. Rather than considering each sound/place juxtaposition in isolation, composite information about the place was accumulated successively from what was seen and heard. Each new sound was compared with what had already been learned of the place from hearing the previous ones as well as simply seeing the slide.

This effect occurred most noticeably with setting C. Subject no. 4 had found the composite impression that there was a "helter-skelter" going on outside the place even by the third sound (the dogs barking) and this or similar comments reappeared for the car crashing (no. 14) and the motorcycle (no. 20). By the ninth sound (children playing) he remarked: "It's consistent with the character of the place - babies, motorcycles, shopping,[3] etc.", supporting his belief that the place must be a haven from a distinctly urban and much less peaceful world over the walls. Two other subjects stated that they had been aware of aggregating information themselves when questioned after the experiment.

[3]This subject had believed the sound of breaking glass (no. 5) was from shoppers on a street outside the courtyard who were dropping fragile objects they had just bought.

(2) Associations which did not relate in some way to the given context occurred a number of times for four of the subjects. The data indicated that these appeared when either the sound did not seem to readily fit the visual context of the place or when that sound already had particularly strong associations for a person. In the latter instance, subject no. 9 each time associated the gun shots (no. 9) with the assassination of President Kennedy, and subject no. 10 the motorcycle sound (no. 20) with the "Hell's Angels" motorcycle gangs. Both subjects had also taken experiment A but neither made these associations then (hearing the sounds alone).

It is difficult to give a satisfactory explanation for this difference. One possible reason might be that the three settings are all clearly urban. The Kennedy assassination occurred in an urban setting and perhaps "Hell's Angels" might also be linked with motorcycle gangs racing around city blocks. Neither subjects described urban-related associations of their own accord in experiment A for these sounds.

Other unrelated associations were fairly commonplace and occurred when the link between sound and setting was weak. The flowing rain water (no. 15) with place A reminded one subject of fountains in two specific places he was familiar with - Trafalgar Square, London, and in front of the Philadelphia Art Museum. The mockingbird (no. 19) and the passing horses (no. 25) both reminded

the same subject of the countryside when presented with place A and several equally trivial associations were made with other sound/setting juxtapositions.

It would seem that the sounds evoked associations which were place-related to the given settings unless a particular sound had some special meaning for a subject. When this happened, the "personalized" association(s) dominated and appeared to be unaffected by the physical context. If this experimental finding is also duplicated in the real world, then it may have an important significance for understanding sonic experiences. The implications of this are discussed in Section G.

Feelings Expressed About the Sound Samples in Context

Several categories of response were seen within the data from question no 4, some mainly relating to the sounds per se and some to hearing the sound in conjunction with a given place.

The responses which related to the sounds alone were again classifiable into "emotional" and "attitude" groups and will be looked at first. The so-called emotional responses for these sounds were very like corresponding ones in experiment A. The car crashing (no. 14), for example, prompted immediate reactions of concern, horror and shock from roughly half the subjects across all three settings. Both the flowing rain water (no. 15) and mockingbird song (no. 19) elicited expressions of pleasure or enjoyment from almost every subject with each setting. Attitude responses which appeared to be independent of

context were similar to those in experiment A. Therefore, comments such as "dogs running loose irritate me", "annoyed at mother for neglecting baby" and "I don't like motorbikes" appeared several times.

Expressions of feeling which were reflective of hearing sounds in specific settings (and which varied according to the setting for a given subject) were more common than those relating to sounds alone. Many of these responses were linked with judging the congruity of sound and place and were expressions about how well this match occurred. These, for exampled, varied from "disbelief" (or amusement!) for the mockingbird singing (no. 19) in place A to "I think the sound very appropriate to the general atmosphere of the place" for the passing horses (no. 25) in place B. Sounds which were uninformative relative to the context - either because the source was fairly apparent or the sound added little to what could be seen - prompted "indifferent", "neutral", "nothing" and "no particular feelings" often.

Feelings about sounds with settings also varied according to what the subject thought was the exact source of the sound. Taking the breaking glass (no. 5) with place A as illustration: one subject was annoyed because she thought careless people were breaking bottles and littering the place. Two thought it was hooligans breaking windows or throwing bottles and were apprehensive about what might be going on. The fourth and fifth subjects (who heard the sound at reduced level) respectively judged the sound as someone accidentally

dropping a bottle or a sheet of glass[4] and was indifferent, and the tinkling of ornaments on a Christmas tree he had noticed and was surprised that such a gentle sound could be heard in this busy street.

A number of responses to sounds in specific settings indicated also how the subject might react on hearing the sound in that setting. Several times subjects said they would try to see where the sound was coming from (when the source wasn't directly apparent). One remarked for the car crash (no. 14) with place A, that he would go into one of the houses and summon the police and an ambulance. Another said he would stop and listen when hearing the mockingbird song (no. 19) in the same setting (which he thought was rather an uncommon sound for such a place). A third, on hearing the shouting children (no. 21) therefore thought that place B was in imminent danger of being filled with a flock of noisy, sightseeing school children and wanted to "leave as quickly as possible".

The feeling of detachment from things outside by subjects in place C gave reactions to the sounds peculiar only to this setting. When those which might be related to unpleasant activities taking place outside (such as breaking glass or gunshots), subjects were generally indifferent and felt isolated from these things. The sound of the crashing car (no. 14) caused one subject to say "I shall let other people get on with the problem" and another to express

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[4]He remarked that the sound wasn't loud enough for the breaking of a plate glass window - what he might have expected (by the presence of a mob of youths) from the slide.

his feelings of being safely out of danger inside. Another subject gave a similar response on hearing the motorcycle (no. 20) with the same setting where he found the annoying sound almost positive since for him it emphasized the peacefulness of the courtyard. The song of the mockingbird (no. 19) similarly enhanced the attractiveness of setting C for this subject, perhaps not unexpectedly.

Summarizing the findings from question no. 4, it was seen that two separate classes of response occurred. These related either to the sounds alone or to the sounds with respect to settings. Responses linked to the sounds only were comparable to those given in experiment A. Those concerned with hearing sounds in specific contexts were influenced by the congruity of the sound there, how informative a sound might be and how the source had been exactly identified with respect to the place. Some responses also indicated a subject's probably reaction he were to hear the sound in the real-world setting. In general, it would seem that the physical situation within which a sound is experienced frequently, at least, modifies the feelings people have about the sounds they encounter in the environment.

[F] EVALUATION OF THE EXPERIMENTAL TECHNIQUES

1. TECHNICAL CONSIDERATIONS

METHOD OF PRESENTATION/EXPERIMENTAL INSTRUCTIONS

Although a limit of thirty responses per subject for each experiment had been set,[1] this task was still rather too much to reasonably ask subjects to perform. The time actually taken to complete the responses varied from forty minutes to over an hour and a half according to how much a subject wrote and how seriously he seemed to be taking the whole experiment. In all cases, however, it was clear that the sequential method of presentation was too repetitive in the way it was conducted.

No subject expressed difficulty in principle imagining himself to be out of doors or in the place shown in the slide as instructed in the experiments. In experiment A (sounds only), two subjects found it helpful to close their eyes when projecting themselves into the external environment. Another remarked after experiment that to make this projection might have been easier if a longer pause had been given between sound samples[2] to allow him to readjust his mental set for each new sound.

With a few of the sound samples in experiment A, some subjects expressed difficulty that these were actually being heard when out of doors. This seemed to be because certain sounds (such as the female laughter or crying baby) were not associated with the external environ-

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[1] See Section D.3.

[2] Normally the tape-deck was re-started as soon as the subject had completed his responses.

ment in the way they were heard here. In these cases subjects often disregarded the experiment instructions and described indoor experiences with the sound. Recollections of hearing some of the sounds when in bed appeared quite frequently. Other problems arose because the acoustical quality of certain sound samples was difficult to relate to exterior locations, but this is covered in some detail later.

LIMITATIONS IN THE PRESENTATION - THE SOUNDS

Realism of the Sound Samples

There appeared to be no problems with loss of reality in the recordings although it is difficult to know the extent to which cases of incorrect identification were due to the recordings or to that particular subject. No consistent errors were seen here to suggest the former and subject no. 5 remarked that to her the sound samples were "too realistic" to have any images. (This comment was reflected in her responses to question no. 2 which were associated single words rather than the whole "images" common for other subjects).

Another (no. 6) commented that she found the sound samples "too specific" and so did not always correspond exactly to a past experience. She cited the case of the car crash (no. 14) where the sequence of run up, skid, impact and clatter of debris did not match her own recollection of a car crash. She had interpreted the event as "a car gaining speed and crashing into a lot of glass" with "not a strong impact" and remarked also that the sequence had "sounded phoney".

A problem which appeared in experiment B for only one subject (but which disturbed him considerably) was the lack of ambience behind the dominant sound in certain samples when played with setting A which

was seen to be crowded with people and vehicles. His particular concern was never receiving sound from these at any time but sometimes being able to "hear" faint sounds such as the breaking glass ("tinkling ornaments")[3] or mockingbird song which would probably be masked by the traffic and people sounds in the real world. Clearly, this is a problem when presenting "small" sounds without ambience in juxtaposition with environments containing visible, more powerful sources which themselves are not heard. Perhaps not surprisingly, the absence of background sound was much less apparent in the deserted, "peaceful" courtyard of setting C.

It does seem, therefore, that while the sound samples were sufficiently realistic taken alone, subjects were sometimes aware of very small details of these, which had not been anticipated: a problem to be faced when selecting "generalized" sound stimuli. However, it does indicate the precision with which we can perceive environmental sounds and store away experiences for future recall.

The problem of the lack of ambience with certain sounds in experiment B was to some extent anticipated. This could be easily remedied in future experimentation by always playing the single stimulus sound against a suitable "background" of other sound which was appropriate for each of the settings displayed. In this way one would achieve a more realistic dominant/background situation where the relative levels

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[3]This subject performed experiment B(2) where the reduced replay level had made the breaking glass (no. 5) sound like only a very faint tinkle.

of these could also be manipulated if each were on separate tapes being replayed simultaneously.

Spatial Relationship and Acoustical Quality of Sound Samples

Since the sounds were all re-recorded from commercially available sound-effects discs, no control could be exercised over the relationship of sound source to receiving position. Many of the sounds had been recorded close to the source for reasons of technical quality and this proximity was often very apparent in the stereo replay. Sometimes, in experiment A, the subject felt he was in an unnaturally close relationship with sounds he was commonly used to hearing from afar, such as the foghorn, both bell sequences, cock crowing and car crash. Some subjects (usually the most responsive) found this proximity difficult to adjust to.

Most other sound samples, while still recorded close at hand, were often experienced this way in reality and therefore no difficulties were expressed with these. Responses to some of the sound samples, however, suggested that in many instances the spatial relationship to source was accounted for (that is, relating the sounds exactly to an experience). Events describing being close to roads and railways, for example, appeared repeatedly.

The reduced level replay used in experiments A(3) and B(2) was an attempt to minimize this apparent unnatural nearness of certain sounds and was partially successful. This is discussed more fully in the following section, however.

Problems were also met with the apparent spatial configuration of sound in three of the samples with experiment B, where this effect made them appear spatially incongruous in certain settings. Specifi-

cally, these were the car crash, the motorcycle circling and children playing. The car crash puzzled one subject in place A where he sensed from the tape that the sound was "behind and to the right" which for him was impossible, given the spatial configuration of the place in the slide. Several judged the same sound spatially incongruous in place B also, because of the narrow streets. One said the motorcycle didn't fit here either because of the wide circle it made before speeding away. Similarly the apparent spatial expansiveness of the shouting children suggested the proximity of a large open space which subjects thought improbable in settings B and C.

Remarks were also made about the acoustical quality of some of the sounds in experiment A, particularly in detecting reverberations off nearby surfaces which were generally taken to indicate an urban setting (sound samples nos. 21, 23, 25 and 29). Sometimes the lack of these (or of ambience) suggested a rural location for the sounds to subjects (sound samples nos. 9, 11 and 20). This awareness of reverberations, however, was not always consistent between subjects: two thought they could hear them and one thought he could not, for sound sample no. 9.

While the problems discussed above were not serious, they should be attended to in future experimentation. To do this would almost certainly require that recordings were actually made from sounds in the field so that spatial and acoustical factors could be controlled. The problem of the spatial formation of sounds or sound events and the acoustical quality of settings could be largely avoided by simply being sufficiently selective in the choice of recording locations. Spa-

tial mis-match between sounds and settings could also be eliminated by recording in real-world settings which were spatially comparable to those displayed to subjects.

Effects of Reduced Replay Level in Experiments A(3) and B(2)

This reduction was achieved by lowering the setting of the tape-deck replay gain control by approximately 50%. All sounds were lowered by this amount since it would have been impractical to constantly re-adjust the replay level during the presentation for certain sounds only. In the author's judgement, it had the following effects on the sound samples:

Certain single sounds which before had sounded excessively close now seemed distant (and therefore more realistic). These were both bell sequences, the coyote howls, foghorn, barking dogs, crowing cock and the mockingbird. Others sounded faint (rather than distant), such as the female laughter, breaking glass, thunder and rain, gun shots, flowing water, firework display, ship departure sequence and the fair-ground sequence.

Another set sounded somewhat unreal - either because tiny details were still audible which would not have been in reality if the source were as distant as the level suggested (such as the tinkle of shattered glass in the car crash) or where the movement pattern of the sounds did not match their apparent removedness. This latter effect was most noticeable with, for instance, the passing horses or band where the slowly moving sources seemed to cross the field of hearing very swiftly because the large (unchanged) angle subtended at the receiving position did not match the faintness of the sounds.

A fourth group - particularly the sequences - became less easy to

identify since at the reduced level, some of the nuances of sounds had now disappeared altogether. This was most apparent with the passing traffic, the ship departure and construction site sequences.

Sounds "being at a distance" was specifically referred to by subjects a number of times in the responses which suggests that the reduced level had achieved the desired effect in at least certain cases. These were the passing traffic (no. 8), the diesel train (no. 12) and the construction site sequence (no. 29) in experiment A(3) and the gun shots (no. 9), car crash (no. 14), and motorcycle (no. 20) in experiment B(2). There were also comments about the faintness of several sounds and one subject remarked on being able to hear small details of the motorcycle sequence (no. 20) even though the low level of sound suggested the source was somewhat removed. Errors were also made in identifying certain sound samples which seemed directly attributable to the reduced level. These were: believing the breaking glass (no. 5) was the tinkle of glass ornaments (because the subject had noticed the apparent source in experiment B(2)); mistaking the foghorn (no. 7) for a buzzer (occured three times) or seagulls (occured once); interpreting the passing traffic (no. 8) as a roller-coaster; and the ship departure (no. 28) as a lumber mill or passing car (the subject here said he had "just guessed"). Two further sound samples were incorrectly identified at low level but the same errors had been made previously at normal level which suggested that adjusting the replay was perhaps not the cause. These were: interpreting the passing traffic as an aircraft (a helicopter by one subject at normal level) and the firework display as a war or riot (a riot also by one subject at normal level).

The above examples emphasized the mixed success of reducing the replay level as a post facto attempt to offset the apparent unreal proximity of certain sounds. Several of these problems had been previously anticipated, however. It is known that distant sounds are selectively attenuated by the atmosphere according to frequency and that high frequency components are most reduced. Consequently, the spectral composition of a particular sound at a distance is somewhat different from that measured at the source and it is this effect, as well as an overall reduction in level, which contributes to judgements about the remoteness of familiar sounds. The binaural function of hearing also supplies information about the spatial location of sound sources. Neither could be accounted for by simply reducing replay level.

If future techniques were to use sounds taped directly from the environment, recordings could be made at realistic distances from the sources. Nevertheless, such locations would have to be selected carefully, especially in urban areas, if specific sources are required in a reasonably "pure" state which is free from unwanted, nearer sounds.

LIMITATIONS IN THE PRESENTATION - THE SETTINGS

The inevitable loss of realism in presenting slides rather than actual environments in experiment B did not appear to influence the comparative date which was being gathered. The obvious limitations were loss of movement, three-dimensionality and the ability to turn one's head and scan the entire spatial field of the setting with eyes and ears as in the real world. However, using slides enabled the visual stimulus to be always held constant while only sounds were varied.

An important shortcoming apparent in the slide presentation was

that sounds did not pair exactly with settings so there was no three-dimensional correlation between the spatial form of the setting and the direction from which sounds appeared to originate. Hence the normal ability to localize sounds and identify their sources by vision and hearing simultaneously was absent.[4] Also lacking, for the same reason, was the facility to localize, through hearing, the sources of sounds which originated from outside the spatial field.

The loss of movement could be easily overcome in further experiment by substituting a film presentation for slides. Total realism (if such is required) can, it is believed, only be satisfactorily achieved with experiments conducted in the actual environment. A possible future technique might combine the advantages of normal visual perception with sonic control by using subjects who were experiencing real settings normally in the field but simultaneously heard specially prepared tapes through isolating headphones which excluded the native sound field around them.

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[4] See Section B.4.

2. THE EXPERIMENTAL METHODS

EXPERIMENTAL AREA A

Although subjects were sensitized here to the sounds they were hearing, later questioning did not suggest that anyone knew precisely what was being investigated. Therefore, within the acknowledged methodological limitations, there seems no reason to doubt the validity of the experimental data.

While the approach of regenerating previous experiences using controlled sonic stimuli may be a valid one for obtaining comparative data, it was seen that the technique could be questioned, however, in two possible respects. First, one cannot be certain that all significant components of a sonic experience have been exposed and, second, it assumes that such experiences can be accurately recalled by subjects. Nevertheless, the detailed information within the responses has been sufficiently insightful for the present purposes and suggests that often past experiences with sounds in the environment can be readily and vividly regenerated.

The "in-depth" interview experiment A(2) (where the subject was verbally questioned after hearing each sound sample) showed promise for further development. Because of time pressures, this technique was only tested once with subject no. 10. The interview was not well organized and gave quite a lot of redundant information since the subject often talked freely and lapped over into the context of later questions. However, this approach did allow the author to probe statements as the subject made them and sometimes to encourage her to elaborate on remarks which seemed interesting.

Because of certain overlap between the standard questions, future

interview methods should perhaps be very much more open ended, with the interviewer only asking "prompt" questions as necessary. It would seem that a particular advantage of the interview is that subjects are not fettered by having to write down their responses and that greater spontaneity is therefore possible.

EXPERIMENTAL AREA B

With the acknowledged technical limitations already outlined in Section F.1, the sounds/slides presentation worked well and gave the kind of responses which were expected. Since this technique was attempting to simulate a real-world condition, it must be acknowledged that the subjects themselves were not in a realistically purpose-orientated situation and therefore the simulation was incomplete.

In this respect, it is believed, no laboratory technique is totally satisfactory. To achieve a realistic orientation in subjects to sound would require them to be unsensitized and behaving normally in a real-world setting. However, this would introduce the problems of control which were discussed earlier.[1] Assuming that such technical difficulties could be overcome, it would be possible to introduce sounds into existing environment and to study some of the effects these have on the users by observation and interview. Such techniques could be fruitful for future development given sufficient resources to carry them out.

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[1]See Section C.3.

3. THE RESPONSE FORMATS

EXPERIMENT A

Some redundancy was seen between the four response questions in the experimental data although the extent varied according to how exactly the subject had interpreted each question. The provision for slight overlap between questions had been deliberate and this appeared to have been successful. In general, some overlap occured often between the "associations" and each of the other three questions. One subject (no. 2) repeatedly thought of several specific events for question no. 2 and not the more generalized associations and images of others. Expression of feelings, when these were strong enough, also appeared spontaneously under this question as already discussed in Section E.1.

EXPERIMENT B

Overlap between discrete questions also occured here although to a lesser extent. Questions nos. 1, 3 and 4 were mutually exclusive in most situations. The "thoughts and associations" responses were sometimes a comment about the subject's reaction to the sound within that context but more often either a further explanation about the possible source of the sound or some information immediately supplied about the place which was not apparent beforehand. When this happened, often question no. 3 was left blank.

THE BI POLAR-ADJECTIVES

The bi-polar adjectives were only used with three subjects in experiment A and were then abandoned. This decision was taken for several reasons. First, the time to complete the rather tedious run of thirty sounds was already long and responding to bi-polar scales made

it even longer and apparently more arduous. Second, the success of the less structured response questions and the kind of responses which these were giving suggested that the rigorous comparative bi-polar method was attempting too rigid an evaluation of what subjects felt. Third, the information in the two scales used (unpleasant-pleasant; uninformative-informative) tended to be given overtly or covertly in the main body of the answers and therefore the bi-polar responses were somewhat redundant. It was also suspected, during experiment, that the subjects were having difficulty giving so precise an evaluation of the sound samples. Therefore, the validity of such data might have been questionable.

[G] POSTSCRIPT

1. GENERAL CONCLUSIONS

In reviewing the research findings one is presented with a complex array of issues to consider. The situation is further aggravated because of the inevitable partiality of the present study. This was essentially only able to approach the whole area of sonic experiences in the environment from two different angles and these relied upon the success of necessarily imperfect experimental techniques. Nonetheless, a number of significant general conclusions have emerged.

Perhaps the most important over-all is that commonplace sounds can be highly meaningful and seem to occupy a more important place in our total perception of environments than might be expected. This finding was clearly apparent in both experiments. It would suggest that in the day-to-day comprehension of the environment, experiences with sound are occuring constantly although we may only be aware of them quite infrequently. Similarly, the responses indicated that many environmental sounds are remembered often in great detail, suggesting the precision with which these are perceived initially.

Another important conclusion is that even quite trivial sounds can be important carriers of information in the environment and the presence of different sounds can influence considerably both the perception of settings and judgements which are made about them. It was also demonstrated that auditory and visual information interact, with each influencing the other as had been expected. However, the extent of this interaction appears to be considerable and illustrates the significance of information which is gained from the physical world

through the ears as well as the eyes.

The experimental study had to be set up without a clear understanding about the importance of the attributes of the setting in which a sound/person interaction might occur. Although the findings here are not totally conclusive, it would seem that the visual aspects of a "place" can at least modify a person's response to the sounds which are heard there. Sometimes the accompanying visual associations with sounds were vivid and highly memorable to subjects, suggesting the importance of the visual aspect within the total experience.

What also seemed to be important was the joint roles of sound and place and the necessity that a match should occur between them which meets the expectations a person may already hold about a given place. This was clearly demonstrated in experiment B. Similarly, in experiment A, specific places were frequently identified by subjects of their own accord in conjunction with certain sounds.

The importance of associations which meaningful sounds in the environment may evoke still appears, at the completion of the study, to be an important component of a sonic experience. Many of the sounds were considerably richer in association than had been anticipated when the experiments were set up. Unfortunately, the techniques could give little indication as to how comparable would be associations from the same sounds in different real-world settings. However, the limited data from experiment B would indicate that the physical context in which a sound is experienced may modify the associations which are evoked for a person by that sound.

As far as generalizations can be made from an exploratory study such as this, it seems that even the apparently unimportant sounds of the environment can be meaningful and contribute to our total perception of the physical world. For this reason alone, they deserve attention from urban designers and researchers alike. Some projections are put forward for both of these in the final two sections which follow.

2. IMPLICATIONS OF THE FINDINGS

While "sonic design" is not considered feasible on a city-wide scale because of the difficulty in controlling sound, the study has demonstrated the general importance of meaningful sound in the environment for people and the effect it has on the perception of settings. There appears to be no valid reason, however, why sound cannot be manipulated at the "project" level and become a powerful tool for urban designers.

One is first faced with the problem of controlling unwanted sound ("noise") before manipulating positively the sounds which will be heard by the users of a given local environment. To call for quieter motor vehicles before anything worthwhile can be done seems unrealistic. Undoubtedly, the elimination of traffic noise would be valuable since it could uncover informative sounds naturally existing in many environments which are presently masked. The author believes that much can be achieved here simply by considering the screening of unwanted sources during the siting of buildings. A solid barrier close to a sound source is an effective way of reducing the sound pressure levels behind it. By placing unbroken building masses near to traffic routes, sound of vehicles could thus be considerably reduced.

The acoustic "micro-climate" in traffic-free areas between buildings seems the most promising point to begin any form of sonic design. The present study indicated that place "reinforcement" by sounds seems important and that natural sounds in general are particularly meaningful and pleasurable to people. Certain sounds (such as the clamor of a market) could be left to occur naturally. If there were considerable enclosure by buildings around a market area, for example, its

sounds would be blended and enhanced by the partial reverberation which the semi-enclosed space provides. Other locations, where reinforcing sounds are absent, could have these introduced electronically by a strategically placed concealed loudspeaker system and many channels of taped sound input could be handled simultaneously if necessary. Such an approach would allow true control of positive sound over small areas. Systems of this kind hold considerable potential for both initial design and later modifications to the sonic micro-climate during actual use. This also seems valuable in that user response to the sounds which were introduced could be monitored and adjustments made in-situ.

At a less ambitious level, much could be done to enhance the sound climate by more careful manipulation of real sources as sometimes now occurs by chance (such as the introduction of fountains into pedestrian areas). Fountains can provide valuable masking from unwanted extraneous sounds as well as making a positive contribution to the sonic quality of a setting. Similarly, the use of trees would encourage birdsong but also the elimination of sources of certain sounds which people found annoying such as barking dogs, should be considered. More research is first needed on a broader scale before a working understanding of what specific environmental sounds people like and dislike is achieved. The findings from this would provide important insight into which sounds should ideally be introduced, or eliminated by screening or masking.

The ability, by association from certain sounds, to "project" one's thoughts out of the place in which they are experienced could

have important implications for improving the perceived quality of existing environments. The introduction of sounds which have commonly-held pleasant associations for people may potentially be valuable, for example, in improving a person's total evaluation of a visually unattractive setting. While further research would first need to be carried out to test these effects more fully, the use of sound could thereby provide an inexpensive means of discretely enhancing existing urban settings.

3. RECOMMENDATIONS FOR FUTURE RESEARCH

The following list represents the immediate research needs seen to be required in this area. These would be considered additional to much needed research into the perception of environments in general.

(1) A repetition of the present study (incorporating the various technical modifications suggested) which covers a much greater range of environmental sounds, many more settings and for different population groups.

(2) Much more extensive and systemmatic research into which environmental sounds are liked and disliked and how, if at all, these feelings vary for different groups of people.

(3) A major requirement is to study how sound is perceived by purpose-orientated people in the real-world, which sounds seem to be important under different conditions and why.

(4) Research into the relationship of sounds and settings and the actual mechanism which causes perception of sounds to vary with setting.

(5) To study how attributes of a setting influence the associations which are stimulated by given sounds there.

(6) Further research on how judgements about settings are modified by the sounds which are heard and some pilot studies into the ways user evaluation of existing settings may be modified when specific sounds are introduced.

(7) A whole area relating to the effect on people of sonic deprivation and of living and working in noise-polluted urban environments which lack sonic quality.

In addition, development work is needed to create more sophisticated field and simulation techniques with which to carry out further research. Because of the apparent complexity of the perceptual processes which influence how the sonic environment is experienced, the availability of adequate research tools is seen to be critical for valid work to proceed in this field.

APPENDIX I

During analysis of the response data, it was felt that some further over-all information could be gained about the sounds used in the experiments by collectively tabulating responses from the several questions which the subject had to complete for each sound sample. This has been done for both experimental areas A and B and appears as two separate sections within this appendix.

The system of tabulation was as follows. Below a brief description of each sound sample, recurrent words and phrases used by subjects have been grouped according to meaning and ranked by the total number of mentions each received. All response data was ordered in this way except that from the pair of questions which judged the sounds (expression of feelings). However, feelings which were sufficiently strong to be evoked spontaneously under other questions also appear here.

Any material which did not fall within the generic patterns of responses to each sound sample has been included but underlined. These cover references to specific places which an individual linked with a sound; the situation where a sound was experienced; the medium through which experienced (if not at first hand); the spontaneously expressed feelings; and references to childhood. Any comments made about the actual sounds or the acoustical and spatial aspects of the taped samples also appear in the tabulations.

Errors or unusual comments which seemed to result from the reduced volume tape reply in experiments A(3) and B(2) are identified by a note in parentheses after the words or phrase in question.

Experimental Area A

No. 1 STEAM TRAIN SEQUENCE

Steam locomotive whistle fades in from distance; its warning bell ringing continuously as it passes by slowly with hissing steam and heavy clanking sounds; slow click of railroad car wheels heard on track as train grinds to a halt with a screech of brakes.

(Recorded close to railroad track.)

	No. of Mentions
1-Train (any reference to) (14)	***** ***** ****
2-Childhood (5)	*****
3-Trip/Journey (4)	****
4-Soot/Smoke/Dirt (3)	***
5-Steam/Non-diesel (3)	***
6-Locomotive/Engine (3)	***
7-Train Station (3)	***
8-Rural (3)	***
9-Waiting at R.R. crossing (3)	***
10-Lonely/Alone (3)	***
11-Urban (2)	**
12-Siren/Whistle (2)	**
13-Industrial/Factory (areas) (2)	**
14-English/European (2)	**
15-Hearing in bed at night (2)	**
16-Nostalgic (2)	**
17-Big(engine)/Massive (trains) (2)	**
18-Tape-recording/Record (2)	**
19-Freight(train) (1)	*
20-Small towns (1)	*
21-T.V./Films (1)	*

No. 2 "BIG BEN" (LONDON) STRIKING SIX O'CLOCK

Famous quarter bells sequence plays; followed by the slow peal of massive "Big Ben" itself striking the hour.

(Recorded in belfry close to bells, against a silent background as heard at the beginning of the B.B.C. radio news.)

	No. of Mentions
1-Time (any reference to) (8)	***** ***
2-Big-Ben (6)	***** *
3-Church bells (5)	*****
4-London (4)	****
5-B.B.C. Radio news (4)	****
6-Films (2)	**
7-Large bell (2)	**
8-Local church (2)	**
9-Clock tower (2)	**
10-Weddings(2)	**
11-Europe (2)	**
12-Going to church (2)	**
13-Hometown (2)	**
14-Carillon (1)	*
15-Oxford (bells) (1)	*
16-Sunday (1)	*
17-Morning (1)	*
18-Evening (1)	*
19-(London) fog (1)	*
20-Birth (1)	*
21-Death (1)	*
22-Solemnity (1)	*
23-Faith (1)	*
24-Local court-house clock (1)	*
25-Small town meeting (1)	*

No. 3 COYOTE HOWLING THREE TIMES

A lone coyote howls mournfully three times.

(Recorded close to animal, against a silent background.)

	No. of Mentions
1-Wolf/Coyote howling (8)	***** ***
2-Wilderness/Lonely/Alone (7)	***** **
3-Dog (howling) (6)	***** *
4-Night/Darkness/Dark (4)	****
5-Expansive/Desert/Prairie (4)	****
6-Moon (3)	***
7-Woods (3)	***
8-Spooky/Eerie/Frightening (3)	***
9-Films (3)	***
10-Camp/Campfire (2)	**
11-Indian calling his dog (1)	*
12-Animal howling (1)	*
13-Wolf-like animal (1)	*
14-Mountains (1)	*
15-West (1)	*
16-Wild North (1)	*
17-Canada (1)	*
18-Deep winter (1)	*
19-Russia - Urals (1)	*
20-Neighbourhood (1)	*
21-Zoo (1)	*

No. 4 FEMALE LAUGHTER

A young woman laughs alone, incessantly and uncontrollably.

(Acoustically, sounds as though recorded in a room, but against a silent background.)

	No. of Mentions
1-Laughing girl/woman (7)	***** **
2-Insane/Mad/Madness/Madhouse (4)	****
3-Radio play/Play/Film (4)	****
4-**** **** (A particular secretary at MIT with a similar laugh - by name) (3)	***
5-Tickle/Tickled/Teased (3)	***
6-Cocktail party/Celebration (3)	***
7-Humour/Happy/Giggle (3)	***
8-Uncontrolled/Hysterical (2)	**
9-Weird/Strange (2)	**
10-Sound is isolated/No other noises (2)	**
11-Fun parks/Carnival (2)	**
12-Silly (1)	*
13-Drunk (1)	*
14-Marat-Sade (1)	*
15-Jane Eyre (1)	*
16-Echoing off a concrete wall/In a tunnel (1)	*

No. 5 BREAKING GLASS

Glass shattering, as though on a hard surface, with a short, light tinkle.

(Recorded close to source, against a silent background.)

	No. of Mentions
1-Breaking glass (10)	***** *****
2-Accident/Dropping fragile object (8)	***** ***
3-Window breaking (6)	***** *
4-Vandalism/Deliberate destruction (5)	*****
5-Bottle breaking (3)	***
6-Breaking bottle to attack someone (1)	*
7-Forced entry (1)	*
8-At night (because no supporting sounds) (1)	*
9-Alley (1)	*
10-Hard ground surface (1)	*

No. 6 THUNDER AND RAIN SEQUENCE

Closely-spaced nearby thunder peals against a continuous background swish of heavy falling rain.

(Recorded as though out of doors-thunder seems overhead and the splash of rain falling on a hard surface, perhaps the ground, is clearly audible.)

	No. of Mentions
1-Thunder/Thunderstorm (11)	***** ***** *
2-Rain (9)	***** ****
3-Wet/Wetness (4)	****
4-Solitary/Solitude/Openness (3)	***
5-Threatening/Some alarm (2)	**
6-Soaking/Heavy (rain) (2)	**
7-Feel of rain (2)	**
8-Smell of grass/rain (2)	**
9-Summer nights (2)	**
10-Listening to rain in bed/Sleeping under a tent	**
11-Sitting in car listening to rain (2)	**
12-Hearing rain on roof of mobile home (1)	*
13-Sound of rain (1)	*
14-Night (rain) (1)	*
15-Winter (rain (1)	*
16-Cool (1)	*
17-Gush of water (1)	*
18-Rural (1)	*
19-Camping trips (1)	*
20-Walking in summer rain (1)	*
21-Childhood (1)	*
22-Waves breaking (1)	*

No. 7 FOGHORN BLOWING

A deep foghorn blows five times for a short period, at ten-second intervals.

(Recorded very close to source, with faint harbour sounds audible in background.)

	No. of Mentions
1-Foghorn (10)	***** *****
2-Seaport/Port/Harbour (5)	*****
3-Mist/Fog/Foggy (5)	*****
4-Ship's horn/foghorn (4)	****
5-Far off/At a distance (REDUCED VOLUME EXPT.) (3)	***
6-Lonesome/Loneliness/Alone (3)	***
7-Aboard Ship (3)	***
8-Big boat/Ships/Vessels (3)	***
9-Greyness/Darkness/Grey air (3)	***
10-Hearing in bed at night (3)	***
11-Buzzer/Buzzing (REDUCED VOLUME EXPT.) (3)	***
12-Harbour industries/Shipyards (2)	**
13-Searching (2)	**
14-Near sea/Sea (2)	**
15-Approaching harbour/port (2)	**
16-Evening (2)	**
17-Boating/Cruising (in a small boat) (2)	**
18-San Francisco (2)	**
19-Rhode Island - Newport (1)	*
- Ocean Drive (1)	*
20-River Mersey (1)	*
21-Cool (1)	*
22-Gulls (REDUCED VOLUME EXPT.) (1)	*
23-Thick swirling (fog) (1)	*
24-Feel wet fog (1)	*
25-Smell of salt air (1)	*
26-Quayside (1)	*
27-Expansive (1)	*
28-Distant other horns (1)	*
29-Not a boat somehow (1)	*
30-Ship or shore (1)	*
31-Films (1)	*

No. 8 PASSING MOTOR-VEHICLES ON HIGHWAY

Cars and trucks passing by in both directions at about 50 miles per hours on a metalled road surface; general vehicle mechanical and tire sounds can be heard.

(Recorded very close to open highway - probably at kerbside.)

	No. of Mentions
1-Traffic/Cars/Autos/Trucks (12)	***** ***** **
2-Highway/Freeway/Motorway, etc. (6)	***** *
3-Wet/Spray (4)	****
4-Speed/Rush/Hurry (3)	***
5-Crowded/Busy (2)	**
6-Motor racetrack/Stock-car racing on T.V. (2)	**
7-Travel/Trip (2)	**
8-Airplane/Helicopter (ONE FOR REDUCED VOLUME EXPT.) (2)	**
9-From a distance (REDUCED VOLUME EXPT.) (1)	*
10-Close(to freeway) (1)	*
11-Noise (1)	*
12-Dirt (1)	*
13-Bad smells (1)	*
14-Rural setting (1)	*
15-Standing on a bridge (1)	*
16-Jay-walking (1)	*
17-Waiting for a bus (1)	*
18-Breakdown (1)	*
19-Monotony (1)	*
20-Foggy morning in a new place (1)	*
21-Sound of tires (1)	*
22-Roller coaster (REDUCED VOLUME EXPT.) (1)	*

No. 9 SMALL-CALIBRE GUN SHOTS

Eight, randomly-spaced pistol shots, with slight ricochet action.

(Recorded close to source, against a silent background. Acoustical quality suggests an enclosed or partially enclosed setting.)

	No. of Mentions
1-Bullets/Shots/Gunshots/Pistol shots (7)	***** **
2-Rifle range/Shooting galleries/parlours (7)	***** **
3-Fairground/Carnival/Amusement parks (7)	***** **
4-Target/Pistol/Rifle practice (5)	*****
5-Small calibre/.22/Not big (5)	*****
6-Fireworks/Firecrackers (3)	***
7-Whip (2)	**
8-Reverberations/Semi-echoes (2)	**
9-Rural setting because no echoes (1)	*
10-Child's cap-gun (1)	*
11-Snapping sound (1)	*
12-Hunting (1)	*
13-Murder with pleasure (1)	*
14-Cool frame of mind (1)	*

No. 10 CHURCH BELLS RINGING

Three bronze bells peal a cadence over twice.

(Recorded close to bells, against a silent background.)

	No. of Mentions
1-Church bells (7)	***** **
2-Chapels/Churches/Cathedrals (5)	*****
3-Public clock/Time chimes (5)	*****
4-Sunday/Going to church (4)	****
5-Carillon (3)	***
6-College/Oxford (college) (3)	***
7-Evening/Night (3)	***
8-Pleasant/Pleasant feeling (3)	***
9-Suburban (2)	**
10-Urban/City treet (2)	**
11-Festive occasions /Weddings (2)	**
12-London/Old towns (2)	**
13-Same as first chime/Thought I heard that before (2) (ref. to sound no. 1 - Big Ben)	**
14-Sunny/Hazy bright days (2)	**
15-Handsome/Lovely sound (2)	**
16-Enriches environment (1)	*
17-Morning (1)	*
18-Clock (domestic) (1)	*
19-New York City (1)	*
20-Funeral of Charles de Gaulle on T.V. (1)	*
21-Europe (1)	*

No. 11 DOGS BARKING

Two agitated dogs bark simultaneously, one more distant than the other.

(Recorded close to both dogs, against a silent background.)

	No. of Mentions
1-Dog(s) barking (15)	***** ***** *****
2-Guard-dogs/Protection (4)	****
3-Rural/Walking in country (4)	****
4-Neighbourhood/Suburban (4)	****
5-Locked up/Restrained/Behind fence/In yard (4)	****
6-Not big/Not ferocious dog(s) (3)	***
7-Everyday occurrence/Happens often (3)	***
8-Night (2)	**
9-Warning/Alarm (2)	**
10-Hunt/Hunting dogs (2)	**
11-Farmland/Farmyard (2)	**
12-Visting people with dogs (2)	**
13-Childhood (2)	**
14-Kennels (1)	*
15-Kids (1)	*
16-Deserted property (1)	*
17-Burglars (1)	*
18-Police dogs (1)	*
19-Farm dogs (1)	*
20-More than just playing (1)	*
21-Open space (because of quiet context) (1)	*
22-Demonstrators (with police dogs) (1)	*

No. 12 DIESEL TRAIN SEQUENCE

Loud clicks of passing railroad-car wheels over tracks; fading throb of diesel locomotive motors in background with repeated siren blowing. Train passes by completely and fades, with siren still sounding, into the distance.

(Recorded close to railroad tracks.)

	No. of Mentions
1-Train (type unspecified) (8)	***** ***
2-Diesel loco/train (5)	*****
3-Railroad crossings (5)	*****
4-Waiting for trains to pass (at no. 3) (4)	****
5-Rural/Countryside/Wide flat spaces/Ohio (4)	****
6-Trucks on rail joints/Wheels striking rail joints/ Hear tracks/Clacking sounds (4)	****
7-Engine noise/blowing/chugging/fluttering (4)	****
8-Train journeys/Long trips/Travel (3)	***
9-Walking/Standing near railroad tracks (3)	***
10-Horn/Whistle/Siren (3)	***
11-Europe/Switzerland (3)	***
12-U.S.A. (3)	***
13-Railroad cars (2)	**
14-Freight (train) (2)	**
15-Small towns (2)	**
16-Childhood (2)	**
17-Night (1)	*
18-Boston and Maine R.R. (1)	*
19-In the distance (REDUCED VOLUME EXPT.) (1)	*
20-Not fast (1)	*

No. 13 COCK CROWING THREE TIMES

Three piercing crows in close succession.

(Recorded close to animal, with faint barnyard sounds in background.)

	No. of Mentions
1-Rooster/Cock crowing (15)	***** ***** *****
2-Dawn/Daybreak/Sunrise/Early/Morning (13)	***** ***** ***
3-Barnyard/Farmyard (7)	***** **
4-Farms (6)	***** *
5-Vacation (on a farm) (6)	***** *
6-Hens/Henhouse/Chickens/Chicken coop (5)	*****
7-Childhood (5)	*****
8-Getting up (4)	****
9-Country/Rural setting (3)	***
10-Birds (2)	**
11-Country life (1)	*
12-Farm animals (1)	*
13-Breakfast time (1)	*
14-Still dark (1)	*
15-Smell of farm (1)	*
16-Close-by (the cock) (1)	*
17-Films (1)	*

No. 14 CAR SKID AND CRASH

Car runs up at high speed; tires screech as it brakes, skids and then collides into a wall (or large solid object) directly in front of the receiver with prolonged clattering of metallic debris and tinkling of breaking glass.

(Recorded alarmingly close to source, against an otherwise silent background.)

	No. of Mentions
1-Motor/Auto/Car accident/Crash/Crashing (15)	***** ***** *****
2-Panic/Fright/Fear/Worried (6)	***** *
3-Films/T.V. (5)	*****
4-Bodies/Blood/People hurt (4)	****
5-Speed/Speeding/Racing (3)	***
6-(Car) Brakes/Skids/Skidding (3)	***
7-No ambience/Lacks background noise (2)	**
8-Early morning (because of no. 7) (1)	*
9-Sick feeling (1)	*
10-Troubling (1)	*
11-Guiltily excited (1)	*
12-High speed (1)	*
13-Crashing into glass (1)	*
14-Crashing into building (1)	*
15-Hitting stationary object (1)	*
16-Crumpled cars (1)	*
17-People rushing to get nowhere (1)	*
18-City living (1)	*
19-Horror (1)	*
20-Racing car (crashing) (1)	*

No. 15 RAIN-WATER RUNNING IN A GULLEY

Continuous gurgle of water running swiftly in an open channel -- but sounding similar to a small brook running over a rocky bed.

(Recorded very close to the water flow.)

	No. of Mentions
1-Brook/Stream (14)	***** ***** ****
2-(Water) Draining/Escaping/Running/Tickling (8)	***** ***
3-Wooded /Woods/Trees (5)	*****
4-Walking/Hiking (4)	****
5-Solitude/Quietness/Peace/Calm (4)	****
6- Hills/Mountains (3)	***
7-Terraces/Rocks/Stones (3)	***
8-(Running) Over stones (3)	***
9-Clean/Clear water/Streams (3)	***
10-Pleasing/Pleasant (3)	***
11-(Roman) Fountain (2)	**
12-Country (2)	**
13-Refreshing/Freshness (2)	**
14-Moss/Mossy (2)	**
15-Waterfall (2)	**
16-Wilds/Boggy moors(2)	**
17-Childhood (2)	**
18-Cool (2)	**
19-Shadow (1)	*
20-Sunshine (1)	*
21-Grotto (1)	*
22-Rainstorm (1)	*
23-Floods (1)	*
24-Fountain (1)	*
25-Brookside (1)	*
26-Ravines (1)	*
27-Natural surroundings (1)	*
28-Beautiful (1)	*
29-Luscious (trees)	*
30-Enjoyable (1)	*
31-Particularly pleasant sound (1)	*
32-Downspout (1)	*
33-Shower stall (1)	*

No. 16 YOUNG BABY CRYING

Very young baby crying nervously.

(Acoustically, sounds as though recorded in a room; against a silent background.)

	No. of Mentions
1-Baby crying/screaming (12)	***** ***** **
2-Tiny/Very young/Very little/Small (10)	***** *****
3-Need milk/Hunger/Hungry (3)	***
4-Our child/children (3)	***
5-Need to be changed (2)	**
6-In a park (2)	**
7-Abandoned infant/Doorstep baby (2)	**
8-Hard to imagine/None out of doors (2)	**
9-Unhappy/Tense (2)	**
10-Irritation/Nausea (2)	**
11-Urgency (1)	*
12-Helplessness (1)	*
13-Stomach troubles (1)	*
14-Hope for the future (1)	*
15-Overpopulation (1)	*
16-Feeding time (1)	*
17-Home setting (1)	*
18-Suburban image (1)	*
19-Visit to maternity ward (1)	*
20-Motherhood (1)	*
21-Refugee villages in Viet Nam (1)	*
22-Cambridge Common on sunny Sunday afternoon (1)	*
23-Films (1)	*

No. 17 MARCHING BAND PASSING

Military brass band playing a march approaches, passes and fades into distance; background chatter of excited spectators.

(Acoustical quality suggests recorded at kerbside in a street lined with buildings, and from close by the crowds of spectators.)

	No. of Mentions
1-Parade/Street Parade (12)	***** ***** **
2-Brass/Military/Marching band (12)	***** ***** **
3-Childhood/High school (band or parade) (7)	***** **
4-Crowd/People/Spectators (5)	*****
5-Nostalgic/Sentimental (2)	**
6-Colour (2)	**
7-Thrills/Fun (2)	**
8-Football game/Sports event (2)	**
9-Costumes (2)	**
10-R.O.T.C./Military life (2)	**
11-America(n) (2)	**
12-Embarrassment and pride (1)	*
13-Pomp and ceremony (1)	*
14-(Marching) Rhythmically (1)	*
15-Cynical amusement (1)	*
16-Quasi-patriotic (1)	*
17-Fanfare (1)	*
18-Flags (1)	*
19-Cotton candy and peanuts (1)	*
20-Military spit and polish (1)	*
21-Uniforms (1)	*
22-Floats (1)	*
23-Troops (marching) (1)	*
24-Hometown (1)	*
25-Ceremony (1)	*
26-4th of July (1)	*
27-Patriots' Day (1)	*
28-Horse shows (1)	*
29-St. Patrick's Day in New York City (1)	*
30-(N.Y.C.) Fifth Avenue (1)	*
31-L.B.J. inauguration in Washington D.C. (1)	*
32-Boston (Beacon Street) (1)	*
33-Disneyland (1)	*
34-T.V. (1)	*

No. 18 POLICE WHISTLE

Blows twice in regular manner; then blows insistently.

(Recorded close to source, against a totally silent background.)

	No. of Mentions
1-Silver whistle/Whistle (12)	***** ***** **
2-Traffic policeman/Directing traffic (7)	***** **
3-Referee/Games/Sports (whistle) (5)	*****
4-Cop/Police/Policeman (4)	****
5-Child/Children (3)	***
6-No traffic/background/In a vacuum (3)	***
7-Police whistle (3)	***
8-At pedestrian crossing (3)	***
9-Urban/Downtown (2)	**
10-Not urgent/assertive (2)	**
11-Any city (1)	*
12-Neighbourhood (1)	*
13-Stopping a car (1)	*
14-Street scene (1)	*
15-To stop a burglar in the night (1)	*
16-Emergency (1)	*
17-Lion tamer (1)	*
18-Doorman calling cab (1)	*
19-Bird (1)	*
20-Small (whistle) (1)	*
21-(New York City) Fifth Avenue (1)	*
22-(Cambridge) - Near Harvard Square (1)	*
- Broadway (1)	*
24-(Boston) Filene's Corner (1)	*

No. 19 MOCKINGBIRD SINGING

Continuous chirping of bird, with second bird in background.

(Recorded fairly close to mockingbird, against a faint undefined background murmur of sound - perhaps distant traffic.)

	No. of Mentions
1-Bird(s) singing/Birds/Birdsong (12)	***** ***** **
2-Wooded /Woods/Trees/Cool glades (10)	***** *****
3-Placid/Peaceful/Peace/Calm/Calmness/Still/ Stillness/Tranquil (9)	***** ****
4-Summer (5)	*****
5-Morning (5)	*****
6-Childhood (5)	*****
7-Farm/Farmhouse (4)	****
8-Water/Stream/Brook (4)	****
9-Meadows/Fields/Tall grass (4)	****
10-Spring (4)	****
11-Walk/Walking (in country) (3)	***
12-Country/Rural (3)	***
13-Early (morning) (2)	**
14-Green (2)	**
15-Brilliant sky/Sunny (2)	**
16-Mockingbird (2)	**
17-Flowers/Wild flowers (2)	**
18-Picnics/Camping (2)	**
19-New England (2)	**
20-Natural setting (2)	**
21-Relaxing/Nothing to do (2)	**
22-Grandmother's (house)/Grandfather's (farm) (2)	**
23-Garden/Backyard (2)	**
24-Pleasant surroundings (1)	*
25-Waking early and lying in bed (1)	*
26-Freedom to play (as a child) (1)	*
27-Outside the (kitchen) window (1)	*
28-Suburban (gardens) (1)	*
29-Front porch (1)	*
30-Crickets (1)	*
31-Frogs (1)	*
32-Thrush (1)	*
33-Blackbird (1)	*
34-Uncommon (bird) (1)	*
35-Hot (1)	*
36-Sylvan (1)	*

	No. of Mentions
37-Gently rolling hills (1)	*
38-Watching animal life (1)	*
39-Fields of clover (1)	*
40-No other people (1)	*
41-(Meadow) Larks (1)	*
42-(Birds) On branches (1)	*
43-Summer cottage (1)	*
44-Evening (1)	*
45-Good fresh smell (1)	*
46-Friendly (1)	*
47-Cheerful (1)	*
48-Vermont (1)	*
49-Maryland (1)	*
50-Wisconsin (1)	*
51-Minnesota (1)	*

No. 20 MOTOR-CYCLE STARTING AND RIDING OFF

Small motorcycle starts up, pulls away, circles round in a large diameter loop, passes and accelerates off rapidly.

(Motorcycle starts and circles close by receiving position; recorded against a totally silent background.)

	No. of Mentions
1-Motor cycle/bike (12)	***** ***** **
2-"Easy Rider" (3)	***
3-Country road/Open road/Highway (3)	***
4-Starting up (3)	***
5-Racing (3)	***
6-Riding off/Pulling off quickly (3)	***
7-Small (motorbike) (2)	**
8-Near-on asphalt driveway/parking lot or sub-urban (2)	**
9-Rebellious/unpleasant people (2)	**
10-Engines revving up (2)	**
11-Greasers/"Hell's Angels" (2)	**
12-Noise/Noisy (2)	**
13-Annoying (1)	*
14-Dangerous (1)	*
15-"Ton-up" kids (1)	*
16-Black leather (1)	*
17-Speed (1)	*
18-Fun to ride (1)	*
19-(Revving up) At stop light (1)	*
20-Freedom (1)	*
21-(Racing) - alone (1)	*
- on sands (1)	*
23-Helmet (1)	*
24-Long hair (1)	*
25-Big sun glasses (1)	*
26-Very prejudiced against (motorbikes) (1)	*
27-Pest on roads (1)	*
28-Loud car (1)	*
29-Scooter (1)	*
30-Making a turn (1)	*
31-Not urban (no reverberations) (1)	*
32-Films (1)	*
33-Two (motorbikes) - another one passed too (1)	*

No. 21 CHILDREN PLAYING IN SCHOOL YARD

Excited shouts and screams of school children at play; pre-adolescent boys' and girls' voices predominate but some older boys' voices can be heard; background of passing light traffic.

(Acoustical quality suggests yard is enclosed by building; recorded apparently at school yard boundary on a public street.)

	No. of Mentions
1-Youngsters/Children/Kids (13)	***** ***** ***
2-Play/Playing (7)	***** **
3-Pool/Swimming pool (6)	***** *
4-Playground (5)	*****
5-Very crowded/Crowd(s)/mob (of children) (5)	*****
6-School/Schoolyard/playground (5)	*****
7-Some adults/Adult voices (4)	****
8-Fun/Happy (3)	***
9-Holidays (2)	**
10-Recess (2)	**
11-Football games (2)	**
12-Park (2)	**
13-Summer/Hot summer (2)	**
14-(Playing) Intensely (1)	*
15-Japanese (park) (1)	*
16-6th to 10th grade (1)	*
17-(Children's) Voices (1)	*
18-Filled with people (1)	*
19-Small, urban (playground) (1)	*
20-Surrounded by buildings (1)	*
21-"Order, Order!" (1)	*
22-Grass (1)	*
23-Circus (1)	*
24-Beach (1)	*
25-Suntan oil (1)	*
26-No water sounds (1)	*
27-Chlorine smell (1)	*
28-Family picnic and swimming as a child (1)	*
29-At swimming pool in youth (1)	*

No. 22 SEAGULLS CRYING; WAVES BREAKING

Crash of waves breaking on beach; cries of flocks of seagulls with intermittent sounds of lapping water; distant harbour sounds.

(Recorded as though on a beach at water's edge.)

	No. of Mentions
1-Sea/Ocean/Tide/Waves/Foam/Surf (17)	***** ***** ***** **
2-Beach/Seashore (12)	***** ***** **
3-Seagulls/Gulls (10)	***** *****
4-Walk(s)/Walking (5)	*****
5-(Waves) Breaking/Crashing (5)	*****
6-Isolated/Solitude/Serenity (4)	****
7-Cliffs/Rocks/Rocky (4)	****
8-Thought/Deep thought/Pensive (3)	***
9-Dynamite/Thunderclap/Explosion (3)	***
10-Infinity/Horizon (3)	***
11-Rhode Island/Newport, R.I. (3)	***
12-Edge (of sea, ocean)/Surf-line (3)	***
13-Ocean/Water lapping (2)	**
14-Swell (2)	**
15-Summer (2)	**
16-Cape Cod (2)	**
17-Maine (2)	**
18-Salt/Salt-air (smell) (2)	**
19-Sand (2)	**
20-(Sand) Dunes (1)	*
21-California (1)	*
22-Plum Island (1)	*
23-Buzzard's Bay (1)	*
24-Sunny day (1)	*
25-Sails (on distant horizon) (1)	*
26-Deep blue water (1)	*
27-Diving (1)	*
28-Sailing (1)	*
29-Large (waves) (1)	*
30-Small (waves) (1)	*
31-Not public beach (1)	*
32-River estuary (1)	*
33-River Thames (near the docks) (1)	*
34-Looking for shells and animals (1)	*
35-Communion with nature (1)	*
36-Squish (of sand) between toes (1)	*
37-Brings to mind a certain sort of coast (1)	*

No. 23 PASSING AMBULANCE AND POLICE CAR ESCORT SIRENS

Police car and ambulance sirens approach and pass by rapidly together on a street with light traffic; momentary exclamation of a child's voice in background.

(Acoustical quality suggests recorded at kerbside in straight street lined with buildings.)

	No. of Mentions
1-Siren(s) (9)	***** ****
2-Cop/police cars/Police (9)	***** ****
3-Fear/Fright/Frightening/Anxiety/Alarm (7)	***** **
4-Common/Omnipresent/Frequently/Many times/ Any day/Daily (7)	***** **
5-Fire brigade/Fire engine(s)/truck(s) (6)	***** *
6-Fire (5)	*****
7-Ambulance (5)	*****
8-Illness/Emergency/Accident (4)	****
9-Urban setting/City scene/All over city (4)	****
10-City streets/Busy stress/On any big street (3)	***
11-Two kinds/More than one vehicle (3)	***
12-Massachusetts Avenue (Cambridge) (3)	***
13-Near Beacon Hill/Boston (2)	**
14-Associated with America (2)	**
15-Rescue squad/wagon (2)	**
16-Hardly notice/No longer have feeling (2)	**
17-Night (2)	**
18-Not fire truck (1)	*
19-In Cambridge (1)	*
20-Hearing in the night (1)	*
21-Unnecessary noise (1)	*
22-Flashing lights (1)	*
23-Voices in background (1)	*
24-Sound reverberations from buildings (1)	*
25-Demonstrators last spring (1)	*
26-Arrest (of criminals) (1)	*

No. 24 FEMALE SCREAMS

A terrified young woman screams hysterically alone.

(Acoustically sounds as though recorded in a room, but against a totally silent background. The scream is somewhat theatrical and doubtful if prompted by genuine fear.)

	No. of Mentions
1-Scream/Woman or girl screaming (12)	***** ***** **
2-Threatened/Frightened/Fear/Terror (5)	*****
3-Films/T.V. (5)	*****
4-Attack/Attacked (5)	*****
5-"It's an act"/"Fake"/"Stagey" (3)	***
6-Needs help/(I feel) Helpless (3)	***
7-Night/Dark streets/alleys (3)	***
8-Distress/Alarm (2)	**
9-Horror/Apparition (2)	**
10-Murder (2)	**
11-Cities/Urban (2)	**
12-Play (2)	**
13-"Kitty Genovese" (2)	**
14-Some animal (1)	*
15-News item (1)	*
16-"Boston Strangler" (1)	*
17-Robbery (1)	*
18-Not in immediate danger (1)	*
19-Need to find out cause (1)	*

No. 25 PASSING TROOP OF HORSES

Two pairs of horses approach and walk past on a hard-paved street; light traffic background.

(Acoustical quality is somewhat reverberant and suggests recorded at kerbside in a narrow street lined with buildings.)

	No. of Mentions
1-Horses' hooves/Horses/Team of Horses (11)	***** ***** *
2-Urban road/City street (6)	***** *
3-Films/T.V. (6)	***** *
4-Carriage wheels/Carriage/Waggon/Horsedrawn vehicle (6)	***** *
5-Stone street/Cobblestones (4)	****
6-Mounted police/Police horses (4)	****
7-Times past/Event in history/Revolutionary days/1890's (4)	****
8-Road/Street(s) (3)	***
9-Paved Surface/Hard pavement (3)	***
10-Central Park, N.Y.C. (3)	***
11-Childhood (3)	***
12-Parade/Brigade (2)	**
13-Riding school/Pony clubs (2)	**
14-Junk man/Brewery delivery (2)	**
15-Some background/hooting car in background (2)	**
16-Troops/Military fete (2)	**
17-Europe (2)	**
18-Uniforms (1)	*
19-In the night (because quiet) (REDUCED VOLUME EXPT.) (1)	*
20-Chicago (1)	*
21-London (1)	*
22-Old city (1)	*
23-Unusual, therefore rather spectacular (1)	*
24-(Police) Controlling spectators (1)	*
25-4 horses (1)	*
26-Hunting (1)	*
27-Cowboys (1)	*
28-Open spaces (1)	*
29-L.B.J. inauguration in Washington D.C. (1)	*

No. 26 FIREWORK DISPLAY

Multiple explosions of massed fireworks with shouts and laughter of large crowd of observers responding in background.

(Recorded in a large amusement park; acoustical quality suggests firework display in an open setting, with fireworks rather distant and spectator sounds coming from over a considerable area.)

	No. of Mentions
1-Rockets/Fireworks/Firecrackers (13)	***** ***** ***
2-Crowds/Onlookers/Many people (8)	***** ***
3-4th of July (8)	***** ***
4-Display/Occasion(s)/Celebration/Organized event (6)	***** *
5-Rifles/Guns/Machine guns/Warlike/Shots (5)	*****
6-Washington Monument grounds (3)	***
7-Splashes of colour/Nightmare flashes/Fantastic sprays of light (3)	***
8-Riot/Student demonstration (2)	**
9-Fun/Excitement (2)	**
10-Responses/Shouts (2)	**
11-November 5th (2)	**
12-Noise/fantastic sound (2)	**
13-Kent State (ONE RESPONSE FROM REDUCED VOLUME EXPT.) (2)	**
14-Shooting military and running village people (REDUCED VOLUME EXPT.) (1)	*
15-Vietnam war (REDUCED VOLUME EXPT.) (1)	*
16-Smoke in the air (1)	*
17-National Guardsmen (REDUCED VOLUME EXPT.) (1)	*
18-Children and people's voices (1)	*
19-Holiday in Spain (1)	*
20-Coney Island (1)	*
21-Corn-on-the-cob (1)	*
22-Fair (1)	*
23-14 Juillet (1)	*
24-Night (1)	*
25-On waterfront (1)	*
26-Childhood (1)	*

No. 27 ANGRY CAT GROWLING

Aggressive growls of angry or frightened Siamese cat.

(Acoustically sounds as though recorded in a room, and light pattering - perhaps the scuttering of the cat about the room - can be heard against an otherwise silent background.)

	No. of Mentions
1-Cat singing/screaming/meowing/Cat (9)	***** ****
2-In distress/Unhappy/Garrulous/Anger/Rage/ Frustration (8)	***** ***
3-Neighborhood (5)	*****
4-Siamese (3)	***
5-Peculiar baby/Baby whining/crying (3)	***
6-"Holden Green" (Cambridge) (2)	**
7-Pets/animals (2)	**
8-Often/Constant occurrence (2)	**
9-Catfood/Hunger (2)	**
10-Snarling/Vicious (2)	**
11-Apartment living/Living in city apartments (2)	**
12-At night (1)	*
13-Catfight (1)	*
14-Stepping on its tail (1)	*
15-A (particular) horrible grey cat (1)	*
16-Harassed by dog (1)	*
17-During mating period (1)	*
18-Backyard (1)	*
19-Locked out (1)	*
20-"I love cats" (1)	*
21-Goat (1)	*
22-Pig (1)	*

No. 28 PASSENGER LINER DEPARTURE SEQUENCE

Fade in to excited crowd of chattering voices; ship hooter sounds long blast very loudly in background; male voice is heard to say "bye-bye" faintly above the chatter; a few seconds later a brass band starts to play "The Night They Invented Champagne" in background; after several further seconds hooter sounds three more short blasts; fade out.

(Acoustical quality and loudness of the ship's hooter suggests recorded on deck or at adjacent pierside.)

	No. of Mentions
1-On quay/pier/Pierside/Docks/Dockside/Waterfront (8)	***** ***
2-Ship departing/Leaving/Departure (7)	***** **
3-Whistle/Siren/Horn (7)	***** **
4-Crowd(s)/People (7)	***** **
5-On board ship/Ocean liner/Big ship/passenger boat (6)	***** *
6-Band/Music (5)	*****
7-Seeing people off/Waving/Shouting to friends (3)	***
8-Special occasion/Gathering/Celebration (3)	***
9-Gaiety/Happiness/Fun (3)	***
10-Sad/Tears/Sentimental (3)	***
11-Exciting/Excited/Excitement (3)	***
12-Soft Human sounds/Voices (2)	**
13-Festive (2)	**
14-"S.S. France" (2)	**
15-"Bye-Bye" (2)	**
16-Hard to tell/Confused (2)	**
17-Travel/Tourists (2)	**
18-Port of New York (2)	**
19-Southampton (1)	*
20-Bermuda (1)	*
21-Leaving for Europe (1)	*
22-Cocktails (1)	*
23-Dancing (1)	*
24-On deck (1)	*
25-Old-fashioned (1)	*
26-Bourgeois (1)	*
27-Ocean (1)	*
28-"The Night They Invented Champgane" (1)	*
29-Paper streamers (1)	*
30-Coming into harbour (1)	*
31-Sunny day (1)	*
32-Billows of steam from horns (1)	*
33-Like an air-raid (sirens) (1)	*
34-Lumber mill(?) (REDUCED VOLUME EXPT.) (1)	*
35-Car passing (?) (REDUCED VOLUME EXPT.) (1)	*
36-Plane (1)	*
37-Half-time at football match (1)	*
38-A show on a pier (1)	*

No. 29 CONSTRUCTION SITE, WITH PILEDRIVER

Concurrent sequence of piledriver, electric-arc welder and hammering with other indeterminate construction activity sounds in background.

(Acoustical quality suggests open site,with welder and hammering close to receiving position but piledriver somewhat removed.)

	No. of Mentions
1-Construction site/Construction (7)	***** **
2-Piledriver (5)	*****
3-Rhythmical/Rhythm (5)	*****
4-Urban/City (4)	****
5-Mill/Factory (4)	****
6-Machines/Machinery (4)	****
7-Industry/Industrial process (4)	****
8-In Boston/Downtown Boston /C.B.D. (3)	***
9-Work/Working hard/Activity (3)	***
10-Welding (3)	***
11-Dirt/Dust/Grease (3)	***
12-Noisy/Noise (2)	**
13-All over the place/Pass each day (2)	**
14-Building/High-rise building (2)	**
15-(Boston)-Government Center (1)	*
-Back Bay (1)	*
17-(Cambridge) At Harvard (1)	*
18-Oil rig (1)	*
19-Riveter (1)	*
20-Presses (1)	*
21-Cutting operation (1)	*
22-Pumping (1)	*
23-Knocking (1)	*
24-Boat-engine (1)	*
25-Smoke (1)	*
26-Fascination (1)	*
27-Car-horn (1)	*
28-New York City (1)	*
29-"Hard-hats" (1)	*
30-Temporary covered-walkway (1)	*
31-Big crane (1)	*
32-Somewhat removed (REDUCED VOLUME EXPT.) (1)	*
33-Resonating (1)	*

No. 30 FAIRGROUND SEQUENCE

Elaborate collage of distinctive sounds: carousel organ playing continuously in foreground; cracks of shooting gallery rifles, rumble of passing roller-coaster cars, single bell strike and happy voices in background.

(Recorded in the midst of all this activity.)

	No. of Mentions
1-Fun-fair/Fairground/Amusement park/Carnival (11)	***** ***** *
2-People/Many people/Crowds/Huge crowd (9)	***** ****
3-Cheerful/Fun/Happy/Laughter/Excitement (8)	***** ***
4-Carousel/Merry-go-round (5)	*****
5-Music/Carousel music (5)	*****
6-State/County fair (5)	****
7-Candy floss/Cotton candy (4)	****
8-Circus (4)	****
9-Pistol range/Shooting gallery/Rifle shoots (4)	****
10-Whips/Cracking whips (4)	****
11-Childhood/As a child (4)	****
12-Popcorn (3)	***
13-Motion/Movement (3)	***
14-Din/Carnival sounds/Mixture of sounds (3)	***
15-Band(s) (3)	***
16-Light(s) (3)	***
17-Crush/Bustling/Great activity (3)	***
18-Old musical instrument/Calliope (2)	**
19-Costumes/Colorful costumes (2)	**
20-Bygone age/Nostalgic (2)	**
21- Colorful/Color (2)	**
22-Ring/Sawdust (2)	**
23-Animals (2)	**
24-Voices/Crowd noise (2)	**
25-Shows/Sideshows (2)	**
26-Exciting/Enjoyable (2)	**
27-"Try Your Strength" tests/machines (2)	**
28-Clowns (1)	*
29-Drilling horses (1)	*
30-Big tent (at circus) (1)	*
31-Trapeze (1)	*
32-Nickelodeons (1)	*
33-Ferris wheel (1)	*
34-Hot dogs (1)	*
35-Smell (of popcorn) (1)	*
36-Street carnival (1)	*
37-North End (Boston) (1)	*
38-Bell for starting merry-go-round (1)	*
39-Dusty shoes (1)	*
40-25¢ rides (1)	*
41-Carnival people (1)	*
42-"Hot and Sticky" (1)	*
43-"Ice-cream on my face" (1)	*

Experimental Area B

No. 5 BREAKING GLASS

Place	'A'	'B'	'C'	Total no. mentions
1-Shattering/breaking glass	(3)	(3)	(3)	9
2-Dropping bottle	(3)	(2)	(2)	7
3-Kids/Young people/Youths/Hippies/Students/ Young hooligans	(2)	(3)	-	5
4-Uninformative	-	(2)	(2)	4
5-Don't know/Doesn't fit/Not sure/Sense of uncertainty	-	-	(4)	4
6-Tourists	-	(2)	(2)	4
7-Excitement/Excited/High spirited people	(1)	(2)	-	3
8-Dropping glass object /glass	(1)	(1)	(1)	3
9-Throwing rock at window	(1)	(2)	-	3
10-Breaking window/shop window	(1)	(1)	-	2
11-Outside/Happening outside (the garden)	-	-	(2)	2
12-Throwing bottle	(1)	(1)	-	2
13-Full of people shopping/People shopping and milling around	(1)	-	(1)	2
14-Car breaking headlamp	-	(1)	-	1
15-Tinkle of ornaments (REDUCED VOLUME EXPT.)	(1)	-	-	1

No. 9 SMALL-CALIBRE GUN SHOTS

Place	'A'	'B'	'C'	Total no. mentions
1-Shots/Gunshots /Gunfire/Rifle/Pistol	(5)	(3)	(4)	12
2-Rifle/target practice/Shooting for fun/Shooting clay pigeons	-	-	(4)	4
3-Small boys/Adolescents/Kids	(3)	(1)	-	4
4-(Think of) assassination of J.F.K.	(1)	(1)	(1)	3
5-Cap gun/Starting pistol	(3)	-	-	3
6-Shooting gallery/Amusement arcade	(3)	-	-	3
7-Don't know (the place is empty)/Raises questions	-	-	(2)	2
8-Trashy stores selling firecrackers ("the place did look false")	-	(2)	-	2
9-Honky-tonkatmosphere/High spirited people	(1)	-	(1)	2
10-Place for enjoyment of the young/Someone playing	(2)	-	-	2
11-Surely (gunfire) can't be happening in this pleasant environment/Danger even in the pleasantest places	-	(2)	-	2
12-National guard	(1)	-	-	1
13-Robbing a bank	(1)	-	-	1
14-(Think of) Kent State	(1)	-	-	1
15-Small calibre	(1)	-	-	1
16-Demonstration out of hand (round the corner)	(1)	-	-	1
17-Somewhat removed (REDUCED VOLUME EXPT.)	(1)	-	-	1
18-Potentiality for violence	(1)	-	-	1
19-Holiday place	(1)	-	-	1
20-Heat breeds violence	-	(1)	-	1
21-Firecrackers	-	(1)	-	1
22-Lunatic drunk	-	(1)	-	1
23-Texas (all those balconies)	-	(1)	-	1
24-Old fort	-	-	(1)	1
25-South	-	-	(1)	1
26-The garden isn't typical of the place	-	-	(1)	1
27-Fancy place (because of pigeon shoot)	-	-	(1)	1
28-Must be alright (because the girl keeps smiling)	-	-	(1)	1

No. 11 DOGS BARKING

Place	'A'	'B'	'C'	Total no. mentions
1-Dog(s)/Dog(s) barking/playing	(5)	(5)	(5)	15
2-Uninformative	(2)	(1)	(2)	5
3-Fields and gardens/park nearby/Rural surroundings	(3)	(1)	(1)	5
4-Unleashed dogs/Dogs running wild/not being kept under control	(2)	(2)	-	4
5-Disturbing the environment/Getting in the way/ Ruining peaceful atmosphere	-	(2)	(1)	3
6-There are residents/locals nearby/People live close together	-	(3)	-	3
7-Relating to something else/Not much import here	-	-	(2)	2
8-Surrounded by poor neighborhood/Sort of neighborhood where people let out dogs	(1)	-	(1)	2
9-Safety from outside things/Place is apart from helter-skelter outside	-	-	(2)	2
10-In silence	(1)	(1)	-	2
11-(Big dogs) fashionable with students	(1)	-	-	1
12-Nice neighbourhood	(1)	-	-	1
13-Tourists' dogs	-	(1)	-	1
14-Unlikely to be tourists' dog	-	(1)	-	1
15-Silly for tourists to walk dog in city	-	(1)	-	1
16-Dog was scared but would like to be aggressive	-	(1)	-	1
17-Street curs	-	-	(1)	1
18-Watchdogs	-	-	(1)	1
19-Wrong in context	-	-	(1)	1
20-On other side of wall	-	-	(1)	1

No. 14 CAR SKID AND CRASH

Place	'A'	'B'	'C'	Total no. mentions
1-Car crash/Crashing/Motor/road/car accident	(5)	(5)	(5)	15
2-Uninformative	(2)	(3)	(1)	6
3-What is it doing to go so fast in a pedestrian way/ Streets too narrow and twisty/Lunatic to go that fast in New Orleans	-	(4)	-	4
4-There are cars outside walls/Road runs close by/ Road beyond wall/Busy main shopping street wall	-	-	(4)	4
5-Speeding/Driving too fast	(2)	(1)	-	3
6-People walking in road/Caused by a tourist/To avoid a pedestrian	-	(2)	(1)	3
7-Place apart from helter-skelter outside/A peaceful haven/Safe inside	-	-	(3)	3
8-Outside the place/the walls/my range of vision	-	-	(3)	3
9-Doesn't fit/Unexpected/Impossible	-	(2)	(1)	3
10-An intersection/Crossroads	(2)	-	-	2
11-People not taking care	(2)	-	-	2
12-Into shopfront/building	(2)	-	-	2
13-A lot of damage and mess	(1)	-	-	1
14-Was someone killed?	(1)	-	-	1
15-Didn't stop for red light	(1)	-	-	1
16-Nearby, but not too near (REDUCED VOLUME EXPT.)	(1)	-	-	1
17-Such (reckless) driving isn't typical	(1)		-	1
18-Peaceful happy place disturbed by this noise	-	(1)	-	1
19-Possibly a drunk	-	(1)	-	1
20-So traffic does go through	-	(1)	-	1

No. 15 RAIN RUNNING IN A GULLEY

Place	'A'	'B'	'C'	Total no. mentions
1-Fountain/Water fountain/Fountain playing	-	(2)	(5)	7
2-Running/flowing water	(2)	(2)	(1)	5
3-Nice place/Picturesque place/Pleasant old city courtyard/Pretty place (because of fountain)	-	(1)	(3)	4
4-Hydrant/Fire/street hydrant	(2)	(1)	-	3
5-Cooking/People are hot and sticky/It's hot	-	(3)	-	3
6-Another (fountain)/with more water than this/since there's one here/(f) makes more noise than its size would suggest	-	-	(3)	3
7-Don't know/Sound doesn't fit place at all/Not typical (if a fountain)	(3)	-	-	3
8-(Fountain) not unexpected	-	(1)	(1)	2
9-Cool and damp/Cool grotto here	-	-	(2)	2
10-People turn on/illicitly run (fire hydrants)	-	(2)	-	2
11-(Think of) places with fountains e.g., Trafalgar Square	(1)	-	(1)	2
12-Running brook	(1)	(1)	-	2
13-(Running brook) behind me	(1)	(1)	-	2
14-Must be near (if running brook)	-	(1)	-	1
15-Police trying to keep the kids cool	(1)	-	-	1
16-(Think of) New York City - poor neighbourhood - blacks	(1)	-	-	1
17-Not a fountain	(1)	-	-	1
18-May be tap running in nearby house.	(1)	-	-	1
19-Uninformative	(1)	-	-	1
20-(Fountain) in some square, courtyard	-	(1)	-	1
21-Canal with weir (unlikely?)	-	(1)	-	1
22-Usual summer sound in U.S. cities (hydrants running)	-	(1)	-	1
23-Civic pride to give an important civic amenity (a public fountain)	-	-	(1)	1

No. 16 YOUNG BABY CRYING

Place	'A'	'B'	'C'	Total no. mentions
1-Baby/Baby crying	(5)	(5)	(5)	15
2-Baby in carriage/perambulator	(4)	-	(1)	5
3-Uninformative	(1)	(3)	-	4
4-Suggests residential neighbourhood/community	(2)	(1)	(1)	4
5-Families/Young married/young people with babies there	(2)	(2)	-	4
6-Baby being carried/carried around	(1)	(2)	-	3
7-Unexpected/Wouldn't expect a perambulator there	(2)	-	-	2
8-Place not suitable/too hot for babies	-	(2)	-	2
9-Irritable/naughty baby	-	(1)	(1)	2
10-(Baby) left unattended in carriage	(1)	-	-	1
11-Familiar sound	-	(1)	-	1
12-Parents have taken baby out of tender in left of picture	-	(1)	-	1
13-Tourists' baby	-	-	(1)	1
14-Worried parents hushing baby	-	-	(1)	1
15-Sorry for person pushing the perambulator	-	-	(1)	1
16-Is it hers?	-	-	(1)	1
17-(Crying) suggests there are others there	-	-	(1)	1
18-(Crying) suggests garden is a good place for a leisurely walk	-	-	(1)	1
19-(Crying) because baby senses parents' apprehensiveness in the overbearing atmosphere of peace	-	-	(1)	1
20-Somewhere behind me	-	-	(1)	1

No. 19 MOCKINGBIRD SINGING

Place	'A'	'B'	'C'	Total no. mentions
1-Bird/Birdsong(s)/Chirping birds/Birds singing/ Bird sound	(5)	(5)	(5)	15
2-Near a park/There must be trees in gardens/courtyard gardens/Place can't be as lacking in green as it looks	(3)	(3)	(1)	7
3-Surprise/Incongruent	(5)	-	-	5
4-Lovely/pleasant/quiet/peaceful/attractive place	-	(3)	(2)	5
5-Uninformative	(1)	(1)	(1)	3
6-Place not too urban/near countryside and woodland/ on outskirts of city	(3)	-	-	3
7-Quite expected in quiet old city/Local birds, happy, fit well	-	-	(2)	2
8-Exotic southern bird	-	(1)	(1)	2
9-Springtime	(1)	-	-	1
10-Faint (bird sound) (REDUCED VOLUME EXPT.)	(1)	-	-	1
11-"Hired by local businessman!"	-	(1)	-	1
12-(Gardens nearby) - "I didn't think that was a garden"	-	-	(1)	1
13-Nice (that they're in this quiet place)	-	-	(1)	1
14-It's surprising how readily birds accept an urban environment where there are oases of green	-	-	(1)	1
15-It is often like this as there are birds here	-	-	(1)	1

No. 20 MOTOR-CYCLE STARTING AND RIDING OFF

Place	'A'	'B'	'C'	Total no. mentions
1-Motorcycle(s)/Motorbike(s) starting/revving up taking off	(5)	(5)	(5)	15
2-Teenagers in leather jackets/"Hell's Angels"/Local youths	(3)	(1)	(1)	5
3-Annoying/Creating noise/Wrecking/disturbing the peace	(2)	(2)	(1)	5
4-(Motorcycle) circling round	(1)	(1)	(1)	3
5-Youths rich/affluent enough to have motorcycles	(2)	-	-	2
6-Racing round blocks/Playing	(2)	-	-	2
7-Showing off/A sporty type impressing everyone	-	(2)	-	2
8-Motorbike gangs/Horrid groups of motorcycles	(2)	-	-	2
9-Undesirable tourists/attracts undesirable elements	-	(2)	-	2
10-Sound presumably from street outside/In a commercial street which must be over all because of that sound	-	-	(2)	2
11-Neighbourhood caters to motocycle gangs	(1)	-	-	1
12-Somewhat removed - but I can hear every sound of it (REDUCED VOLUME EXPT.)	(1)	-	-	1
13-Seeing people in complete silence ("strange")	(1)	-	-	1
14-Silly to cycle in New Orleans - too many pedestrians	-	(1)	-	1
15-Not hoodlums	-	(1)	-	1
16-Appeal to young	-	(1)		1
17-Has some other type of life going on than just the tourists	-	(1)	-	1
18-Not unexpected - all types found in tourist attraction city (New Orleans)	-	(1)	-	1
19-(Motorcycle circling) Don't understand how that movement pattern can fit into this old quarter it may not, therefore, be an old quarter; perhaps a stage set	-	(1)	-	1
20-Uninformative	-	-	(1)	1
21-Unexpected	-	-	(1)	1
22-Someone has left the place	-	-	(1)	1
23-Peaceful haven	-	-	(1)	1
24-Not tucked away somewhere quiet	-	-	(1)	1
25-I am sheltered from this particular unpleasantness.	-	-	(1)	1
26-(Motorcycle circling) Seems to match visual image of the place	-	-	(1)	1

No. 21 CHILDREN PLAYING IN SCHOOL YARD

Place	'A'	'B'	'C'	Total no. mentions
1-Children/Crowd(s) of children/Excited children/ Kids/Lots of kids	(3)	(3)	(4)	10
2-School/School noise/School playground	(4)	(1)	(2)	7
3-School/camp outing/Sightseeing tour of children/ Coach loads/Organized groups	-	(3)	(2)	5
4-Children/many children playing/Children's playground	(3)	(1)	(1)	5
5-In a school/church school/orphanage in Latin country	-	-	(3)	3
6-Hippie part of suburbia/Healthy neighbourhood threatened by new hip element	(2)	-	-	2
7-Good/popular place for children/showing children	-	(1)	(1)	2
9-(Children) in a big space	-	(1)	(1)	2
10-Uninformative	(1)	(1)	-	2
11-Consistent with character of the place (from other sounds already heard)	(1)	-	-	1
12-Lots of children will know and pass through the place for school	(1)	-	-	1
13-Strange (the teenagers are silent)	(1)	-	-	1
14-(Children) at amusement hall	-	(1)	-	1
15-(Children) waiting to watch an outdoor activity	-	(1)	-	1
16-Maybe a beach	-	(1)	-	1
17-Incongruous (I don't think there are that many children around)	-	(1)	-	1
18-In accordance with one's experience	-	-	(1)	1
19-Running loose	-	-	(1)	1
20-Residential neighbourhood	-	-	(1)	1
21-Swimming pool somehwere around	-	-	(1)	1
22-Place is apart from helter-skelter outside	-	-	(1)	1
23-I'm surprised that this quiet protected place opens up to such a big play space	-	-	(1)	1

No. 25 PASSING TROOP OF HORSES

Place	'A'	'B'	'C'	Total no. mentions
1-Horses/Horses walking/trotting/galloping/Lots of horses	(4)	(3)	(4)	11
2-Horse and carriage/Horse drawn carriage	(1)	(3)	(2)	6
3-Police/Mounted police	(2)	-	(2)	4
4-Tourist attraction/place/Holiday place with varied facilities	-	(3)	-	3
5-Riding schools nearby/Local riding school	(2)	-	(1)	3
6-Uninformative	-	-	(2)	2
7-Incongruous	(2)	-	-	2
8-Old world	-	(2)	-	2
9-Provincial	-	(1)	(1)	2
10-Hansom cabs	-	(2)	-	2
11-Parade/Local ceremony	-	(2)	-	2
12-Ride tours/Pleasure rides for children	-	(2)	-	2
13-Maybe it's near a park/country	(2)	-	-	2
14-Outside on street/(Carriage) on street	-	-	(2)	2
15-Preservation of pre-motor car era atmosphere	-	(1)	-	1
16-Maybe it's not rundown suburbia	(1)	-	-	1
17-(Think of) countryside, gymkhanas	(1)	-	-	1
18-Nice that they are still here	-	(1)	-	1
19-Perhaps a stage set	-	(1)	-	1
20-Same scale as buildings and street	-	(1)	-	1
21-Nice to hear (a carriage) pass by the gate	-	-	(1)	1
22-Middle of old city	-	-	(1)	1
23-Foreign	-	-	(1)	1
24-Latin country(therefore not unexpected)	-	-	(1)	1
25-(Think of) Wild West!, Salud, Amigos, Pancho Villa, the Alamo	-	-	(1)	1

APPENDIX II

THE SUBJECTS

Subject Number	
1	Male, late twenties; architect, at present Urban Design student, American. From rural Texas.
2	Male, late twenties; architect, at present Urban Design student, American. From suburban Virginia.
3	Female, mid-twenties; graduate student in Psychology, American. From suburban California. Wife of no. 2.
4	Male, early thirties; senior administrative government official, at present graduate student in U.S. on fellowship, British. From suburban London.
5	Female, early thirties; computer programmer part-time/ housewife, British. From suburban London. Wife of no. 4.
6	Female, late twenties; secretary, American. From mid-town Manhattan (New York City). Recently returned from working in Paris for two years.
7	Male, late twenties; law student, American. From urban Detroit.
8	Male, early thirties; architect/city planner, American. From suburban Minnesota.
9	Male, early forties; architect/professor of Urban Design, American. From rural New Hampshire and Cambridge, Mass.
10	Female, mid twenties; housewife, formerly research chemist, British. From suburban northern England. Wife of graduate student at present in U.S. on fellowship.
11	Male, mid twenties; architect, at present Urban Design student, American. From suburban Virginia.
12	Female, early twenties, secretary/housewife, American. From suburban Virginia. Wife of no. 11.
13	Male, mid twenties; architect, at present Urban Design student, American. From rural Mississippi.

Subject Number	
14	Female, mid twenties; housewife, formerly research chemist, American. From rural Mississippi. Wife of no. 13.
15	Male, mid twenties; architect, at present Urban Design student, Korean. From urban Seoul.
16	Male, mid twenties; linguist, at present graduate student in U.S. on fellowship, British. From suburban London.
17	Male, early twenties; law student, American. From uptown New York city.

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