EXPERIMENTAL STUDIES OF HUMAN CROWDING:

A TEST OF TWO MODELS.

A thesis presented in partial fulfilment

of the requirements for the degree of

Doctor of Philosophy in Psychology

at Massey University

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1990

ABSTRACT

Following a review of the history of human crowding the attributional arousal model of crowding was examined. This model views the experience of crowding as spatially induced arousal, attributed to the closeness of others. The model introduces the possibility of misattribution of arousal source leading to a reduction in perceived crowding. A salience hypothesis was developed in order to account for the ease with which misattribution was predicted to occur.

Study One attempted to test the salience hypothesis. The study varied two levels of distance and four levels of information concerning arousal source in attempting to partially replicate one of the key studies on which the attributional arousal model is based. The 320 subjects were run in groups of five.

The distance manipulation was effective in inducing crowding in subjects seated at close distances. However, the predicted levels of increased arousal failed to emerge. This unexpected result precluded any test of the salience hypothesis, since increased levels of arousal are necessary in order for causal search and misattribution to occur. This result showed that the experience of crowding may occur independently of arousal.

The information expectancy model was developed to explain the results from Study One. This model assumes invasion of personal space is necessary for the

experience of crowding, and also that confirming of expectations will reduce the impact of crowding. Study Two aimed to clarify the role of information and expectations in the context of experimental crowding. A further aim was to gather psychometric data on the efficacy of measurement scales for the concepts of arousal and crowding.

Study Two varied three levels of spatial information and two levels of nonspatial information. The 240 subjects were run in groups of five and all were seated at close interpersonal distance.

Results showed the measurement scales possessed high levels of internal consistency. However, accurate spatial information failed to reduce the impact of crowding and this result calls into question the utility of pre-exposure information. Disconfirmed nonspatial expectations increased levels of reported crowding suggesting that accurate information concerning the activities which occur while in crowded conditions is important. Sex differences emerged and these contributed to the view that women may be more adaptable than men under conditions of reduced interpersonal distance.

The results of these studies were considered in terms of their implications for the models of crowding. Suggestions for further research were discussed. These included examining the relationship between spatial invasion and crowding, and further considering the impact of information on the experience of crowding.

ACKNOWLEDGEMENTS

I wish to gratefully acknowledge the unfaltering support and commitment of my first supervisor John Podd.

The helpful advice and encouragement which I received from John Spicer and Mike Smith is also acknowledged with the warmest appreciation.

My thanks also go to the staff of the Department of Psychology who have been of assistance in so many ways.

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INTRODUCTION

OVERVIEW

Crowding may be regarded as a human response to spatial variables. It is a subjective experience which becomes more likely as the distance between people is reduced.

The social psychology of crowding has produced several models, one of which is examined in detail in this thesis. The attributional arousal model is unique in predicting that the experience of crowding may be reduced as a result of misattribution of spatially induced arousal. The first experiment is an attempt to partially replicate a key supporting study (Worchel & Yohai, 1979) and also extend the model.

The failure to replicate basic features of the supporting study, or to provide support for fundamental predictions of the attributional arousal model, stimulated the development of a new model of crowding. The information expectancy model of crowding incorporates the personal space approach to crowding along with an emphasis on the importance of information in developing accurate expectations about spatial concerns. The second study in this thesis tests the predictions of this model.

HISTORY OF CROWDING

In reviewing the history of crowding Altman (1978) identifies three perspectives which have been influential in shaping the manner in which crowding is both understood and studied. Each of these perspectives has contributed to contemporary views of the nature of crowding, and for that reason are important to consider. The three perspectives (the sociological tradition based on urban analysis, animal research, and psychological research) and their approaches to the study of crowding will be presented.

The **urban sociologists** examined, with the use of correlational techniques, relationships between high concentrations of human population and indicators of social pathology such as mental illness and crime. The sociological examination of crowding was stimulated by Le Bon (1903) whose seminal work, "The Crowd", analysed the processes which led to mob behaviour. Le Bon was an influential figure who, according to Moscovici (1986), was one of the first scholars to consider the masses as anything other than a behavioural anomaly. This increased attention followed the twin processes of industrialisation and urbanisation which resulted in more people collecting together in cities. Estimates vary about the extent to which the worlds population has shifted. The last century has seen an increasing percentage of the population living in cities. Davis (in Insel & Lindgren, 1978) estimates that in 1850 only 2% of the world's population lived in cities of over 100,000 inhabitants. In the mid 1970s 24% of the world's population lived in cities, while in the year 2000 an estimated 40% will do so.

It was this process of large numbers of people collecting together in cities that stimulated Le Bon (1903), who Moscovici (1986) credits with providing the impetus for a new psychology: the psychology of the masses. While reflecting increased awareness of the urbanisation of the population this new psychology referred to "the crowd", rather than crowding. In this respect the psychology of the masses was relatively undifferentiated in considering masses, mobs and crowds as one. Le Bon's psychology of the masses was based on the view that a person does not behave in the same way when alone and when in a crowd. The extent of the crowd's influence is still very much of interest today. Before examining contemporary views of crowding, it is worth considering Le Bon's ideas, which provide an interesting perspective on the influence of crowds.

Moscovici (1986) discusses Le Bon's contribution as originating from a consideration of the crowd. Once people form a crowd they think, feel and behave differently. Three "symptoms" were apparently manifest when in a crowd : 1. lowering of intellectual faculties, 2. intensification of emotional reactions (including a dimming of rationality), 3. disregard for personal profit, people becoming both unselfish and irresponsible. Le Bon argued that in crowds people are more likely to engage in antisocial acts due to the anonymity and sense of invulnerability which the crowd affords. This process of individual submersion into the wider group subsequently came to be studied by social psychologists interested in the effects of deindividuation (e.g., Festinger, Pepitone, & Newcomb, 1952).

Le Bon (1903) was almost singularly pessimistic in his view of the crowd's influence on the individual's behaviour. He wrote that when in a crowd, the individual "descends several rungs in the ladder of civilisation" (p.36). Farr (1986) maintains that these views were a response to the social and political events of the time. Both intellectual interest in the nature of crowds and the changing nature of social influence were germinal in the conception of social psychology. Not all authors saw the crowd in such negative terms. McDougall (1921), for example, reacted against the irrationality of Le Bon by suggesting that it was only through participation in group life that "man becomes fully man" and manages to rise above the level of the savage. This issue of the positive or negative influence of crowding on behaviour is one which still pervades the current literature.

The urban sociologists extended these early views and sought to establish relationships between areas of high population and social pathology. In examining areas of high population these early studies considered the relationship between population **density** and such indices of social pathology as mental illness (Faris & Dunham, 1965), suicide (Schmid, 1955), and crime rates (Schmid, 1969). These studies typically found higher levels of the indices of social pathology in central city areas when compared to the less densely populated suburbs.

Altman (1978) reports that these studies yielded moderate relationships which led to the conclusion that crowding was harmful to human well being. This

conclusion was tempered, however, by a number of criticisms. Altman discusses these as being firstly, the problems of interpretation; that is, covariation does not necessarily mean that population density causes social pathology. Secondly, that this approach is unable to ascertain the underlying dynamics because the sociological analyses used large (and variable) indicators of population density. It was rare, for example, for these studies to be based on people or families. A more typical unit was people per acre, reflecting the societal level approach to these problems. Thirdly, these studies had no clear conceptual framework or understanding of the concept of density. Also, these studies were firmly based in the tradition of population density rather than employing the concept of crowding.

Freedman (1980) has also criticised the contribution of the urban sociologists. He notes that when factors such as income and educational level are taken into account, these studies have found no substantial relationships between density and indices of social pathology. Epstein (1980) is similarly critical of these studies in concluding that their results are inconsistent, with negative effects sometimes being documented, and other times not.

The **animal studies** of crowding, which began to appear in the late 1950s, resulted in startling findings, not the least of which was a series of studies (Calhoun, 1962) documenting the dramatic effects of long term crowding. A colony of Norwegian rats was placed in an experimental enclosure where they were free to multiply. When the colony reached 80, the population was held constant by the removal of new offspring. A breakdown in the use of available

space occurred, the rats congregated in limited parts of the enclosure such that density levels were very high in those areas. This behavioural irregularity became known as a "behavioral sink". Manifestations of the behavioural sink included abnormalities in females' ability to reproduce and care for offspring, disrupted nestbuilding, hyperactivity, pansexuality, and cannibalistic behaviour. Calhoun concluded that these abnormalities were so severe that over time the breakdowns in normal reproductive functioning would result in the extinction of the colony.

Calhoun (1962) had specifically designed this enclosure to encourage unequal distribution of rats in various parts of the enclosure. His research showed that unusually high levels of density **may** lead to social deterioration. Similarly, Christian, Flyger, and Davis (1960) studied deer living in overcrowded conditions and noted increased disease and death.
generalise particularly when this involves complex social behaviour. For this

The animal studies were popular with the research community because they offered certain advantages. Specifically, the long term effects of population density were able to be telescoped due to shorter life expectancies of the animals. Detailed autopsies were possible as were experimental variations in living conditions. For ethical reasons such variations would not be possible with human subjects. The principal difficulty with the animal studies is the problem of generalising these results to human crowding. Freedman (1972) notes that although the animal findings are fascinating and provocative, it is difficult to

reason the animal literature should be regarded merely as a starting point.

Cohen, Malpass, and Klein (1980) compare the human and nonhuman literature. They note that a stress syndrome, typically comprised of endocrine and behavioural responses which control and limit population growth, is usually found in nonhuman populations. The absence of a similar mechanism amongst humans has resulted in some interesting explanations. Of some interest is the suggestion that humans may have developed cognitive mechanisms (associated with the evolution of symbolic behaviour) which mediate between objective density and perceived crowding.

It should be remembered that the animal studies examined the long term effects of high concentrations of population density. As will be discussed shortly, the relationship between density and crowding is far from an exact one. One final point which deserves comment is that the dramatic and exclusively negative results from the animal studies contributed substantially to the debate as to whether crowding has a positive or negative influence on behaviour. In particular, Calhoun's (1962) experimental theatre provided a very powerful stage on which to display the sinister potential of high and sustained population density.

The animal literature also functioned to stimulate **psychological interest** in crowding. This interest has further been excited by the fact that crowding is a human experience which we are all able to relate to. The Guinness book of records (McFarlan, 1989) reports that the largest crowd was established in

January 1977. An estimated 12.7 million people attended the Hindu festival of Kumbh-Mela at Allahabad, Uttar Pradesh, India. It is almost impossible to imagine what being part of such a huge mass of people is like. However, we are all able to understand what being part of a more normal sized crowd is like. Reports of crowds usually rely on some estimate of the number of people, these being readily available in the case of large sports events or concerts. Such figures are unavailable, however, on crowded summer beaches, or to indicate the number of shoppers on the streets, or the number of bargain hunters in the stores. Yet these experiences may be just as relevant to being crowded as being part of a measured crowd at a controlled event.

The notion of crowding involves more than a mere estimation of the number of people involved. There is more to this particular human experience than simply the number of participants. Recently, environmental researchers have started asking questions about the experience of crowding in order to find out more about the factors which contribute to it. These questions have been fuelled not only by concern about our welfare but also by intellectual curiosity about the nature of an experience which is readily available, yet poorly understood.

The concern centers around a fear of overpopulation and the possible negative concomitants of scarce resources, including food and territory. Such overcrowding may be seen as a 'third world' problem, but in Western industrialised countries related problems are also of concern. Examples include the overcrowding which occurs when cities are unable to adequately

accommodate their inhabitants, and the crowding related tragedies which have occurred at soccer matches.

A further spur to the development of psychological interest in studying crowding was a widespread increase in awareness of environmental issues. During the 1960s awareness of pollution, population control and conservation of resources became public issues. Psychology has never been slow to respond to the **Zeitgeist** and it is perhaps no accident that environmental psychology experienced its most rapid growth during the 1960s (Holahan, 1982). Interest in the effect of the environment on behaviour had been around for a long time, but the **Zeitgeist** of the 1960s certainly sharpened research interest in the field. It was towards the end of that decade that saw the publication of the first professional journals in environmental psychology (Gifford, 1987). Crowding was but one topic of research interest which was carried along on the wave of activity which occurred at that time. Experimental social psychologists began publishing their research findings on crowding in the early 1970s. Among the first of these studies was work by Freedman, Klevansky, and Ehrlich (1971) who brought the phenomenon into the laboratory by having small groups of subjects work on a variety of tasks in either a crowded or an uncrowded room.

Laboratory studies of crowding have been criticised (Paulus, McCain, & Cox, 1979) on the grounds that realistic stress levels are impossible to achieve for ethical reasons. Paulus et al. argue that subjects know that participation in a laboratory experiment will be of short duration and this inflates the artificiality of

the experience. These drawbacks are not insignificant but they must be considered in the light of the control afforded by laboratory experiments.

The three traditions which provide a historical context to the study of crowding have been presented. In chronological order these are firstly, the sociological tradition which documented correlations between population density and social pathology. Secondly, the dramatic results obtained by the animal literature which further consolidated the notion that "crowding" resulted in negative consequences. Thirdly, the youngest "tradition" to contribute to the study of crowding, the psychological perspective. To date this perspective has only been considered briefly on the basis of the question of why psychologists have become involved in crowding research. The next section will consider how psychologists define crowding.

DISTINCTIONS AND DEFINITIONS

A useful beginning to the problem of understanding what is meant by the term "crowding" is to consider what it is not. More specifically, to examine how it differs from some closely allied terms.

An important distinction exists between crowding and overcrowding. When considering crowding there may be discussion over the issue of whether positive or negative connotations prevail. In the case of overcrowding, discussion is

unnecessary as the term has been invoked to reflect the problematic nature of the situation, and also to imply something about the cause of the problem. Prison overcrowding is a case in point. Farrington and Nuttal (1980) suggest that overcrowding in prisons may produce violent or disruptive behaviour. Similarly, it has been reported (Cox, Paulus, & McCain, 1984) that densely populated prisons have increased rates of suicide, illness, aggression and rule violation.

Stokols (1972) made an important distinction between density and crowding. Density relates to a physical dimension which involves the space available for each person. Crowding is seen as an experiential dimension whereby the restrictive aspects of limited space are perceived by the individuals exposed to them. Density is thus a necessary but not a sufficient condition for the experience of crowding. Density is regarded as an objective physical ratio of number of people per unit of area, while crowding is a subjective feeling. Stokols sees crowding as an aversive experience which develops when the available space is perceived to be less than adequate. Worchel and Brown (1984) regard crowding as a negative psychological state or feeling.

The phenomenological view of crowding promoted by Stokols (1972) has not met with universal acceptance. Griffit and Veitch (1971) and also Freedman (1975) define crowding as amount of square footage per person, and thereby equate crowding and density. Altman (1975) is supportive of Stokols' definitions. He argues that density is strictly a physical quality with no inherent psychological meaning. Density in this respect seems to occur in a psychological vacuum. It is

no more than a measure of people per unit of space. Such measures are similar to the reports of crowd size ("18,000 people attended the game"), and are useful in providing an index of the physical property of a particular crowd, but add little to our understanding of what the experience would be like. This last point highlights one of the key distinctions between the study of crowds and the psychology of crowding. Crowds are typically viewed from the outside, from the perspective which emphasises the behaviour of the mass. The psychology of crowding typically adopts a "within" perspective which considers the individual in the mass (Kruse, 1986).

The phenomenological view suggests that the experiential component of crowding is of prime importance. For example, Stockdale (1978) refers to crowding as being a perceived and subjective state. Crowding would, therefore, seem to be in the eye of the beholder. Holahan (1982) also discusses the subjective approach to defining crowding but notes that the objective parameters of density are easily defined compared to the complex subjective elements which lead to the perception of crowding. Thus, an important aim of crowding research is to further develop the definition of crowding.

Freedman (1975) argues against the phenomenological view. He maintains that crowding should not be restricted to a subjective perception, but should refer to the amount of objective space available. Of course, it is possible to measure both. Freedman's view follows directly from his assertion that the experience of crowding need not necessarily be a negative one, but that the nature of the

experience be dependent on the particular circumstances in which it occurs. This is an important issue within the literature as it questions a basic assumption, namely, that the experience of crowding is something which is regarded as universally and psychologically aversive. The point is that crowding need not necessarily be experienced as aversive or noxious. Freedman's research bears testimony to this, as does the fact that we may often attend crowded events which are also highly enjoyable.

One view of crowding which combines both the physical and subjective aspects of crowding is the personal space approach. Numerous authors espouse this view (Sommer, 1969; Altman, 1975; Worchel & Teddlie, 1976; and Vine, 1982). Spatial invasions are regarded as the source of density related stress. Worchel and Teddlie, for example, define crowding as an intrusion of one's personal space.

Sommer (1969) defined personal space as an area around a person's body into which others may not enter. Holahan (1982) similarly defined it as the zone around an individual into which others may not trespass. A convenient metaphor is that of a "bubble" of space which surrounds each of us. Personal space extends above and behind the individual, but its most usual function is to serve as an index of interpersonal distance between people.

There is some dispute within the literature (e.g., Patterson, 1975) as to whether personal space or interpersonal distance (IPD) is the more appropriate term.

Strube and Werner (1982) define IPD as simply the distance between two individuals. They argue that IPD is observable to both parties in an interaction and is likely to be used as a communication cue. IPD may also mediate the effectiveness of other communication cues, for example, facial expression and voice quality. Personal space, on the other hand, is characterised by subjective ownership. It is defined as the area surrounding a person's body, and considered to be the exclusive space of that person. Personal space is not observable and may be greater or smaller than the distance separating interactants. Similarly, personal space may extend in all directions and may vary in shape and size.

Patterson (1975) and Strube and Werner (1982) would prefer to see the term "personal space" abolished. They suggest a number of reasons why the concept of personal space may be misleading. Firstly, the idea of personal space involves the notion of a comfortable distance which is fairly stable. Patterson highlights the variability associated with personal space (this ranging from no distance at all to several feet) depending on factors such as gender of interactants, culture, relationship and situational constraints. This variability raises concerns about the "stability" of the concept. When we talk of a person's personal space, to which particular personal space are we referring? Secondly, it is argued that the term "personal" is misguided, as it implies individual ownership as if the space is somehow attached to the individual. However, this space achieves meaning only in relationship to another individual. We do not identify a personal space with respect to inanimate objects, but we may identify a distance between people. This distance is carefully negotiated between individuals using a

variety of verbal and nonverbal cues. IPD has the advantage of referring specifically to the distance between the individuals (and implicitly recognising that this will vary). Further, the term focuses attention on the relationship between individuals. Moreover, it is more closely linked to the operational definitions used in the measurement of the concept.

Despite the advantages of using the term IPD, a number of models use the personal space notion as the term of choice. Personal space models of crowding (e.g., Worchel & Teddlie, 1976) see spatial violation leading to arousal which is then attributed to the presence of others in the environment. Thus, the experience of crowding is seen as resulting from a violation of personal space rather than density. This approach relies on a concept (personal space) which includes a consideration of the question of density from the perspective of the individual. The personal space approach therefore differs from a strict density view by considering the space (interpersonal distance) which separates individuals rather than the number of people in the space available to them (much of which may be unused). Greenberg and Firestone (1977) supported this view with the finding that perceptions of crowding can be instigated by interpersonal intrusion. They conclude that high density is not a necessary precondition for perceived crowding.

It is useful to consider the distinction between social and spatial density at this point. Social density (McGrew, 1970; Loo, 1972) is dependent on the number of people in a particular area. High social density occurs when a large number of

people occupy a specific area, and low social density occurs when a small number of people are in the same area. Thus, crowding based on social density depends on large numbers of people. Spatial density, however, holds the number of people constant and varies the available space. High spatial density depends on a small spatial allocation, while low spatial density may occur in a larger area. Social density is defined in terms of the number of people in a given area, while spatial density is defined in terms of the available space in a particular setting. Gifford (1987) uses the example of classroom size to clarify the distinction. Imagine a classroom with 30 students. The density (ratio of individuals to area) may be doubled by either adding another 30 students, an increase in social density, or by partitioning the room in half thereby increasing the spatial density. Mathematically the ratios stay the same with either of these two procedures doubling the density. Psychologically the two procedures will lead to different outcomes (McGrew, 1970). Aiello, Thompson, and Brodzinsky (1983) acknowledge the possibility of overlap between the two. They equate high social density with "too many others" and high spatial density with "too little space".

A personal space definition of crowding depends on the operationalisation of social density. Another definition which relies on the notion of social density is provided by Desor (1972) who defines crowding as excessive perception of conspecifics. Such a definition emphasises the perception of people, rather than the actual number of people. One limitation of this definition is that we are not given any real understanding of what constitutes "excessive perception".

Conceptual and definitional dispute characterises the research into crowding. Insel and Lindgren (1978) refer to crowding as a hypothetical construct. With regard to the problematic nature of defining the construct they see it as having similar status to the notion of intelligence. They decline to define crowding as they believe it better to simply talk about crowding as though everyone understands what it means. The precedent for this was set by researchers in the area of intelligence some 50 years ago.

Disputes over definitions should perhaps be expected given the diversity of disciplines which have been involved in investigating the nature of human spatial behaviour. The history of crowding presented in this chapter has considered the influence of three key perspectives. However, Baldassare (1978), a sociologist, discusses the contributions of various disciplines: biologists, ethologists, anthropologists, ecologists, environmentalists and psychologists. He makes the observation that psychology has only recently come to the party.

In conclusion, crowding may be regarded as a subjective experience. Crowding, while dependent on the spatial relationships of those involved, is ultimately something which is in the eye of the beholder. This section has reviewed major distinctions and found that crowding is distinct from overcrowding and also from density. A further distinction has been drawn between social and spatial density, with social density more closely associated with current conceptions of crowding. Recent definitions stress the physical and subjective elements of crowding both of which are contained in an approach which emphasises the construct of

personal space. Personal space relies on the notion of social density. Multi-disciplinary interest in spatial behaviour characterises the field. This diversity of perspective is mirrored in the models of crowding which, in general, attempt to provide an explanation of the processes involved in the experience of crowding. These models will be considered next.

MODELS OF CROWDING

Epstein and Karlin (1975) discuss a social psychological model of experimental crowding based on normative expectations. According to this model, crowding occurs when the distance between individuals is less than the "appropriate" distance for that setting. One of the implications of this model is that expectations of what is appropriate are situationally determined. Another implication is that expectations dictate the comfortable distance for interaction between individuals. Epstein and Karlin assert that IPD mediates the experience of crowding.

The basis of the Epstein and Karlin (1975) model is the pioneering work on PROXEMICS, the scientific study of human spatial behaviour, conducted by Hall (1959, 1963, 1966). Hall identified four spatial zones which he referred to as interpersonal distance zones. The Intimate Distance Zone (0 - 18 ins) where the presence of the other is unmistakable and may be overwhelming due to increased sensory input. This zone is rich in its potential for communication, with

use being reserved for intimates. The Personal Zone (1.5 - 4 ft) encompasses the characteristic spacing people use with each other. In the Social Zone (4 - 12 ft) impersonal business may be conducted. People who work together tend to use the close social zone, (each zone has both a close and a far phase). This distance is also used by people attending casual social functions. The far phase of this zone suggests formality in interactions. Finally, Hall proposes a Public Zone (12 -25 ft) where communication cues are quite gross. The far phase of this zone is used for formal occasions , public speakers or people of very high status.

Each zone includes a range of distances. Hall (1966) maintains that the distances are important because of the interpersonal communication possibilities which each offers. Space, and therefore distance, is seen as a vehicle for communication. The names of each zone serve as a clue to the type of activity and relationship associated with each distance.

Epstein and Karlin (1975) follow Hall's (1966) lead in stating that in any situation there exists a set of expectations which dictate the comfortable distance for interaction. Accordingly, distances which fall short of what is appropriate in a given situation produce social crowding. Further, disconfirmation of expectations about appropriate spatial distance may lead to stress reactions. This model is based on the foundation of environmental cognition, whereby situations are matched with preexisting views of what is personally regarded as correct for that situation.

Altman's (1975) privacy control model also predicts that stress reactions will result from crowding. According to Altman, crowding occurs when the privacy regulation system fails, thus allowing more social contact than is desired. This model assumes there are times when contact with others is sought, and other times when such contact is actively avoided. Crowding occurs when the desired level of privacy is greater than the achieved level of privacy. Altman's view has the experience of crowding being mediated by the construct of psychological control, the loss of which is regarded as an aversive experience. While there is ample support in the literature to suggest that loss of control has unfortunate consequences (e.g., Seligman, 1975), it is Altman's proposal that this loss of control is essential in the experience of crowding.

Privacy control is similar to Epstein and Karlin's (1975) model in that crowding results from a conflict between what the individual either expects or desires and what actually happens. A major difference between the two, however, is that Altman's (1975) model includes the notion of control. The privacy regulation system is a control system whereby the individual is seen as being able to react to situations in an attempt to restore desired levels of privacy. The notion of control may well be important in mediating negative psychological consequences, as demonstrated by Sherrod (1974). Groups of eight subjects worked on tasks in either high density (small room) or low density (large room). Some subjects were led to believe they could control their density; they had the option of leaving and working in a less dense room, though the experimenter preferred them to remain. This simple manipulation of control led to a reduced experience of

crowding by subjects in the high density setting. Similarly, aspects of control were manipulated by Langer and Saegert (1977). They used informational messages designed to provide predictive control. In high and low density supermarket settings they provided subjects with information about how they were likely to feel if the store become crowded. The manipulation was successful in reducing discomfort and perceptions of crowding and was also associated with improved task performance.

The concept of control is also implicated in two further models of crowding: the information overload model and the behavioural constraint model.

Overload models (e.g., Milgram, 1970; Cohen, 1978) postulate that perceived crowding results when the amount of stimuli impinging on an individual exceeds informational processing capacity. Saegert (1978) suggests that density is a very special case of cognitive overload because of the behavioural consequences of social stimulation. It is argued that high population levels make interactions difficult to predict and control, as well as increasing problems of focusing on task relevant information in the environment. A basic assumption of the overload models is that individuals have a finite attention capacity, which may be surpassed in a high density environment.

Milgram (1970) hypothesised that when large numbers of people occupy a restricted space while engaging in individual tasks, the amount and complexity of situationally relevant information can lead to attentional overload. Milgram argued

that such overload may explain the impersonal detached mode of the typical urbanite. More generally, the overload perspective emphasises the cognitive involvement of people in the experience of crowding. Density, **per se**, is not seen as the primary determinant of task performance, affect and social behaviour, but rather as a physical condition which can give rise to attentional overload when a person is engaged in active transactions with, or scanning of, the environment. Overload models assume that crowding necessarily entails increased information and this may lead to difficulties in coping with the extra input of information.

Support for attentional overload is rather mixed with Neiser (1976) suggesting that there is no evidence that attentional capacities are so easily reached. Attention is a subjective notion, and in this respect is similar to Altman's (1975) notion of privacy control. Clearly, individuals decide for themselves the level of privacy which is desirable. Similarly, they may decide at what point they can no longer cope with further information.

Behavioural constraint models of crowding assume that crowded situations place behavioural constraints on people. Decreased behavioural freedom may lead to a loss of control, which may in turn exacerbate the negative consequences of crowding. Proshansky, Ittleson, and Rivlin (1970) propose a constraint model which they label a goal blocking model. The model suggests that crowding is experienced when a person's goals are blocked by the density of the environment. Similarly, Karlin (1980) suggests that when certain conditions successfully block goals then people will experience negative emotions and will

seek to explain the cause of these. While not invalidating the notion of behavioural constraint, crowding is viewed by this model as an exclusively negative phenomenon. It is defined in terms of its interruptive influence on the achievement of behavioural goals and the resulting negative affect. This need not necessarily result from crowding related processes and therefore should be regarded as a rather restrictive view of crowding.

Karlin (in Cohen et al., 1980) also suggests that in seeking the cause of negative emotion people may either look to situational factors or to dispositional properties of the others involved in the setting. It is proposed that dispositional attributions will result in anger and aggressive or withdrawn behaviour. If, however, situational attributions are made then the environment may be labelled as crowded. Individuals will then explain their responses, and the responses of others, as being caused by crowding. Such an attribution to the situation (crowding) may result in attempts to exert control over the environment by trying to change it or escape from it. Behavioural constraint does not mean that individuals relinquish attempts to exercise control. Karlin further suggests that if escape or modification of the situation proves to be impossible then individuals may experience a loss of control with accompanying feelings of hopelessness and depression. Under these circumstances, goal attainment becomes even more difficult.

Behavioural constraint models, by definition, emphasise the negative aspects of crowding. They are based on the extent to which the experience of crowding

limits people's options, induces helplessness (loss of control) and negative affect. One criticism of the behavioural constraint models is that they focus too much on the negative aspects of crowding. This is not to deny that there are times when experiencing crowding will be a totally negative experience. For example, I spoke to one couple who had attended an indoor motor show in Birmingham, England in 1978 where more than twice the maximum number of people expected attended. People became so crowded that, in this case, the couple's legs were raised off the ground and they completely lost control of the direction in which they wanted to travel. They were simply forced to go in the same general direction as that which the crowd took them. They described their experience as extremely frightening. The behavioural constraint model is relevant to this sort of experience. The criticism, however, is that by focusing on the negative features of the phenomenon these may be seen as the only features. Thus, this particular model has nothing to say about a crowding experience where people's enjoyment of the experience is actually enhanced by the presence of others. A "good crowd" of people attending a party, for example, will often facilitate one's enjoyment of the event, more so than if the event is poorly attended.

An interesting feature of the Karlin (1980) model is the implied use of attributional processes. Attributional models of crowding will be discussed more fully following the review of general models. This review will conclude with a consideration of Freedman's (1975) density intensity model.

Freedman (1975) links density and crowding, suggesting that density operates to

make others who are present more important stimuli in the situation. He acknowledges the importance of others in any situation, but argues that with low density their importance is minimised since there may not be interaction among them. Likewise there may be no competition for resources or no necessity for dealing with them in any way. As density increases, people play a greater role in the actions and reactions of others. It is proposed that responses to others under conditions of high density will be stronger and more intense. In essence, the medium of physical distance serves to magnify the impact of the stimulus properties of the person.

The intensification notion may be analogous to any stimulus as it increases in importance. Enjoyable music, for example, may be even more enjoyable when amplified. However, increasing the volume of music which we dislike will only intensify our dislike. What is suggested by the density-intensity model of crowding is that high density may have either good or bad effects. Schiffenbaur and Schiavo (1976) demonstrated such an intensification effect by varying both interaction distance and quality of interaction. They found that close partners were liked more in positive interactions and less in negative interactions. Similar support was forthcoming from a study by Storms and Thomas (1977) where close distances intensified subject's liking for friendly or similar confederates.

The models of crowding reviewed include: Epstein and Karlin's (1975) model based on normative expectations; privacy control (Altman, 1975) based on the notion of personal control in relation to crowding; information overload models

which invoke the assumption that attentional capacity may be exceeded by the conditions associated with high density; behavioural constraint models which emphasise the extent to which behavioural options are restricted by increased density; and finally the density-intensity model (Freedman, 1975) which regards the process of increased density as being akin to magnification of social stimuli. The notions of normative expectations, perceived control, stimulus overload, behavioural constraint and density-intensity may be seen as competing positions, but may also reflect the fact that different processes are involved in the experience of crowding. Crowding is a complex phenomenon and it is of little surprise that such a diverse range of models has developed. Adding to the range of psychological explanations of crowding are the attributional models which will be the subject of the next chapter.

CHAPTER TWO

ATTRIBUTIONAL MODELS

In 1976 three separate publications appeared in which attributional processes were involved in models of crowding. Schiffenbauer and Schiavo (1976); Patterson (1976); and Worchel and Teddlie (1976), each independently embraced cognitive explanations of crowding. Attribution research blossomed in the 1970's, with its widespread impact felt in many areas of social psychology. The area of crowding was no exception, with the attribution literature being responsible for the birth of a new class of attributional models of crowding. These models are important to consider as they are representative of a major contemporary stance in social psychology. These three models are distinct from the models presented in the previous chapter, because they share the assumptions that firstly, arousal mediates the experience of crowding; and secondly, that increased arousal triggers an attributional search.

Schiffenbauer and Schiavo (1976) examined hypotheses derived from Freedman's (1975) notion of density intensification. They suggest that subjects are aroused by close approaches and crowded environments. This arousal initiates an environmental search for a reason, in which any cues may be used as an explanation for arousal. When positive cues are present, the arousal will receive a positive label while the reverse will occur when negative cues preside.

Schiffenbauer and Schiavo had confederates giving subjects either positive or negative comments on their performance on a problem solving task. In the negative evaluation condition arousal was expected to be negatively labelled with negative arousal being attributed to the confederate, who under these conditions is also thought likely to be disliked. This explanation of crowding is based on the pivotal assumption that close interaction distances lead to increased arousal. This assumption has previously received some support (Middlemist, Knowles, & Matter, 1976; McBride, King, & James, 1965; D'Atri, 1975; Zajonc, 1965).

Patterson's (1976) model relates to a variety of nonverbal dimensions (including personal space), but not specifically to crowding. It is important to consider because it relies on similar constructs as the other models. Patterson's basic proposal is an outgrowth of Argyle and Dean's (1965) equilibrium model of nonverbal behaviour. This latter model proposes that both approach and avoidance forces underlie the display of nonverbal behaviours in social interactions. Approach forces derive from affiliative needs and the desire for social feedback. Avoidance forces, on the other hand, include fear of self-disclosure and rejection. Approach and avoidance forces govern a number of nonverbal dimensions including interpersonal distance, gaze, smiling and body posture. Collectively, these dimensions determine the level of intimacy, also referred to as the point of mutual comfort. The model proposes that intimacy can be maintained at an appropriate level (equilibrium) by compensatory changes in any one dimension counteracting imbalances in any of the other dimensions. Thus, a person who attends too closely to another may be met by a reduction in

gaze or an increase in interpersonal distance. Once a comfortable level of intimacy has been reached, any change requires a reciprocal change in order to maintain equilibrium.

Patterson's (1976) arousal model of interpersonal intimacy is a major extension of equilibrium theory. The model proposes that sufficient changes in the intimacy behaviours of one person will produce arousal changes in the other. Patterson argues that arousal changes may be useful in explaining results which have indicated reciprocal reactions, that is, the complete opposite of that predicted by equilibrium theory. Based on the assumption that reduced interpersonal distance will increase arousal, the model proposes that either substantial increases or decreases in the immediacy (exceeding some range of subjectively rated comfortable intimacy) of one person will result in a change in the arousal level of the other person. Depending on several variables (nature of the relationship, environmental setting, perceived control over the situation), Patterson suggests the resulting arousal will be labelled either positively or negatively. When change in immediacy results in positively labelled arousal, such behaviours will be reciprocated. Conversely, when immediacy changes produce negatively labelled arousal, such changes will lead to compensatory reactions.

Based on Schacter's (1964) two factor theory of emotions, Patterson (1976) argues that the mediating emotional states are a product of both arousal change and cognitions. A further assumption is that cognitions exercise considerable influence on the emotional states, which in turn determine specific behavioural

responses. Patterson (1978) emphasises the importance of arousal change suggesting that reduced arousal may be more important, especially in a situation where the person is fearful or distressed.

Worchel and Teddlie (1976) propose a two factor model of crowding, suggesting that the initial stage in the experience of crowding involves violations of personal space. Violations of personal space are assumed to cause the individual to feel aroused. According to this view, spatial violations need not occur in high density situations. Personal space violations may occur even under conditions of low density, for example, when people congregate in a corner of a large available area (high social density). A unique implication of the personal space approach to crowding is the possibility of one person crowding another. While two people do not constitute a crowd the subjective nature of the crowding experience means that one individual may still invade another's space to the extent of inducing crowding. The other side of such views of crowding is the acknowledgement that spatial invasions do not necessarily result in feeling crowded. For example, invasions often occur at major rock concerts or sports events, but people do not report feeling crowded at such events. Often such crowds are seen as exhilarating and adding to the enjoyment of the experience (Tuan, 1977; cited in Worchel & Cooper, 1983). Events like these run the risk of losing much of their excitement if viewed from a stadium which is nearly empty.

In an attempt to explain the experience of crowding, Worchel and Teddlie (1976) focused on the attributional process. They noted Schacter and Singer's (1962)

work which suggests that arousal leads the individual to search the environment in order to explain and label the arousal. Schacter and Singer suggest the label which is selected will be determined by environmental cues. Accordingly, Worchel and Teddlie assume that spatial violation arouses the individual who is then motivated to search for the cause of arousal. Crowding will occur if, and only if, the individual decides that the arousal is due to others being too close. If arousal is attributed to another cause, crowding will not result. Thus, the spatial invasions which may be experienced at a football match will arouse spectators who will attribute the source of arousal to the excitement of the game and will not feel crowded.

While there is some similarity among these models, namely that they all rely on the involvement of arousal and corresponding causal search, there are also some important differences. A key difference is that Patterson (1976) invokes attribution in the sense of attaching a label or interpretation to an emotional state. In contrast, Worchel and Teddlie (1976) emphasise the causal search which is thought to occur before labelling. A second difference is that Worchel and Teddlie's model deals specifically with spatial considerations and is therefore directly linked with crowding. Patterson's model accounts for changes across a number of nonverbal dimensions and may be regarded more as a model of interpersonal (dyadic) intimacy. Thirdly, Worchel and Teddlie maintain that causal misattribution is easily induced, while the other two models provide for no such possibility. A final difference among these models is that both Schiffenbauer and Schiavo (1976) and Patterson maintain that arousal will be either labelled

positively or negatively depending on a variety of factors. The Worchel and Teddlie model does not include the labelling of arousal as positive or negative. Arousal is simply attributed to one source or another.

Three attributional models have been introduced. Recent developments and research pertinent to these approaches will now be reviewed before one of the attributional models is considered in more detail.

Morasch, Groner, and Keating (1979) note that attributional models of crowding generally assert that perceptions of crowding result when a person experiences arousal, the cause of which is attributed to the presence of others in the environment. Morasch et al. discuss the possibility that such an attribution may or may not be accurate. They suggest that inaccurate causal attributions to others as the source of arousal may be made if it is more comforting than an accurate attribution would be. Morasch et al. attempt to link the attribution component of the perception of crowding with a motivational bias, the tendency for success to be attributed to internal factors, while failure is more likely to be attributed to external factors (Zuckerman, 1979). Attributions to others in the environment as causing arousal are external attributions. Morasch et al. therefore predict increased attributions to others in the environment (and a corresponding increase in perceptions of crowding) when failure is experienced. They predict a positive correlation between perceptions of crowding and failure. Their results support this prediction; however, the positive correlation between perceptions of crowding and failure only occurred when the failure was recorded with an activity

which was rated as important. They conclude that failing at an unimportant activity will produce little or no arousal, thereby precluding the need for an attributional search.

Gochman and Keating (1980) similarly propose that individuals will experience crowding when they become aroused and attribute this to some aversive aspect of the high density environment. Gochman and Keating suggest that individuals who are aroused by a source they are unable to identify will actively search for an explanation for the arousal. If an external cue is readily available as a label for the arousal, the person will attribute their arousal to that source. They propose a limited scope for this search, as arousal will cause the individual to focus on the most salient features in the environment. Consequently, these salient features are most likely to be judged as causes of arousal (Pryor & Kriss, 1977; Taylor & Fiske, 1978).

Gochman and Keating (1980) cite research evidence (e.g., Ross, Rodin, & Zimbardo, 1969; Storms & Nisbett, 1970; Valins & Nisbett, 1972) indicating the ease with which individuals will make incorrect attributions for their arousal when such explanations are reasonable and apparent. They suggest that density could be mistakenly identified as the cause of nondensity induced arousal if it is salient relative to other possible explanations. They also highlight the possibility of the plausibility of a crowding attribution being enhanced by the widespread cultural belief that density negatively influences behaviour. It is also worth noting that this belief has found its way into the major theories of crowding.

Gochman and Keating (1980) examined the proposition that arousal caused by factors unrelated to density can be misattributed to crowding, given a moderately high density environment. This hypothesis was strongly supported by their results. In high density environments, individuals who experienced both disconfirmed expectancies and unattained goals made greater attributions to crowding than those whose expectations or goals were met.

Vine's (1982) model combines a personal space approach with an attributional element. The model is centered around a series of sequential steps, the first being a spatial invasion. This stimulates an assessment of the perceived discrepancy between distance sought and the actual IPD (similar to the normative expectations model of Epstein and Karlin, 1975). It is assumed that any discrepancy will result in arousal. The arousal stimulates an assessment of the causes of the arousal. Vine postulates that what subsequently occurs depends on the assessments of responsibility for the spatial invasion and its personal significance. Vine argues that people react differently to "neutral thwarting" as opposed to "personal thwarting". Thwarting is used as if it is synonymous with the process of spatial invasion. Personal thwarting is perceived to be directed to oneself, or at least the intruder is seen as personally responsible. Neutral thwarting is situationally necessitated and indiscriminate. At this point, the model diverges significantly from other attribution models. It suggests aversion to either the environment or to the intruder. Following this, coping strategies are developed and perceptions of their success are also considered.

A number of attributional models have been reviewed, (Schiffenbauer & Schiavo, 1976; Patterson, 1976; Worchel & Teddlie, 1976; and Vine, 1982). These models and the subsequent research which has developed from them has been considered. The models are all individual approaches centred around a common theme and sharing a common genesis. That genesis is the relationship between arousal and attribution in the context of crowding. This relationship and its most archetypical manifestation will be considered in detail in the next chapter.

CHAPTER THREE

AN EXAMINATION OF THE TWO-FACTOR MODEL OF CROWDING

The two-factor attributional arousal model (Worchel & Teddlie, 1976) is one of several attributional models. A unique aspect of this model is that it allows for the possibility of misattribution of arousal source leading to a reduction in perceived crowding. Worchel (1978) refers to the possibility of reducing the experience of crowding without increasing the amount of space available to the individual. He regards this as particularly important in view of the fact that on earth we have a finite amount of space, yet the population doubles every 35 years. Thus, the experience of crowding may be reduced by cognitive rather than spatial means (Worchel & Yohai, 1979). For this reason the model warrants careful consideration. First, an overview of the model will be presented. Then, specific elements of the model will be examined and the major research question and rationale for Study One presented.

The two factor model of crowding (Worchel & Teddlie, 1976) identifies invasion of personal space as the spatial variable associated with crowding, and attribution as the cognitive process through which the experience of crowding occurs. It is asserted that arousal will follow an invasion of personal space. Once aroused, the individual will attempt to find an explanation for the arousal. If the arousal is attributed to others being too close, the individual will experience crowding and will subsequently attempt to reduce this negative state. Crowding

is assumed to be an aversive experience, such that its occurrence will immediately result in attempts to avoid, reduce, or limit the experience.

Worchel and Yohai (1979) maintain that the experience of crowding will result in performance decrements on complex tasks and also increased interpersonal hostility. Following the attribution of arousal to crowding, they suggest attention will focus on alleviating the negative state of crowding. This demand on the individual's attention is predicted to cause performance decrements on complex tasks. Presumably these attentional demands are insufficient to cause any disruption to performance on simple tasks, although the distinction between simple and complex tasks is never made clear. Thus, the attribution to crowding implies disrupted performance due to the individual's mobilisation of effort to reduce the negative state. Interpersonal relations are predicted to suffer following an attribution of crowding because the focus on reducing the experience of crowding increases the salience of others in the environment. These others are not only viewed as directly causing the individual to feel crowded but also as frustrating attempts to reduce crowding.

Two methods are proposed for manipulating attributions in order to reduce the experience of crowding. Firstly, it is suggested that this may be effected by reducing the salience of others in the environment. Worchel and Teddlie (1976) interfered with the attribution process by diverting attention away from the other people in the environment. This was achieved by invoking "attribution inhibitors" (placing interesting pictures on the walls of the room, showing a movie, or having

some other distracting event occur). Worchel and Teddlie found that the presence of attribution inhibitors reduced the extent to which subjects reported feeling crowded. Additionally, they found increased performance (on an anagram task) and decreased aggressiveness.

The second proposed method of reducing the experience of crowding involves encouraging misattribution by means of providing an alternative source of arousal. It is possible, of course, that the two methods overlap, as the pictures provided by Worchel and Teddlie (1976) may have had an arousing effect for subjects. Worchel and Yohai (1979) provided subjects with an alternative source of arousal, by misinforming them about being exposed to a "subsonic" (inaudible) yet arousing noise. In fact no noise was used. The expectation of receiving an arousing noise was effective, however, in reducing perceptions of crowding and improving task performance relative to subjects who were provided with no alternative explanation. The authors conclude that the process of attribution is a major component inherent in the experience of crowding.

Diagrammatically the Worchel and Yohai (1979) model may be represented as shown in Figure 1.

Each of the components of this model will now be examined in detail.

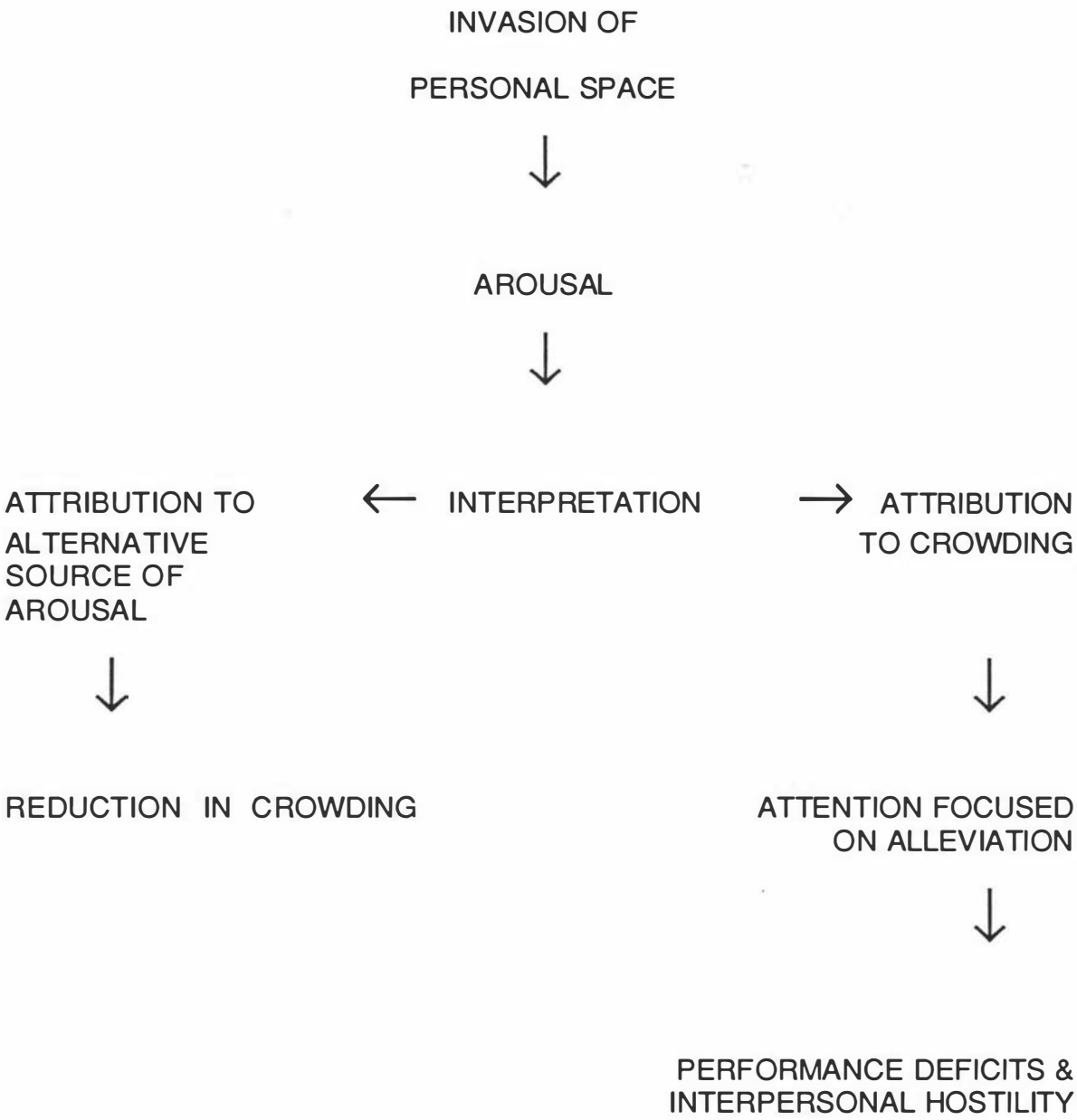

Figure 1. Diagram of the attributional arousal model showing spatial invasion leading to increased arousal and interpretation.

SPATIAL INVASION

Hall (1966) suggests that interactions are characterised by the distance between participants. Appropriate interaction distances will be smaller for friends than for strangers. Stress is predicted to follow violation of the appropriate interaction distance. Research supports the view that spatial violations can create discomfort and arousal. Sommer (1969) found spatial violations resulted in avoidance of eye contact, changing of body position, and physical departure in order to re-establish personal space. Evans and Howard (1973) and McBride et al., (1965) systematically considered the effects of invasion on physiological arousal. For example, in the McBride et al. study, elevated galvanic skin responses were found when the personal space of subjects was violated. In an unusual study, Middlemist et al., (1976) demonstrated that violations of personal space can result in physiological arousal. They hypothesised that arousal, due to spatial invasion, would result in delayed onset of urination. In a men's toilet they used a hidden periscope to measure how long it took men to begin urination and how long they urinated when alone, when another man stood one urinal away, and when another man stood in the adjacent urinal. In accordance with predictions, urination took longer to begin and also lasted less time when someone stood closer.

The personal space approach to crowding implies that arousal may be generated by spatial invasion. Another implication of this approach to crowding is that sex of subject is an important variable. There is some suggestion in the literature that

females have smaller personal spaces than males (Willis, 1966; Aiello & Aiello, 1974; Evans & Howard, 1973). These studies report that males typically feel uncomfortable and may become hostile in high density situations, whereas females do not. Evans and Howard note that research has shown repeatedly that the appropriate interaction distance is smaller for females than for males. That is, the distance at which females feel comfortable when interacting is smaller than the distance at which males feel comfortable. A personal space view of crowding therefore suggests that females would have to be more densely packed together than males before experiencing personal space violations and crowding.

Vine (1982) maintains that crowding involves an invasion of a body-centered personal space zone. This zone is seen as an area which the individual will regard as their own and seek to keep free from unwanted intrusions. Violation is likely to occur when spatial and/or social density is high. Vine argues that the strength of such an approach is that many salient factors influencing perceived crowding operate at the level of the interaction between any subject and specific others. Some of these may apply even in low density situations where no more than two people need be involved. Thus, crowds are not an essential aspect of crowding, since dyadic encounters constitute a microcosm for most types of crowding experience.

The personal space dimension of the experience of crowding has received general support in the research literature. Greenberg and Firestone (1977) found that perceptions of crowding and also the experience of stress could be

instigated by interpersonal intrusion. In an interview situation, subjects whose personal space was intruded (they sat so close their knees were touching), reported increased crowding related stress, and also increased perceptions of crowding. Levitt and Leventhal (1978) found that both density and intrusion of personal space concurrently affected the perception of crowding. Walden and Forsyth (1981) similarly concluded that perceptions of crowding were influenced by interpersonal distance. Those subjects seated closer together rated themselves as more crowded than those subjects seated further apart.

An invasion of personal space is the basic foundation of the two factor attribution model of crowding. The research evidence suggests spatial invasion may produce discomfort and arousal. An implication of the personal space approach is that male subjects, because of their greater spatial requirements, will more easily experience crowding than females. The suggestion being that a more rigorous test of any theoretical predictions should be conducted with female subjects. The personal space view of crowding has received general support in the research literature. It also has the advantage of permitting research into the experience of crowding without requiring crowds of people, a point which has not been lost on those researchers favouring laboratory experiments.

AROUSAL

Worchel (1978) notes that with the exception of Freedman and colleagues (e.g.,

Freedman, 1975) most investigators agree that there is an arousal or stress component in crowding. This comment is not intended to suggest that arousal and stress are the same, but rather reflects the problems inherent in the measurement issues in this area. Worchel's model is predicated on the notion that arousal is involved in the experience of crowding.

Evans (1978) reviews four lines of evidence supporting the notion that crowding is mediated by arousal. Firstly, task performance data are generally in accordance with the Yerkes-Dodson law. Evans suggests the research has indicated slight facilitation or no effects of spatial impingement on simple task performance with decrements on complex tasks under the same conditions. Secondly, the psychophysiological data indicate heightened arousal under conditions of crowding and spatial invasion. These measures include skin conductance, cortisol levels, blood pressure, heart rate and micturation. Thirdly, some of the individual differences found in reactions to spatial limitations are consistent with the proposed arousal mechanism. For example, extroverts allow much closer personal space approaches and become less aroused under such conditions than introverts. Finally, observational data on tension and gaze behaviour are consistent with the view that crowding is mediated by arousal.

Karlin and Epstein (1979) refer to crowding as a "reliable" method for stress induction in humans. Based on the physiological measures alone, they conclude that crowded subjects are almost invariably more aroused than their noncrowded counterparts.

Although there may be some consensus on the apparent involvement of arousal in the experience of crowding, this is not matched by agreement on what actually constitutes arousal under these circumstances. Worchel and Yohai (1979) discuss arousal (without defining it) as being something which results from an invasion of personal space, something which subsequently needs to be explained, and something which if attributed to the closeness of others will be labelled as crowding. They further suggest that misattribution of the cause of arousal can result in reduced reports of crowding. Finally, when presenting their results under the subheading "Arousal" they use the terms **arousal** and **stress** interchangeably, and measure this notion of arousal with one question which asked subjects about the extent to which they felt "relaxed or ill at ease". The interchangeable use of terms may be described as careless and at the very least will do little to foster progress in the area.

Regarding the measurement of arousal, Worchel and Yohai (1979) note that their results apply only to perceived arousal asserting that demonstrations of physiological arousal are unnecessary because perceived arousal is more directly linked to the process of attribution. Worchel and Brown (1984) expand on this point by stating that the model is concerned with how individuals attribute perceived arousal. They note that the relationship between actual and perceived arousal is beyond the scope of the model. They maintain that the attribution process is set into motion by the "perception of arousal". Therefore, it is asserted that the relationship between actual and perceived arousal (despite its importance) has no direct bearing on the question of whether the experience of

crowding is mediated by attributions.

The lack of a clear definition of arousal is regrettable, especially as the concept is a pivotal one for the model. Definitions of arousal are available elsewhere in the crowding literature. For example, Epstein (1980) refers to arousal as a state of activation.

The general conclusion to be drawn from a consideration of the relationship between spatial invasion and arousal is that spatial invasion may result in increased physiological arousal and also increased awareness of physiological indicators such as increased heart rate and skin conductance. Spatial invasion may also be accompanied by feelings of discomfort which may be highly correlated with physiological arousal. The need to explain such arousal is based on the assumption that subjects are careful assessors of their internal arousal states (Schacter & Singer, 1962). Calvert-Boyanowksy and Levanthal (1975) are critical of this assumption particularly as it implies that the same care is not applied to complex external environments. In the context of the two factor model it suggests that possible variables which may well contribute to increased arousal in an experimental setting (for example, uncertainty in the setting and performance evaluation anxiety) will not be seriously considered as potential sources of arousal in the attributional search.

Finally, the model asserts that individuals will need to explain their spatially induced arousal. This assumes that arousal precedes cognition. The reverse

order seems just as plausible, but this possibility is not addressed by the model.

COGNITION

In the diagram of the attributional arousal model (Figure 1) this section is represented as "interpretation". This refers to the cognitive aspects of the model and includes the processes of attribution and attention, and the related issues of pre-exposure information and salience.

Attribution

The two factor model links arousal via the process of attribution to the experience of crowding. If arousal is attributed to other people being too close then crowding will be experienced. However, if arousal is attributed to another source crowding will not be experienced. The model suggests that when arousal is experienced the individual will search the external environment and attribute the arousal to a salient and plausible source which is present. Schacter and Singer (1962) pioneered research which examined the cognitive elements involved in the experience of an emotion. After arousing their subjects with injections of epinephrine, they informed them the drug would either cause them to feel aroused (informed condition), or would have effects other than arousal (misinformed condition), or would have no noticeable effects (ignorant condition). They found subjects were more likely to report emotional states consistent with environmental cues (euphoria or anger) in the misinformed and ignorant

conditions than in the informed and placebo (no drug) conditions. Schacter and Singer suggest that where subjects did not anticipate arousal, it was necessary for them to locate a source in the environment that could be used to cognitively label the internal state. For the informed and placebo conditions, labels were either provided by the experimenter or were unnecessary when no arousal was experienced.

Similar results have been found with situationally induced arousal. In such studies (often referred to as misattribution studies), arousal is induced by leading subjects to expect an imminent environmental stressor (e.g., electric shock). Misattribution is then induced by introducing another possible source of arousal. Behavioural or self report measures are then taken to indicate how arousal has been labelled. Valins and Ray (1967) were able to reduce snake phobias by convincing subjects that their arousal was due to impending electrical shock and not snakes. Similarly, Storms and Nisbett (1970) were able to reduce insomnia by making subjects believe their arousal was due to a placebo pill rather than to their personal problems. Ross et al. (1969) found subjects were more willing to work for monetary reward than escape from impending electrical shock when they were convinced that their arousal was due to the presence of a loud noise rather than the shocks.

The misattribution studies have been criticised by Calvert-Boyanowsky and Levanthal (1975) who suggest the results have been misinterpreted. They argue that no clear evidence exists to show that misattribution was involved in these

studies. Instructions in misattribution studies are designed to affect attributions but they also provide subjects with differing information about what to expect. Calvert-Boyanowsky and Levanthal suggest that it is the difference in information which results in misattribution effects and not actual changes in subjects attributions. They examined this hypothesis and concluded that it was indeed the information in the instructions which accounted for the misattribution effects. They also found that giving subjects accurate information resulted in less anxiety than giving inaccurate information. Similarly, Manstead and Wagner (1981) reviewed the degree of support for Schacter and Singer's (1962) two factor theory (on which the two factor model of crowding is based), and concluded that there is a disconcerting lack of empirical support for the theory. These criticisms imply that the attributional arousal model of crowding may not be based on the most solid of foundations. If in fact, Calvert-Boyanowsky and Levanthal are correct, it may be that the two factor model of crowding is based on a misinterpretation of results.

The idea that the evaluation of crowding may be an attributional response to arousal has developed more recently in the literature (e.g., Worchel & Teddlie, 1976; Worchel & Yohai, 1979). Worchel and Teddlie examined the hypothesis that the addition of attention distractors would alleviate the experience of crowding. The attention distractors were six posters placed on the walls of the experimental room. It was proposed that these would serve as attributional inhibitors and would distract the individual from making the attribution to crowding. Further, it was expected that the pictures would only have an effect for

individuals who were aroused and in a position to make an attribution for the cause of this arousal. In fact, the addition of pictures to the environment had exactly the predicted effect, with the experience of crowding and the stress associated with it both being reduced.

The strength of the Worchel and Teddlie (1976) study is that it directly examines, and subsequently provides support for, the personal space approach to crowding. However, Worchel (1978) acknowledges that this experiment offers only indirect support for the attributional hypothesis. One criticism is that the addition of pictures to the walls may have served to reduce arousal, or that they merely distracted subjects. That is, the pictures could have acted to influence processes other than the predicted attribution - crowding process. Paulus (1980) similarly criticises the attributional approach in noting the difficulty in predicting whether subjects will use density or other "coincident" stimuli for the attribution of their arousal. Paulus also highlights the apparent conflict between the results of the Worchel studies and those of Langer and Seagert (1977) who found that focusing subjects' attention (and presumably attributional tendencies) on density factors reduced the impact of the density.

Worchel and Yohai (1979) designed a study which more directly examined the role of attribution in crowding. They also wished to demonstrate that crowding perceptions could be reduced by allowing subjects to misattribute the cause of their arousal. They reasoned that if subjects were provided with an alternative explanation for arousal, unrelated to crowding, they would be less likely to

attribute the stress caused by violations of personal space to crowding. They had groups of five same sexed subjects sit in a circle. Subjects were seated at either a **close** or a **far** interpersonal distance and were informed that the aim of the study was to test the effects of subliminal stimuli on group performance. A "transmitter" was placed in the corner of the room. In the Arousing condition, subjects were told that a subliminal noise would be played while they worked. They were informed that the noise would be inaudible, but previous studies had shown that it had often caused individuals to experience some discomfort and distress. Identical instructions were issued to the subjects in the Relaxing condition, with the exception that they were told the noise would have a calming and relaxing effect on them. A No - Explanation condition was also run in which subjects were not told of the subliminal noise. Following these instructions, subjects worked on a series of tasks similar to those used by Worchel and Teddlie (1976).

Worchel and Yohai's (1979) results were consistent with their hypotheses (even though they are open to alternative interpretations). Worchel and Yohai interpret their results as supporting the attributional crowding hypothesis; that is, the contention that crowding is experienced through an attributional process, whereby the individual becomes aroused by spatial violation and searches the environment to determine the cause of arousal. When personal space was violated (as in the close condition) the experience of crowding was significantly reduced by providing an alternative explanation for the arousal. These results suggest that the subjects in the arousing condition attributed the cause of their

arousal to the subliminal noise and, therefore, felt less crowded.

Worchel and Brown (1984) showed that misattribution may result from a "pooling" of arousal. They had subjects watching arousing or nonarousing films under conditions of close or far interpersonal spacing. For subjects at close distances those who saw arousing films reported less crowding than those who saw nonarousing films. Worchel and Brown interpret this to mean that the spatially induced arousal was attributed to the films and thus the experience of crowding was reduced. Again the results are open to alternative interpretations. It could be, for example, that showing films of explicit sexual acts or the severe beating of a boxer were simply more involving or demanding of viewers attention than a film about ecological evolution. Such an involvement or attention hypothesis would suggest that viewers seeing "arousing" films were less concerned about those seated next to them. This possibility would not rely on arousal mechanisms or attributional processes, neither of which were actually demonstrated by Worchel and Brown.

Aiello et al. (1983) report a study in which subjects in conditions of high spatial density were exposed to humour and unlike the Worchel and Brown (1984) study found that these subjects reported feeling **more** crowded and confined. According to the two-factor model the humour should have provided the plausible alternative explanation for arousal and served to reduce perceptions of crowding. Accordingly, this study provides no support for the two-factor model.

There is mixed support for the role of attributions in the process of crowding. In a nutshell, the two factor model suggests that even when there exists sufficient spatial conditions for crowding, the attributions which individuals make about their state of arousal will determine whether or not they feel crowded (Worchel & Brown, 1984). One criticism of the two factor model is that it overemphasises the role of cognitive processes. It seems possible, for example, for individuals to feel crowded because they observe themselves to be part of a crowd. Such a possibility places the experience of crowding within the context of a crowd, without necessarily relying on either arousal or cognitive processes which may or may not operate.

Attention

One of the implications derived from the two factor model of crowding concerns the apparent plasticity of attributions. Worchel and Teddlie (1976) suggest that these attributions may be moulded by either redirecting the individual's focus, or by providing alternative "explanations" for arousal. A key assumption underlying this suggested plasticity is that attention directs the focus of attributions.

The effect of crowding on attentional processes is the basis of the overload theory of crowding (Milgram, 1970). Other researchers have also documented the role of attention. Baum and Greenberg (1975) found withdrawal and decreased attention to others among subjects who were anticipating a crowded situation. Heller, Groff, and Soloman (1977) suggest that in high density

conditions individuals have greater demands placed on their attention and information processing capacity. Specifically, they suggest an increased need to monitor the activities of others. From such increased attentional demands, they predict decrements in other cognitive activities. Cohen and Spacapan (1978) discuss an attentional interpretation of the aftereffects of stress. They postulate a cognitive fatigue explanation to account for the finding that crowded subjects were subsequently less likely to help than noncrowded subjects.

Evans (1979) discusses the relationship between arousal, attention and task performance. He explains the effect of overarousal on complex tasks as resulting from high arousal causing a focusing of attention. Attention is focused such that it is allocated only to the more important information cues in the task. Complex tasks involve a greater number of relevant cues than simple tasks, and under conditions of high arousal it is more likely that one of the salient cues will be ignored thus creating a decrement in task performance. In simple tasks the focusing on more important information is less likely to result in the lack of attention to salient cues, since it is likely that there will be less of these.

The two factor model of crowding similarly draws on attentional processes. Worchel and Yohai (1979) suggest that following the attribution of arousal to the closeness and presence of others (crowding), attention will be focused on alleviating this presumably aversive state. This attentional demand will result in both performance decrements and interpersonal hostility.

In sum, the two factor model assumes the plasticity of attributions to be directed by the focus of attention. Crowding is assumed to result in attentional demands, which may induce some negative consequences and may further set the stage for attributional manipulation.

Information

Langer and Saegert (1977) reduced the stress associated with crowding by presenting pre-exposure information which created the expectation of arousal. This information ameliorated the aversiveness of crowding for those who were exposed to it. The information one has prior to the experience of crowding can exert a powerful effect on the actual experience.

In Worchel and Yohai's (1979) study, informing subjects that environmental factors would arouse them did not reduce their experience of crowding when they suffered no personal space invasion. In fact, this information tended to make subjects feel somewhat more crowded. However, when spatial violations were involved, this alternative explanation for arousal significantly reduced the experience of crowding.

Informational manipulation was also used to good effect in Fisher and Baum's (1980) study. In the context of anticipatory crowding they assessed the effects of two control relevant messages with a different informational focus. The foci were either situational ("others will be close and may bump into you") or emotional,

("you may be uncomfortable because others will be close to you"). They predicted situationally focused information would be more effective in reducing the impact of high density because of the salience of external threats in many crowded settings. This prediction was confirmed, as was the second hypothesis which predicted that emotionally focused information would elicit reduced labelling of the context as crowded because emotionally based messages were expected to shift the locus of attribution for discomfort away from the external environment. Situationally relevant information led to an environmentally based attribution for the discomfort (crowding).

Wener and Kaminoff (1983) manipulated information by way of signs in a field setting. Providing accurate information resulted in significantly reduced perceptions of crowding, discomfort, confusion and anger.

In sum, the evidence reviewed suggests that information has an important role to play in the experience of crowding. While Worchel and Yohai (1979) provided bogus information about an alternative source of potential arousal with the effect of reducing perceptions of crowding, other studies have similarly reduced the negative aspects of crowding by the provision of accurate information about the nature of the crowding experience. This highlights the possibility that Worchel and Yohai may have utilised an independent variable which they interpret within a particular framework, while the same manipulation may be open to quite a different interpretation. In other words the informational studies provide evidence to suggest that subjects respond directly to information, without the need to

invoke attributional interpretations.

Salience

Fiske and Taylor (1984) define salience as a stimulus property that attracts an observer's attention. Pryor and Kriss (1977) also link salience to attention in noting that when something is salient it receives a disproportionate amount of attention relative to its context. Further, they relate salience to attribution by proposing that people, or environmental entities that are salient, will receive more causal ascriptions or attributions.

Taylor, Crocker, Fiske, Sprinzen, and Winkler (1979) suggest that salient social stimuli also have a disproportionately large impact on the judgement process (even though such stimuli may be logically uninformative or even irrelevant). They suggest that, generally, the form of the salience effect is that people attribute causality to the stimuli that engulf their attention. Taylor and Fiske (1978) discuss salience as a "top of the head" phenomenon. They suggest people do not view all the evidence that may bear on a particular problem. Instead they frequently use the information which is most salient or readily available to them, that is, that which is most easily brought to mind. They also maintain that salience of information has a direct bearing on causal attributions....."we believe that the causal attributions people make .... are often shaped by seemingly trivial but salient information" (p.253). This view is later summarised (Fiske & Taylor, 1984) by their conclusion that, generally speaking,

causal attributions follow the focus of attention.

PERFORMANCE DEFICITS AND INTERPERSONAL HOSTILITY

Worchel and Yohai (1979) hypothesise that the experience of crowding will result in performance deficits on complex tasks and also increased interpersonal hostility. Following the attribution of arousal source to the closeness of others (crowding), attention will be focused on alleviating this negative state. This attentional demand will be disruptive to task performance because the individual will mobilise efforts to reduce the negative state. Interpersonal relations are predicted to suffer similarly because the focus on reducing the experience of crowding increases the salience of others in the environment. These others are thus seen as directly causing the individual to feel crowded and, in some cases, frustrating attempts to reduce crowding.

Worchel (1978) cites evidence (Evans, 1975; McClelland, 1974) which suggests that crowding does interfere with the performance of complex tasks, whereas it has little deleterious effect on more simple tasks. This generalised view of crowding-induced decrements on complex but not simple tasks is endorsed by Walden and Forsyth (1981).

Worchel (1978) explains the reasoning behind the prediction of increased interpersonal hostility as being a result of others frustrating individual attempts to

restore personal space. This frustration is thought to lead to an increase in hostility and possibly aggression. Support for this prediction is mixed, with both supporting evidence (Hutt & Vaizey, 1966; Evans, 1979; Worchel & Yohai, 1979) and nonsupporting evidence (Loo, 1972; Stokols, Rall, Pinner, & Schopler, 1973; Aiello, DeRisi, Epstein, & Karlin, 1977).

This chapter has examined details, background and research evidence relevant to the elements of the two factor model of crowding. The notion that spatial invasion is involved in the experience of crowding has received considerable support in the literature. The two factor model holds that spatial invasion will result in increased arousal, and the literature provides some support for that relationship. The model maintains that accompanying arousal is the need to explain the source of arousal. This assumption has been criticised. Explanations of arousal will be sought via the attributional search, with the possibility of misattribution highlighted by the model. The misattribution of arousal has been questioned as being open to the more parsimonious interpretation that subjects respond directly to the information provided. This interpretation will be developed more fully in the next section which will discuss the rationale for Study One.

RATIONALE FOR STUDY ONE

Worchel and Yohai's (1979) attributional model suggests the arousal which follows a spatial invasion will be misattributed to an alternative source of arousal (provided a plausible alternative is present) rather than being correctly attributed

to the actual source. Further, it is suggested that in the absence of such an alternative, performance deficits and interpersonal hostility will be apparent. These are regarded as the negative aspects of experimental crowding. One unique aspect of the model is the role of attributions, specifically, the apparent ease with which misattribution may be induced. The model predicts that given a plausible, alternative source of arousal, subjects will make the attribution to that source rather than to the fact of being exposed to a spatial invasion. The basis for this prediction is open to criticism.

In the Worchel and Yohai (1979) study subjects in the NOISE AROUSING condition reported lower perceptions of crowding when compared with two other conditions, a no information (CONTROL) condition and a NOISE RELAXING condition. The criticism stems from the fact that subjects in the noise relaxing condition were likely provided with an explanation which was highly implausible! The implausibility of this explanation comes about because subjects in the CLOSE (crowded) condition were, in all likelihood, aroused yet the "plausible alternative" with which they were provided informed them they should be feeling relaxed. The point being that this information is discordant with the reality of their experience, and is therefore not a plausible alternative to which they could reasonably attribute their arousal. In its simplest form this criticism implies that Worchel and Yohai's subjects may have opted for the bogus noise alternative because it was the only salient explanation for their arousal. Subjects were made acutely aware that the noise might influence their arousal level while they remained unaware that a spatial invasion could have the same effect.

The specific mechanisms through which an alternative explanation for one's arousal become established remain unclear. One question which arises from such consideration is: Why do subjects opt for a plausible alternative to which they may attribute arousal, rather than the **actual** source?.

The model predicts that subjects will attribute their arousal to plausible alternative sources (as if it is safe to assume that subjects will be blind to the actual source), but offers no explanation as to **why** this should occur. Theoretically, this question is of interest since the answer is likely to have a direct bearing on the basic tenets of the model.

One reason why misattribution may occur stems from the fact that people are typically unaware of their spatial behaviour (Holahan, 1982). Paulus, Annis, Seta, Schkade, and Mathews (1976) in discussing the lack of consistent effect of density on affect, similarly raise the possibility that density may result in psychological effects "without involving subjective awareness". This implies that spatial behaviour is a subtle aspect of interpersonal relationships, with people being unaware of the influence of spatial factors. This point was not lost on the "father" of proxemics. Hall's (1959, 1966) book titles, (**The silent language**, and **The hidden dimension**) reflect both the obvious public elements of spatial behaviour and also the more private concealed aspects.

If it is the case that people are by and large unaware of the importance of spatial factors on behaviour then it seems reasonable to assume that when an

alternative source of arousal is present, this will take precedence over spatial sources as these are typically unavailable to subjects' awareness. The view being expressed here is that alternative sources of arousal are only accepted because they are made more salient than the actual arousal source. Another way of expressing this point is to suggest that it is not the plausibility of the alternative that has been examined, but rather the salience of the alternative. In brief, misattribution results from a process which has the focus of attention being directed towards the alternative, and therefore away from the actual source of arousal.

The finding that misattribution results from the manipulation of the salience of possible sources of arousal would represent a significant contribution to the literature. One aim, therefore, of the first study was to examine the role of salience of information about arousal sources. This contribution would add to our understanding of the experience of crowding itself. Such knowledge would also serve as a theoretical contribution in helping to answer a question which is currently unanswered by the two factor model. Finally, information of this nature would make a useful contribution to the existing literature on causal attribution.

To examine the effects of the salience of arousal sources, Study One employed four information conditions (CONTROL, NOISE, DISTANCE, NOISE + DISTANCE). The first two conditions, control and noise salient, served to replicate the two essential conditions of the Worchel and Yohai (1979) study. In accord with the replication, it was predicted that crowded subjects from the noise

salient condition would feel less crowded than their counterparts from the control condition. In order to assess more closely the need for an alternative source of arousal the distance condition was run. The interest here was to look at the effect of providing subjects with a possible source of arousal which was **not** an alternative. The distance information was intended to make salient the spatial factors which were operating in the situation. The model suggests only that plausible alternative sources of arousal will result in reduction of the perceptions of crowding. It was hoped to show that a non-alternative source of arousal, presented plausibly and with equal salience, could also result in reduced perceptions of crowding. Such a demonstration would add support to the notion that it is salience rather than "alternativeness" which is important, and also that (given the condition of plausibility) the content of informational messages is less important than the form.

Support for this suggestion comes from Langer, Blank, and Chanowitz (1978) who showed that subjects are willing to use information provided, as long as it fits an appropriate "script". Langer et al. contend that pseudo-thinking is more the rule than the exception for practically all verbal and nonverbal behaviour. Provided the structure (form) of the message is congruent with one's past experience, it may occasion behaviour mindless of relevant details. The point being that subjects in the Worchel and Yohai (1979) study may have processed information about the arousal properties of the "noise" quite mindlessly and uncritically, accepting it at face value.

Another aim of Study One was to examine the effect of reducing the salience of the "plausible alternative". This was done by including a dual salience condition with two information foci, (NOISE + DISTANCE). Thus, subjects were informed that both bogus noise and the spatial factors operating could result in arousal. This condition allowed the opportunity to examine whether providing subjects with two salient information sources would produce an additive effect. If this were so, then providing both sources of information should result in less perceptions of crowding than either source of information alone.

CHAPTER FOUR

METHOD

OVERVIEW AND DESIGN

The experiment was a 2 (distance) x 4 (information) factorial design. Subjects were run in groups of five, with allocation to groups being on the basis of availability. Once constituted, groups were then randomly assigned to one of the eight conditions.

SUBJECTS

The subjects were 320 female volunteers solicited from introductory level university papers (Psychology, Education, Nursing and Business). Female subjects were chosen because they were available in greater numbers and also because they would provide a more rigorous test of the model. Subjects were run in groups of five, with group members being previously unacquainted. The nonacquaintance of subjects was previously used by Worchel and Yohai (1979). Other research (Cohen, Sladen, & Bennett, 1975; Rotton, 1987) has suggested that nonacquainted subjects are likely to experience more crowding than subjects who are friendly.

Groups of five were used as this replicated the size of the groups employed by Worchel and Yohai (1979). Within the experimental crowding literature the size of groups has varied between three (Burger, Oakman, & Bullard, 1983) and 10 (Nagar & Pandey, 1987). Numerous studies have used groups of four (e.g., Karlin & Epstein, 1979). A number of studies have had groups of five (e.g., Klein & Harris, 1979), while the most popular number employed in small group crowding research is six (for example, Walden & Forsyth, 1981).

The students were approached in class where they were informed of the requirements of the study, and in line with Tesch's (1977) recommendation they were also advised of the possible benefits of participation. Specifically they were informed that the study was looking at group performance and would take approximately 45 minutes. They were also told that the study would provide them with the opportunity to experience the role of the research subject and they would see how laboratory experiments are conducted with human subjects. Those volunteering completed a consent form on which they supplied their names and telephone numbers with the understanding that they would be contacted at a later date to arrange a suitable time to complete the experimental procedure. The volunteers were also told to expect to receive by post a summary of the results on the completion of the study.

EXPERIMENTAL MATERIALS

The **experimental room** was a small (2.75 m x 2.47 m x 2.42 m high) internal

room, without windows. On the door was a sign, "Small Group Research Lab". The room was furnished with five armless chairs, arranged in a closed circle in the center of the room. In the center of the circle and suspended from the ceiling was a microphone. The microphone was suspended 63 cm below the ceiling and was clearly visible when subjects entered the room. In one corner of the room was a large speaker clearly labelled "NOISE TRANSMITTER". On an adjacent shelf was a noise generator labelled "NOISE GENERATOR". A small tape recorder was also positioned on the shelf.

The **experimental pre-instructions** (see Appendix A) were pre-recorded and for each group one of four sets of pre-recorded instructions were used. The four sets of pre-instructions corresponded to the four information conditions which were **NO EXPLANATION, DISTANCE EXPLANATION, NOISE EXPLANATION,** and **DUAL** (distance plus noise) **EXPLANATION**. The **no explanation** condition served as a control condition. The subjects were thanked for volunteering for the study which, they were told, was to examine group performance and group interaction. Subjects in the **distance explanation** condition were told the same, but were also told that the study would be examining the effects of interpersonal distance on behaviour. They were informed that the distances involved may cause them to feel stressed and uncomfortable. The **noise explanation** condition was the same as the no explanation condition. Subjects were thanked and told that the study was examining group performance and interaction. Additionally, subjects in the noise explanation condition were informed that the study was looking at the effects of subliminal noise on behaviour. Subjects were

led to expect an inaudible noise and were informed that it may cause them to feel stressed and uncomfortable. Finally, the **dual explanation** instructions began in the same manner as the no explanation condition, but in addition subjects were informated that the study was interested in examining the effects of both interpersonal distance and subliminal noise on behaviour.

Five **identification badges** (labelled "A" to "E") were issued, one to each of the subjects. These identification badges were used to help the subjects identify individuals later when they were completing the ratings included in the post-experimental questionnaire.

A **group word task**, identical to that used by Worchel and Yohai (1979), involving the extraction of words from a master word was used as a measure of group performance. Subjects were required to derive as many words as possible from the master word, OBSERVATIONALLY.

A **group discussion/decision task**, Johnny Rocco (Ward, 1970) and the accompanying decision scale (Love-Punishment scale), was used. This task was the same as employed by Worchel and Yohai (1979). The task involved reading a case study about a young offender, Johnny, and then making a decision about the most preferred manner of treating Johnny.

The **post-experimental questionnaire** consisted of a 20 item questionnaire (see Appendix B). These questions were based directly on the questionnaire used by

Worchel and Yohai (1979), which examined reactions to the experiment, the room and fellow group members. Responses to these questions formed the key dependent measures of arousal and crowding.

Affect measurement employed the Multiple Affect Adjective Check List (MAACL: Zuckerman, Lubin, & Robins, 1965). The MAACL elicits self report ratings of Depression, Anxiety and Hostility. It comprises 132 adjectives which are arranged alphabetically. Of these, 21 items assess Anxiety, 40 assess Depression and 25 items assess Hostility. There are 23 buffer items which are unscored.

The Today form of the MAACL was used as this instructs subjects to respond in terms of their immediate feelings. In the review by Kelly (see Buros, 1972), the reliability of the MAACL (odd-even and plus-minus) is reported as ranging between .17 and .92, with the median being .72. The checklist therefore possesses reasonable internal consistency.

On a more cautionary note, Kelly (see Buros, 1972) is critical of the fact that in spite of no item being scored on more than one scale, the intercorrelations among the three scales are very high. The reported intercorrelations are in fact as high as their reliabilities. The high intercorrelations among the three affect scores may reflect true intercorrelations between anxiety, hostility and depression, or may reflect a lack of discriminant validity.

In considering the validity of the instrument, Megargee (see Buros, 1972) notes that much of the research dealing with the validity of the MAACL has consisted of administering the instrument under conditions likely to elicit the relevant affective states and comparing the scores with those obtained under normal conditions. The MAACL has been used in a number of settings. Students have been tested before and after examinations, military personnel have been tested during basic training and actors have been tested prior to going on stage. Hypnotically induced mood states, sensitivity training, stress interviews, tranquillising medication and induced relaxation have been used to alter mood, and concomitant changes in MAACL scores have been noted. Megargee concluded that, by and large, the results of these studies had been positive.

Kelly (in Buros, 1972) also highlights the problem of acquiescent response set. Kelly cites a study by Siller and Chipman (1965) which reported correlations of .05 to .48 between MAACL anxiety scores and various measures of acquiescence. Of even more concern, according to Megargee (in Buros, 1972), is Herron's (1969) report that a set to respond with too many or too few adjectives contributes a significant proportion of the variance on the MAACL.

The MAACL has previously been used in crowding research. Zeedyk-Ryan and Smith (1983), for example, found increased hostility in subjects who experienced increased social density.

PROCEDURE

Due to the replicative aspect of the current study and the desirability of avoiding confounds, the procedure for this study was modelled as closely as possible on Worchel and Yohai (1979).

Subjects were telephoned to arrange a convenient time. This time had to be suitable to the other members of the group. For this reason the allocation of subjects was not random but rather more haphazard. This arrangement was often made several days in advance of the actual meeting time. In order to increase attendance, all subjects were telephoned on the eve of the appointed time to remind them of the time of the meeting. This precaution was taken to avoid only four of the five subjects attending. Where this did happen the four subjects were dismissed and another time was rescheduled.

On arrival, all subjects were met by the experimenter and introduced to the female experimental assistant. At this point the procedure was conducted solely by the assistant who was blind to the experimental hypotheses. This precaution was taken to avoid the possibility of experimenter bias. Subjects were shown into the experimental room and each given an identification badge to pin on.

The experimental assistant had previously been provided with a prearranged randomly allocated schedule of experimental conditions. These conditions applied to the two independent variables, DISTANCE and INFORMATION. The

distance variable was either **close** or **far**, while the information variable was operationalised by reference to one of the four prerecorded sets of taped instructions. In the **far** condition the front legs of adjacent chairs were spaced 51 cm apart. In the **close** condition the front legs of each chair were touching those of the adjacent chairs. In this close condition the assistant drew back one of the chairs to allow four of the subjects to be seated, and once the fifth subject was seated her chair was moved in to complete the circle. The knees of subjects in the close condition were thus touching the knees of the subjects either side of them.

Once seated the following instructions were read to all subjects:

> "Do not move your chairs because the session is being recorded, and the chairs have been carefully placed to ensure optimum recording quality. This is important because later we will be analysing voice levels."

Following the request to retain the seating positions, subjects were played one of the four sets of pre-instruction information (Appendix A). The four information conditions were **NO EXPLANATION, DISTANCE EXPLANATION, NOISE EXPLANATION,** and **DUAL** (distance plus noise) **EXPLANATION.**

Following these pre-instructions subjects were asked to begin the first task, which was to derive as many smaller words as possible from the master word (OBSERVATIONALLY). Subjects were asked to work together to produce a

single list, and the task was limited to 10 minutes. One subject acted as recorder and was provided with a clipboard, paper and pen. After checking to ensure that all subjects understood the instructions, the assistant left the room returning 10 minutes later.

On returning, the experimental assistant collected the word list and introduced the next task. This task involved both individual and group decisions concerning the best treatment for a juvenile (Ward, 1970). Subjects were each given a case history and a copy of the love/punishment scale. This scale lists seven alternative treatments which range from extending love and understanding at one extreme to a punitive option at the other extreme. Subjects were asked to read the case history and then indicate which of the available options they favoured by circling one of the numbers corresponding to each option. Following the collection of the individual decisions, subjects were asked to discuss the case as a group for five minutes and arrive at a group consensus. The experimental assistant then left the room for a period of five minutes, whereupon she returned and recorded the group decision.

The final task in the experimental room was to complete a copy of the MAACL. Following this the subjects were taken to an adjacent room containing desks and chairs and asked to complete the 20 item post-experimental questionnaire.

On completion of the post-experimental questionnaire, the experimental assistant thanked the subjects and left the room, to be replaced by the experimenter who

then debriefed the subjects and answered any questions. All subjects were then thanked for their participation, and asked to respect the confidentiality which the study required. Many of the research subjects were living in the same hostels and this precaution therefore seemed necessary.

ETHICAL CONSIDERATIONS AND DEBRIEFING

The principal deception in this study was that subjects were not informed that they would be seated (as half of them were) at an unusually close distance to others. This deception amounted to telling subjects that the study was interested in group performance when in fact the key interest was in group performance under specific environmental conditions. This deception was necessary because to provide complete informed consent would have seriously compromised the internal validity of the study. Thus, partial informed consent was employed, with the provision that any obvious expression of discomfort displayed by subjects was to be immediately attended to by the experimental assistant. In extreme cases it was thought that the group might have to be disbanded if a subject was in any way distressed by the closeness involved in the experimental procedure. In practice this eventuality never occurred.

In addition, subjects were fully debriefed. Debriefing procedures may be considered (e.g., Tesch, 1977) as little more than an article of professional faith. The extent to which such procedures may vilify the deceptions, or function

remedially to somehow undo any ill effects which may have resulted, are questionable. However, the procedures employed should address the issues of ethics, methodology and education. Accordingly, the debriefings considered the issue of deception. Its use was explained and justified. All aspects of the methodology were also considered and finally the key aims of the research were explained. Subjects were encouraged to raise any concerns or ask any questions. They were also asked, in the case of subjects in the close condition, about the extent to which they felt uncomfortable in the situation with their knees touching the knees of two other strangers for the duration of the experiment.

Finally, the subjects were informed that at the conclusion of the experiment and when the data had been analysed they would be sent a copy of these results in summary form (see Appendix C). This was designed to maximise the educational value of participation in this research. Following this, subjects were thanked and dismissed.

UNIT OF ANALYSIS

One issue which has a bearing on the results of any crowding research is that of unit of analysis. In studying the phenomenon of crowding, is it best to examine the individual's experience within the crowd, or is it better to examine the effect of the experience on the group as a whole? In short, should the individual or the group be the unit of analysis? If the group is used as the unit of analysis this

involves summing the data from the individual members of the group and dividing by the number of group members. Thus, if the group is the unit of analysis the data to be analysed are a smaller number of group means. An individual analysis simply involves using each individual group member's data.

One of the problems in studying crowding is that such research is very subject demanding, especially when the group is employed as the unit of analysis. As previously mentioned, there are difficulties in recruiting and scheduling groups of subjects, particularly if large numbers of subjects are required. One way of overcoming this would be to run a small number of groups and use the individual subject as the unit of analysis. The efficiency afforded by individual analysis has previously been employed (Aiello et al., 1977 ; Epstein & Karlin, 1975), but only after tests for the equality of groups within treatments had been performed and yielded no significant differences. Such tests provide some support for the view that the assumption of independence had not been defied. Also, in these studies, data were collected individually after leaving the experimental room; thus, there was no interaction during measurement. Jain (1987) included only one group (comprised of ten members) in each of four experimental conditions and analysed results on the basis of the individual as the unit of analysis. Subjects were instructed not to talk to each other, thus reducing the chance of interaction and presumably also attempting to preserve their independence. Zeedyk-Ryan and Smith (1983) conducted an individual analysis without taking either of the above precautions.

A more conservative, and indeed more popular, approach is to use the group as the unit of analysis. Most experimental studies of crowding employ this approach. Epstein and Baum (1978) maintain that whenever the possibility of group members influencing one another exists the group should be the primary unit of analysis. The group as the unit of analysis was used in the current study as, unlike the studies which have used an individual analysis, subjects were required to engage in interactive tasks which increased the possibility of non-independence between individuals. It would have seemed unreasonable to have subjects engage in dependent activity, and then to have treated the data as if the assumption of independence had not been defied. In addition, the previous research by Worchel and Yohai (1979) used the group as the unit of analysis.

The possibility of employing noninteractive tasks was also considered, but dismissed on the grounds that this would have served to enhance the artificiality of the situation.

CHAPTER FIVE

RESULTS

For each of the key dependent variables a 4 (information salience) x 2 (distance) analysis of variance was calculated. Planned comparisons (Rosenthal & Rosnow, 1985) were used to examine specific predictions. Data were analysed using the Statistical Package for the Social Sciences (Norusis, 1985). Decisions concerning statistical significance were guided by the convention of $p < .05$. Summary ANOVA tables are included in Appendix D.

AROUSAL

The two factor theory of crowding predicts that crowding will result in subjects being more aroused than their noncrowded counterparts. It was therefore predicted that crowded subjects would manifest higher levels of arousal than noncrowded subjects. Worchel and Yohai (1979) measured arousal as being subjects' responses to the question of how "relaxed or ill-at-ease" they felt. The current study used the same measure. The mean ratings for arousal are provided in Table 1.

Crowded subjects (those in the close condition) were not significantly more aroused than their uncrowded counterparts, $F(1,56) = 1.91$, ns. Surprisingly, this

study was unable to show that crowded subjects were any more aroused than uncrowded subjects.

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR RATINGS OF AROUSAL

Distance	Information Salience			
	Control	Noise	Distance	Noise & Distance
Close	3.90 1.67	4.58 0.83	3.65 1.70	4.13 1.21
Far	4.18 0.64	4.18 0.92	3.25 1.04	3.58 0.68

Note: 1 = Relaxed, 10 = Ill at ease. N = 8 for all cells.

CROWDING

To assess perceptions of crowding, subjects were asked both how crowded and how confined they felt. Again, this parallels the measures used by Worchel and Yohai (1979). Table 2 clearly shows that subjects seated at the close interpersonal distance felt more crowded than those subjects seated at the far interpersonal distance. There was a highly significant main effect for the interpersonal distance manipulation, $F(1,56) = 65.15$, $p < .001$. (Note that where "p = " is used this result has come from the Anova table, Appendix D, and where

"p <" is used this signifies that the result of a specific comparison has been extracted from an appropriate table of values. The one exception is when the p value is taken from the Anova table and reads "p = .000" . In this instance the result is changed to read "p < .001"). The means collapsed across information salience conditions were (Close = 6.32, Far = 3.43).

TABLE 2

MEANS AND STANDARD DEVIATIONS FOR RATINGS OF CROWDING

Distance	Information Salience			
	Control	Noise	Distance	Noise & Distance
Close	7.13 1.35	6.65 1.19	5.75 2.01	5.75 2.04
Far	2.95 0.67	3.90 0.56	3.98 1.24	2.90 0.74

Note: 1 = Not at all crowded, 10 = Very crowded

The following results consider only subjects from the close conditions as the remaining predictions all concern the relative effectiveness of various forms of information in reducing the impact of crowding. These predictions do not, therefore, apply to the noncrowded subjects.

It was predicted on the basis of the two factor model that the noise salient information condition would report less crowding than the control condition. This

prediction was examined by a planned comparison between these two conditions, but failed to reach significance, $F < 1$. One of the principal predictions of this study was that making the effects of distance manipulations known to subjects would have the effect of reducing the extent to which they felt crowded. A planned comparison examined the difference between the control and distance salient information conditions. Subjects in the close distance salient information condition reported feeling less crowded (mean = 5.75) than subjects in the close control condition (mean = 7.13). This difference was in the expected direction but failed to reach significance, $F(1,56) = 3.69$, $p < .10$. The expectation that distance salient information, being more plausible than the (bogus) noise salient information, would result in less crowding was unsupported $F(1,56) = 1.58$, ns. Finally, it can be seen from Table 2 that combining both noise and distance information failed to decrease the experience of crowding compared to either condition alone.

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR RATINGS OF CONFINEMENT

Distance	Information Salience			
	Control	Noise	Distance	Noise & Distance
Close	6.35 1.25	5.83 1.24	4.70 1.92	5.68 2.07
Far	4.23 0.92	4.48 1.49	4.15 1.23	3.65 0.82

Note: 1 = Not at all confined, 10 = Very confined

The means for the ratings for confinement are provided in Table 3. In general, these results parallel those obtained for crowding. Subjects in the close condition (mean = 5.64) reported feeling significantly more confined than subjects in the far condition (mean = 4.12). The ANOVA for confinement showed a significant main effect for the distance manipulation, $F(1,56) = 15.74$, $p < .001$.

Considering only the crowded (close) subjects, the relative reduction in confinement for the noise salient condition when compared to the control condition failed to reach significance, $F < 1$. This result mirrors the result for crowding. Taken together, these two results highlight the failure to replicate one of the fundamental aspects of the Worchel and Yohai (1979) study. However, unlike the crowding measure, the relative reduction in confinement experienced by subjects in the distance salient information condition when contrasted with the control condition was significant, $F(1,56) = 4.68$, $p < .05$. Although the distance salient information condition did result in lower ratings of confinement than any other condition, the difference between this and the noise salient information condition was not significant, $F(1,56) = 2.18$, ns. As with the crowding measure, the dual salience (crowding and noise) information condition failed to produce any significant differences when contrasted with the other information conditions.

PERFORMANCE

The performance measure was the same as that used by Worchel and Yohai

(1979), that is, the number of words derived from the master word. The two factor theory clearly predicts performance deficits for subjects in crowded conditions. Contrary to this prediction, subjects in the close conditions performed no differently (mean = 98.41 words) when compared to subjects in the far conditions (mean = 97.31 words). Means for the measure of performance are provided in Table 4.

TABLE 4

MEANS AND STANDARD DEVIATIONS FOR THE NUMBER OF WORDS DERIVED FROM THE MASTER WORD

Distance	Information Salience			
	Control	Noise	Distance	Distance & Noise
Close	102 22.98	96 16.53	104 8.61	92 11.11
Far	103 8.65	85 12.12	98 11.48	103 16.02

Note: means rounded to the nearest number of words.

Information provided to subjects in the noise condition seemed to have an effect on the performance of these subjects when compared to those subjects in both the control and distance conditions. The comparisons supported this with noise condition subjects showing a performance deficit when compared to control condition subjects, $F(1,56) = 4.96$, $p < .05$. This performance deficit also was

apparent when noise condition subjects were compared to the distance condition subjects, $F(1,56) = 4.07$, $p < .05$.

INTERPERSONAL RELATIONS

The two factor model predicts that the experience of crowding will result in increased hostility. Five separate dependent measures were investigated in order to test this prediction : punitiveness (Johnny Rocco), ratings of friendliness and aggression toward fellow group members, the extent to which other group members were liked, and MAACL hostility scores.

Surprisingly, subjects who were crowded (close condition) were no more punitive (mean = 2.80) in their treatment of Johnny Rocco than were uncrowded (far condition) subjects (mean = 2.60). Although in the expected direction, the main effect for distance failed to reach significance, $F(1,56) = 2.38$, $p = .13$. However, the main effect for information was of borderline significance, $F(1,56) = 2.69$, $p = .06$. On closer examination, using specific contrasts for the crowded subjects only, a significant difference emerged in the comparison between close distance (mean = 2.55) and close control subjects (mean = 3.00), $F(1,56) = 4.31$, $p < .05$. Informing subjects about their crowding experience in advance resulted in them treating Johnny Rocco less punitively than the control subjects who were not provided with the same information.

The results for ratings of friendliness of other subjects also failed to support the

model. Crowded subjects rated their fellow group members to be no less friendly (mean = 7.59) than the uncrowded subjects (mean = 7.53).

Similarly, no differences were evident on the measure of perceived aggressiveness of other group members. Crowded subjects rated their fellow group members to be no more aggressive (mean = 6.97) than their uncrowded counterparts (mean = 7.06).

The lack of support for the two factor model was further confirmed by a consistent lack of differences between crowded and uncrowded subjects on the final two measures of interpersonal relations. On the measure of liking for fellow group members, crowded subjects indicated only marginally less liking for other members of their group when compared to uncrowded subjects, $F < 1$. The respective means were 7.07 for crowded subjects and 7.26 for their uncrowded counterparts. On the Hostility scale of the MAACL, crowded subjects were only marginally more hostile than the uncrowded subjects, but the difference was not significant, $F(1,56) = 1.61$, $p = .21$.

Collectively, these five measures have failed to establish any differences in the way in which crowded subjects responded to others when compared to uncrowded subjects.

OTHER MEASURES

The effectiveness of the interpersonal distance manipulation was supported by the finding that crowded subjects regarded themselves as less comfortable (mean = 5.03) than uncrowded subjects (mean = 4.28), $F(1,56) = 6.24$, $p = .02$. Not only did the interpersonal distance manipulation result in subjects feeling crowded, but they also felt less comfortable (as may be expected if subjects were truly crowded). Similarly, in the case of the other two affective scales (Depression and Anxiety) crowded subjects scored more highly than uncrowded subjects. Crowded subjects reported increased levels of depression (mean = 15.05) when compared to uncrowded subjects (mean = 13.56), $F(1,56) = 5.35$, $p = .02$. The increases on the Anxiety scale of the MAACL also suggested that crowded subjects reported feeling more anxious (mean = 7.10) than their uncrowded counterparts (mean = 6.38). This difference was of only marginal significance, $F(1,56) = 3.63$, $p = .06$

Finally, there were two results which were of interest in terms of the impact of different information on the experience of crowding. Firstly, subjects were asked to rate their ability to concentrate during the experiment. For crowded subjects, in both conditions where subjects were informed about the bogus noise (noise mean = 6.72, noise + distance mean = 6.60), ability to concentrate was apparently impaired in comparison to subjects who were told the focus of the study was to examine the effect of interpersonal distance on behaviour (distance mean = 7.72). This specific comparison was significant, $F(1,56) = 4.85$, $p < .05$.

In addition, an overall main effect was apparent for information, $F(3,56) = 3.06$, $p = .04$, suggesting that this particular effect was more widespread and influenced the uncrowded subjects also.

Secondly, subjects were asked to rate the extent to which they felt distracted during the experiment. For crowded subjects those in the noise condition reported being more distracted (mean = 4.22) than either the control condition (mean = 3.02) or the distance condition (mean = 3.20). The difference between these means was significant, $F(1,56) = 7.40$, $p < .01$. Informing subjects about the possibility of subliminal noise in the experimental room increased the extent to which they felt distracted while in that environment.

THE RELATIONSHIP BETWEEN AROUSAL AND CROWDING

Subjects in the close condition reported increased levels of crowding compared to subjects in the far condition. However, the reduced interpersonal distance in the close condition was not accompanied by the predicted increase in levels of arousal. These results raised questions about the relationship between arousal and crowding. Did this result, for example, mean that crowding was independent of arousal? To answer this question a series of analyses were conducted to clarify this relationship. Firstly, the correlation between these two variables was calculated, $r = 0.40$, $p = .001$. Clearly, the two are not unrelated. Secondly, an ANCOVA was conducted on the variable of crowding with arousal as a co-variate. This resulted in a significant co-variation between arousal and crowding,

$F(1,55) = 26.25$, $p < .001$. (See Appendix E for ANCOVA summary table). However, with arousal controlled the ANCOVA revealed one additional significant result: an interaction between distance and information, $F(3,55) = 3.37$, $p = .025$.

INDIVIDUAL ANALYSIS

As mentioned previously, the group was the accepted unit of analysis for this study. However, out of interest, some individual analyses were conducted. Only selected dependent variables were included and the summary ANOVA tables for arousal, crowding and confinement are included in Appendix F. The individual analyses boast larger degrees of freedom in accordance with the larger N's which individual analysis affords. This increased power more than offset the increased variability and resulted in increased levels of significance.

Examples of this can be found in the summary tables provided in Appendix E. Considering the dependent variable of arousal, the effect of the distance manipulation had a significance level of $p = .17$ with group as the unit of analysis. This level became $p = .10$ for the individual analysis. This result is typical of the kind of increase in statistical sensitivity afforded by the individual analysis. However, as previously argued, it was not considered appropriate to complete all the analyses this way.

CHAPTER SIX

DISCUSSION

Contrary to predictions, crowded subjects did not report significant increases in arousal as a result of the reduced interpersonal distance which they experienced in the experiment. This result is of particular interest in view of the theoretical expectations and the already equivocal results surrounding this issue (Freedman, 1975; Karlin & Epstein, 1979; Smith & Knowles, 1979; Webb, Worchel, Riechers, & Wayne, 1987). The controversy surrounding the role of arousal includes a number of diverse views. These views include those (e.g., Freedman) who have been unable to provide experimental support for the involvement of arousal in the experience of crowding, as well as those (e.g., Karlin & Epstein) who maintain that crowded subjects are almost invariably more aroused than uncrowded subjects. The middle ground in this debate is occupied by Smith and Knowles (1979) whose field study pointed to the role which cognitive interpretations may occupy in mediating the nature of reactions to spatial invasion. They conclude that when a spatial invasion seems appropriate for the conditions, stress and arousal may not occur. Simply telling subjects that the research was "investigating group behaviour under a variety of conditions" may have been sufficient to legitimize spatial violation in the present study.

The two factor model is predicated on the notion that arousal is an inherent element of the experience of crowding. Results, such as those derived from the

current study, which show increased levels of reported crowding without significant increases in arousal strike at the very foundation of the two factor theory. These results run contrary to one of the fundamental assumptions on which the two factor theory is based. The current study is not alone in its failure to document crowding-induced arousal. The earlier work of Freedman (1975) and also the more recent studies by Patterson, Roth, and Schenk (1979), and Webb et al. (1987) have also found that crowding may occur without arousal necessarily being involved. The failure of the current study to induce arousal in crowded subjects stands as an interesting finding which adds to the existing literature on the relationship between crowding and arousal.

This result should not be interpreted to mean that there is no relationship between arousal and crowding as there was in fact a significant positive correlation between the two. In addition, crowding was seen to covary significantly with arousal when examined with an analysis of covariance. With arousal controlled, a significant interaction between the independent variables (distance and information) emerged. This may be interpreted to mean that control (no information) subjects were more extreme in their ratings of being crowded or not crowded, but these extremes were reduced for subjects who were provided with information. These results are interesting in demonstrating the emergence of this interaction when arousal was controlled. This suggests that there is some unreliability and error variance associated with the measure of arousal. This highlights the need to employ a more reliable measure of arousal in future.

A further qualification concerns the issue of measurement. If arousal is not measured in a psychometrically sound fashion, then the validity of results may be threatened. The question being considered is to what extent can we be sure that asking how "relaxed or ill at ease" people feel is a useful measure of their arousal. The answer to this question is, regrettably, that we do not know at this stage. This reflects on the crowding research which, up to the present, has neglected important psychometric issues. The current study used the same measure of arousal as used by Worchel and Yohai (1979), with considerable care taken to replicate two of the Worchel and Yohai experimental conditions. It should be noted, however, that if the measure of arousal used was unreliable then failure to replicate the previous Worchel and Yohai results should not be seen as too surprising. Unreliable measures are likely to produce unreliable results.

Another possible explanation for the nonarousal of crowded subjects relates to the sex of subjects. It has previously been demonstrated (Evans & Howard, 1973) that females tolerate small interaction distances better than males, although Hayduk (1983) reports inconsistent results for the effect of sex on spatial variables. Kalb and Keating (1981), for example, found that females felt more crowded than males in a field setting. This inconsistency is disputed by Nicosia, Hyman, Karlin, Epstein, and Aiello (1979) who argue that there are consistent sex differences. They conclude that when compared with noncrowded counterparts, men generally react more negatively than women when crowded. Reasons for this include the suggestion of Epstein and Karlin (1975) that the

experience is stressful for both men and women, but women are able to share this distress with each other while cultural norms prevent men from engaging in such open expression. In Stokols' (1976) view, the difference reflects the cultural emphasis on male territoriality and aggressiveness. Gifford (1987) similarly concludes that in laboratory studies men respond more negatively than women.

The sexual composition of groups in experimental laboratory studies are perhaps best characterised by the impressive nature of the variety involved. A number of studies have used male subjects only (Schaeffer & Patterson, 1980; Nager & Pandey, 1987). Others have used same sexed groups (McCallum, Rusbult, Hong, Walden, & Schopler, 1979; Nicosia et al., 1979; Worchel & Yohai, 1979), with male and female subjects being run in separate groups. Paulus and Mathews (1980) employed mixed sex groups, with male and female subjects being included in the same group. A further strategy has been to leave the sexual composition of the groups "uncontrolled" (Klein & Harris, 1979; Paulus et al., 1976). In the case of Kuykendall and Keating (1984) the sex of subject was not even mentioned in the description of group composition.

In the Worchel and Yohai (1979) study, men and women were divided into same sex groups. They reported no differences due to sex of subject, as was also the case in the McCallum et al., (1979) study. Worchel and Yohai suggest that previous findings where differences between males and females have been apparent may have resulted from a failure to "severely" violate the personal space of the women involved. However, it would be difficult to level this criticism

at the present study which took care to use the same seating arrangements used by Worchel and Yohai, where subjects' personal spaces were clearly violated. While the sex of subject may be invoked as an explanatory factor in considering the unexpected nonarousal of crowded subjects in the present study, it is also clear that further research is required on the nature of sex differences before these issues can be settled.

One final consideration regarding the failure to induce high levels of arousal in subjects at close interpersonal distances stems from the suggested (Morasch et al., 1979) correlation between task failure and arousal. They argue that failure at an important task will increase arousal and also perceptions of crowding. In the present study, subjects experienced no failure and if Morasch et al. are correct should not have experienced arousal. This possibility, however, would not be helpful in explaining the increased levels of arousal reported by the subjects in Worchel and Yohai's (1979) study.

Despite the failure to find a main effect for arousal, subjects in the close interpersonal distance condition still reported feeling more crowded and confined than subjects in the far condition. In addition, these subjects reported feeling less comfortable, as would be expected in an experimental study designed to make subjects experience crowding. There are two major implications which stem from these results.

Firstly, the results may be seen as an endorsement of the effectiveness of the

crowding manipulation. Seating subjects at close distance resulted in subjects reporting more crowding, confinement and discomfort. This suggests that the distance manipulation worked, and that subjects did indeed feel crowded in the experimental setting.

Secondly, this finding can be seen as clear evidence **against** the two factor model which suggests the experience of crowding follows an attributional sequence which is activated by increased arousal. Nonaroused subjects, if the model is correct, would be unlikely to engage in the attributional search as the activating cue for the search would be absent. In the present case, the motivating force which drives the attributional search was apparently absent. In simple terms, the model suggests that nonaroused subjects should **not** report feeling crowded. The present study shows that nonaroused subjects did, in fact, report feeling crowded and confined. This finding has interesting implications for the model. Specifically, it suggests that it is possible to experience crowding without being aroused. Arousal, therefore, does not appear to be a **necessary** prerequisite for the experience of crowding. This result therefore represents a challenge to the two factor model demonstrating that the experience of crowding may not be arousal dependent, as the two factor model implies. A further qualification is that although the predicted increases in levels of arousal failed to reach significance, arousal was positively correlated with the measure of crowding. This may imply that although not significantly aroused, subjects could have been sufficiently aroused to initiate the attributional sequence.

It is important to note at this stage that further examination of the theoretical predictions become academic due to the failure to document arousal in the crowded subjects. With the apparent failure of the spatial invasions to induce feelings of increased arousal, specific predictions based on the two factor model lose much of their meaning. If the attributional process suggested was not operating there would be no reason to expect differences between the information conditions. With few exceptions, this is precisely what was found for crowding, confinement, performance and the measures of interpersonal relations.

The model predicts that subjects exposed to noise salient information would experience reduced crowding. This prediction was unsupported. Similarly, the expected difference between crowded control subjects and crowded subjects in the distance salient condition failed to reach significance. The prediction that distance salient information, being more plausible than the bogus noise salient information, would result in reduced crowding was also unsupported. On an equally unspectacular note, the dual information condition also failed to decrease the experience of crowding when compared to other conditions.

In general, the results for confinement parallel those obtained for crowding. There was a very clear cut main effect for the distance manipulation, supporting the effectiveness of the manipulation and also highlighting the possibility that crowding (and the comparable feeling of confinement) may be experienced without the associated high levels of arousal. However, with only one exception the information conditions had no impact on reports of confinement. The

exception was that subjects in the distance salient information condition experienced a significant reduction in confinement compared to crowded controls. One interpretation of this is that informing subjects about the actual nature of the crowding experience and the purpose of having them seated in that fashion served to reduce the extent to which they subsequently felt confined in the situation.

Taken together, the results for confinement and crowding suggest that providing subjects with simple, plausible information about the situation in which they found themselves had significant effects on behaviour. This interpretation is supported by studies which found that accurate situational information reduced crowding-related stress. Baum, Fisher, and Soloman (1981) found that for subjects who were not familiar with the setting all types of information was of benefit, whereas subjects who were familiar with the setting derived particular benefit, in terms of reducing crowding related stress, from information which was more accurate. Fisher and Baum (1980), in an anticipatory crowding context, found that messages were effective in relieving discomfort to the extent that they were accurate in their descriptions of the anticipated setting. In the same vein, Wener and Kaminoff (1983) manipulated accurate information by way of signs posted in a crowded lobby with consequent reductions in users' perceptions of crowding, discomfort, anger and confusion. Langer and Saegert (1977) found that supermarket shoppers had the aversiveness of their crowded environment ameliorated when provided with information about the effects of crowding.

It seems possible, therefore, that informing people about their relationship with spatial variables may have beneficial effects (reduced perceptions of crowding). The fact that the distance salient information had this effect while the noise salient information did not, may reflect subjects' judgments about the tangibility and plausibility of the information presented to them.

With regard to performance, the model predicts deficits for crowded subjects. Contrary to this prediction, close subjects performed no differently when compared to far subjects. In considering the influence of information salience on task performance it seems that subjects in the noise salient condition suffered a performance deficit when compared to control and distance salient subjects. This decrement in performance might indicate that informing subjects about bogus events can serve to interfere with cognitive tasks, especially when compared to the innocuous effect of providing accurate information about the experimental environment. Of special interest is the fact that interference produced by the noise salient information in this study runs at complete odds with the effects reported by the study conducted by Worchel and Yohai (1979). In their study, close subjects who were provided with the noise arousing explanation outperformed close subjects who were not provided with any explanation. Such contradictory results represent an interpretive challenge.

At the very least it would seem prudent to consider the claims of the two factor model with renewed caution in the light of the results which have emerged from the present study. It is possible to have subjects in crowded conditions without

significantly increasing arousal levels, and without detrimentally influencing their performance on cognitive tasks. A further conclusion to emerge from the current study is that the sort of information which subjects are given may have a negative effect on subsequent performance.

The two factor model makes predictions about the influence of crowding on the manner in which people relate to one another. Specifically, the model predicts interpersonal hostility among crowded subjects, in contrast to uncrowded subjects. Five separate dependent measures were taken to examine this prediction. The pattern of results was fairly consistent across the measures, with a general failure to establish any differences in the way in which crowded subjects responded to each other when compared to their uncrowded counterparts. The crowded subjects were no more punitive in their treatment of Johnny Rocco, reported no less friendliness towards their fellow subjects, detected no more aggression on the part of their fellow subjects, reported liking their fellow group members as much, and rated themselves as feeling no more hostile (on the MAACL) than uncrowded subjects. Just two of the affective measures produced differential results for the crowded subjects compared to the uncrowded subjects. Crowded subjects were both more depressed and marginally more anxious than uncrowded subjects. However, the general lack of support for the predictions of the two factor model is impressive in its consistency. This suggests the model has been unable to capture the crucial elements involved in the experience of crowding.

This failure to find the predicted interpersonal hostility may have been due to the relative nonarousal of crowded subjects. If this were the case it would suggest that arousal may be important in mediating the negative concomitants of crowding. However, Worchel and Cooper (1983) discuss situations where spatial violations may not always lead to the experience of crowding. They include situations such as the spatial invasions which occur at sports events and rock concerts, where people apparently fail to report feeling crowded. They suggest this may be due to people attributing their arousal to the source which is most evident to them, namely the excitement of the game or concert. The present findings highlight two other possible explanations for failure to report crowding at events where crowds typically gather.

Firstly, it may be that spatial violation is simply not arousing for people who attend such events. This nonarousal is possible, as the results of the present study testify. Secondly, it may be that people do become aroused but that no misattribution occurs. The arousal in this case may be due to the excitement of the game or concert, and people correctly attribute the source of their arousal to that. People may be aware of the arousal they are experiencing (especially if the game is exciting), but the presence and closeness of others is not arousing because it is expected and considered reasonable within this context. Sports events and rock concerts, to take but two examples, legitimise spatial violation and under these conditions the negative aspects of crowding are not experienced. This particular explanation receives some support from the results of the present study as crowded subjects were nonaroused and those who were

informed of the distance manipulation experienced less confinement as a result of the information they had been given. The suggestion here is that this information somehow served to legitimise the close conditions.

On a broader level, the lack of negative elements which the current research has been able to document suggests that the model should perhaps be modified to account for such disparate results. Further, there now exists some additional evidence for the view that crowding is not the universally negative experience that some authors have believed it to be. In many respects, the experience of the crowded subjects in the current research was indistinguishable from the experience of the uncrowded subjects. They responded on the majority of the measures no differently to the uncrowded subjects.

The effect of information on the measures of interpersonal hostility was limited with less punishment, on the scale dealing with Johnny Rocco, being recommended by those subjects in the close condition who were provided with information about the nature of the experience in advance when compared with uninformed controls.

On a purely exploratory level there were two additional findings of interest both reflecting the differential impact of information on subjects' behaviour while in crowded conditions. For those subjects who were informed of the bogus noise (noise and noise + distance conditions), ability to concentrate was impaired when contrasted with those subjects who were given information about the nature of

the distance manipulation. This comparative reduction in ability to concentrate suggests that providing information which is designed to ameliorate the negative effects of crowding may have actually been counterproductive in achieving this aim. The other aspect of this information which may be important is that it was **inaccurate** and therefore may have interfered with subjects' ability to concentrate. This suggestion is supported by the results which showed that noise information increased distraction. Specifically, it was found that informing crowded subjects of the possibility of subliminal noise in the experimental room increased their reported level of distraction when compared to control or distance salient conditions. This disruptive effect of the bogus noise information is of special interest because it is the exact opposite of the effect predicted by the two factor model.

To conclude, the present results suggest the experience of crowding need not be dependent on feelings of arousal. In this respect, these results fail to support one of the basic assumptions of the attributional arousal model. However, it seems unreasonable to argue that the general lack of differences necessarily demonstrates a failure of the model. These results may have been quite different had subjects shown the predicted levels of arousal. Unfortunately, the question of the extent to which information salience can affect causal attributions in the context of crowding is one which remains unanswered by the present results. Nevertheless, the fact that subjects reported feelings of crowding and confinement without associated increased arousal is an interesting one. At a theoretical level this finding requires examination and integration, and at an

empirical level requires further consideration.

What seems to be necessary for future research to consider is a way of reconciling these unexpected results within some meaningful theoretical framework. This task will be attempted in the next chapter.

CHAPTER SEVEN

AN INFORMATION EXPECTANCY MODEL OF CROWDING

The two factor attributional model of crowding has received some support in the literature (Worchel & Teddlie, 1976; Worchel & Yohai, 1979; Worchel & Brown, 1984). In addition, the model has received broad coverage in numerous introductory social psychology textbooks (e.g., Baron & Byrne, 1987; Forsyth, 1987; and Penner, 1986).

Despite receiving some research support and wide acknowledgement in introductory texts, the model fails to explain two key findings which emerged from the first study. Firstly, the model (which is based on the idea that arousal precedes crowding), makes no provision for the experience of crowding **without** arousal. This is the very situation described in the first study. Secondly, the model makes predictions concerning the effects of providing subjects with information about alternative sources of arousal, but is unable to explain why, for example, providing accurate information about spatial variables reduced the impact of the experience of crowding. In short, it seems as though the first study highlighted inadequacies in the power of the two factor model to explain and accurately predict human responses to the experience of crowding. A new model is called for in an attempt to deal with these inadequacies.

The proposed (information expectancy) model incorporates one essential

element of the two factor model. Namely, the assumption that spatial invasion is an integral part of the experience of crowding. The notion that spatial invasion mediates crowding is common to a number of crowding theories (e.g., Epstein & Karlin, 1975; Proshansky et al., 1970; Freedman, 1975). The relationship between spatial invasion and crowding was initially mentioned in Hall's (1959, 1963, 1966) work. The numerous attribution models, including the two factor model, also regard crowding as being initiated by an invasion of personal space.

The second element in the proposed model is a cognitive one in which information relevant to the spatial invasion is appraised. It is proposed that information appraisal which occurs prior to the spatial invasion will serve to shape expectations. Based on the finding that providing **accurate** information about spatial variables (thereby setting realistic expectations) can reduce the impact of crowding, it is further proposed that confirmation of spatial expectations will also reduce the impact of crowding. It is suggested, however, that disconfirmed spatial expectations will serve to increase the impact of crowding.

The theoretical relationship between information and appraisal was discussed within the perspective of cognitive control by Averill (1973). Information (referred to as "information gain") is, according to Averill, concerned with cognitive preparation for an event, and relates to the predictability and anticipation of that event. Appraisal involves both interpretation and evaluation of events which are linked to expectations. Schmidt and Keating (1979) maintain that information functions to initiate cognitive preparation and to generate accurate expectancies.

Expectations are seen as important because they provide the individual with the opportunity to prepare for the specific context in which the spatial variables will occur. Such contextual considerations have been shown to have an important bearing on personal space requirements (Gifford, 1982), but to date the context in which crowding occurs remains largely unexplored. It is the contention of the information expectancy model of crowding that when a context is made explicit, certain expectations about what is spatially appropriate become apparent. This contention will be experimentally examined in the next study with the aim of clarifying the role of information and expectations as a first step towards linking experimental studies of crowding to similar experiences which occur naturally in the context of a social setting.

Support for the role of expectations comes from a number of sources. Direct support comes from the existing literature while indirect support may be derived from the fact that a number of key crowding studies may be reinterpreted to fit with the fundamental propositions of the information expectancy model. In addition to these two lines of support (to be discussed shortly), the role of expectations are also implicated in reports (Tuan, 1977; cited in Worchel and Cooper, 1983) that people who attend crowded events do not report feeling crowded. This apparent contradiction may simply reflect expectations about spatial aspects of such events being confirmed. Spectators may expect (on the basis of previous attendance) to watch their favourite sport standing shoulder to shoulder with other fans. Furthermore, they may feel quite comfortable with that level of density because it is expected in such situations.

Further support for the role of expectations having a bearing on the experience of crowding comes from a study by Langer and Saegert (1977) in which shoppers in a crowded supermarket were provided with information about what they could expect under such conditions. This intervention attenuated the negative effects of crowding. The authors conclude that knowledge of potential relationships with the environment would seem to be beneficial. These benefits included ease of finding items, the extent to which other customers were perceived to be interfering, level of comfort and perceived levels of crowding.

Baum et al. (1981) reviewed the literature on pre-exposure information. They examined a variety of different contexts and concluded that accurate expectations of what one may feel, or what will happen, may reduce stress. These contexts were considerably broader than the usual ones in which spatial concerns are of interest. They included : preoperative information improving recovery from surgery; preparatory information reducing distress involved in painful medical procedures; and pre-exposure information reducing stress associated with crowding and noise. Across all these settings the most useful information is that which leads to expectations which are **accurate**, that is, expectations which are confirmed by the experience subsequent to the setting of expectations. Baum et al. suggest the reason accurate expectations may prove useful is that they increase the predictability of the situation and this may assist in coping with the situation. Accurate expectations may also provide standards against which social comparison may occur.

Gochman and Keating (1980) were also interested in the relationship between expectations and crowding. They argue that disconfirmed expectations and unattained goals will result in increased arousal which will in turn be misattributed to density-related sources, even if the disconfirmation of expectations and nonattainment of goals is not due to density-related factors. They examined the effects of disconfirmed expectations on attributions to crowding. Their results showed that disconfirmed expectations about nonspatial aspects of the environment can increase attributions to crowding. Expectancy disconfirmation occurred both in laboratory and field settings, employing both disconfirmation of time and performance expectancies, with resulting increases in attributions to crowding. Disconfirmation resulted in subjects saying they felt more hindered by the number of people in the room. Actual perceptions of crowding were not significantly increased by nonspatial expectancy disconfirmation.

Klein and Harris (1979) note that informing subjects of crowded conditions has received little attention. They examined the effect of anticipating a crowd and subsequent confirmation or disconfirmation of that expectation. This study followed the tradition of anticipatory crowding studies (e.g., Baum & Greenberg, 1975), and employed a forewarning which was indirect. When signing up for the experiment, subjects either signed on a sheet which had either two or five lines for subjects' names. Klein and Harris' results suggest that expectancy confirmation enhanced performance while those subjects who were warned about a crowd which failed to materialise performed most poorly.

Indirect support for the information expectancy model may be taken from the Worchel and Yohai (1979) study which crossed information with distance in a two factor design. Information presented to subjects either led them to expect arousal or relaxation while in crowded conditions. Control groups received no such information. The arousal expectation condition reported a reduced level of perceived crowding. The authors interpreted this finding as evidence for the misattribution of arousal, but it is also possible to invoke an expectancy confirmation interpretation.

Subjects in the arousal information condition were led to expect to feel "stressed and uncomfortable", which (even given the findings of the first study) is an expectation more likely to be confirmed by the experience of crowding than subjects who were led to expect they would feel "relaxed and calmed". There is, after all, some evidence suggesting that crowded subjects **may** feel aroused (stressed and uncomfortable). As yet, there is no evidence demonstrating that crowded conditions are relaxing and calming. The point being that subjects in the arousing information condition are likely to have had their expectations about how they would feel in those conditions confirmed. In contrast, those subjects in the relaxing information condition were likely to have experienced expectancy disconfirmation.

Therefore, there is some support for the idea that spatial information is used in the establishment of expectancies and that personal space invasion is a necessary prerequisite for the experience of crowding.

The cornerstone of the information expectancy model is that:

> **expectancy confirmation may reduce the impact of crowding, while disconfirmation may serve to increase the impact of crowding.**

PREDICTIONS OF THE INFORMATION EXPECTANCY MODEL

The first assumption of the model is that any information available or provided about the situation will be appraised by the individual. The information will serve to shape individuals' expectations. These expectations may be classified as either spatial or non-spatial. Spatial expectations refer to expectations about distancing behaviour in particular situations. Information relevant to spatial expectations may, for example, be helpful in answering an individual's concerns about whether to expect close or far interpersonal distances. Non-spatial expectations will derive from information which is irrelevant to concerns about interpersonal distancing. Non-spatial expectations are of less importance to the model which attempts to understand the processes involved in the experience of crowding. The major concern is with those elements which have a direct and obvious bearing on crowding. Non-spatial expectations may well have a bearing but the nature of this must be considered as secondary, at least until the role of spatial expectations has been clarified.

The second major assumption is that invasion of personal space is a necessary

prerequisite for the experience of crowding. The model assumes that interpersonal distance would need to be reduced before crowding would be experienced. This sequence of events is flexible. The model is not concerned with the order of events so much as the process; that is, spatial invasion may or may not precede information appraisal. For example, it could be that under some circumstances the spatial invasion occurs as the first stage in the process, as in the case where a person is thrust quite unexpectedly into a crowded situation. Normally, however, it would be expected that some information would precede the spatial invasion. The spatial invasion is the physical aspect of crowding and is an essential component in the experience of crowding. It is the element about which the cognitive aspects of the model are centred.

It is now possible to derive some predictions from the model based on the assumptions that information will be appraised and that an invasion of personal space is important for the experience of crowding. The first prediction relates to the effects which both confirmation and disconfirmation will have on perceptions of crowding for spatial and nonspatial expectations. It is predicted that if spatial expectations are **confirmed**, this will have the effect of reducing the impact of crowding. Such reduction refers to perceptions of crowding being lessened, subjects feeling less aroused and performance deficits being less likely. Confirmation of spatial expectations would parallel the situation which occurred in Study One, where accurate information about spatial variables reduced the impact of crowding.

Note that "accurate" means the information provided led subjects to expect that interpersonal distance was a variable of experimental interest and this distance may cause them to feel uncomfortable. In other words, the accuracy of the information was verified by the nature of the subsequent experience which would have thereby confirmed the initial expectancies. In this way, accurate information about the crowded situation will lead to confirmation of spatial expectations.

Further, it is predicted that **disconfirmation** of spatial expectancies may serve to exacerbate negative aspects of the experience of crowding. Thus, perceptions of crowding may be increased, and increased discomfort and performance deficits may also occur. Just as accurate information is linked with spatial confirmation, the converse is also the case. Inaccurate spatial information will lead to disconfirmation of spatial expectations. Simply stated, false information will create expectations which will be at odds with the reality of the subsequent crowding experience.

A distinction needs to be made between positive and negative disconfirmation. Negative spatial disconfirmation refers to experiencing **less** interpersonal distance than expected, whereas positive spatial disconfirmation refers to experiencing **greater** interpersonal distance than expected. The information expectancy model is concerned with the experience of crowding and therefore experiences where interpersonal distances are at a minimum will be of most interest. One of the implications of the distinction between positive and negative spatial disconfirmation is that positive disconfirmations are likely to be of little

interest, as in these situations individuals will actually have more space available to them than they anticipated. Such situations are unlikely to be perceived as "crowded".

The model can also address the question of what influence nonspatial variables have on the experience of crowding. In this regard Walden and Forsyth (1981) highlighted a relatively unexplored issue which concerned the effect of a second source of stress which is concurrently imposed on those who are faced with "excessive interpersonal proximity". These authors attempted to establish an "additive stress" model, but their results failed to support such a model. Note, however, that the sources were stress-related autonomic effects which were purported to be drug (placebo) induced. In this respect the second stressor was intended to be symptoms (increased heart rate, respiration and other anxiety related symptoms) not unlike those sometimes associated with the experience of crowding.

Specifically, it was predicted that nonspatial expectations will influence the experience of crowding such that disconfirmation of nonspatial expectations will exacerbate the negative aspects of crowding. Similarly, it was predicted that confirming nonspatial expectations will operate to ameliorate the negative aspects of crowding.

These predictions derive from the nucleus of the information expectancy model. The following study examined the extent to which these predictions received

empirical support. But first, the predictions of the model will be further clarified by explicitly stating some formal hypotheses.

HYPOTHESES

Appraisal

The information expectancy model is based on the premise that subjects will process available information and this will result in the formulation of expectations about both spatial and nonspatial concerns. The following hypothesis examines the validity of this premise. It was predicted that:

1.1 subjects whose spatial expectations were confirmed would report anticipating less interpersonal distance than subjects whose spatial expectations were disconfirmed.

Crowding

A fundamental assumption of the information expectancy model is that subjects appraise information. It was predicted that if this information was accurate this would result in lowered perceptions of crowding. Specifically, it was predicted:

2.1 that subjects whose spatial expectations were confirmed would report

reduced perceptions of crowding when compared to (no information) control subjects who were not induced to have any spatial expectations.

Similarly, it was predicted that inaccurate information which lead to expectations subsequently disconfirmed by close interpersonal distancing, would serve to exacerbate or increase perceptions of crowding. It was therefore hypothesised:

2.2 that disconfirmed spatial expectations would increase perceptions of crowding for those subjects compared to (no information) control subjects.

It was anticipated that disconfirmed nonspatial expectancies would serve to exacerbate the experience of crowding. The role of nonspatial expectancies was examined by the hypothesis:

2.3 that confirmed nonspatial expectations would result in subjects experiencing less crowding than subjects who experienced nonspatial disconfirmation.

Arousal

The information expectancy model does not assume that arousal is a necessary prerequisite for the experience of crowding. Thus, if subjects are essentially nonaroused while in crowded conditions (as was the case in the previous study), then the confirmation or otherwise of their spatial and nonspatial expectations should make little difference to levels of arousal. It was therefore hypothesised:

3.1 that no differences in reported levels of arousal would be evident between subjects whose spatial expectations were confirmed and those whose spatial expectations were disconfirmed.

Similarly:

3.2 that no differences in reported levels of arousal would be seen between subjects who experienced nonspatial confirmation and those who experienced nonspatial disconfirmation.

Annoyance

It was anticipated that the annoying elements of being in a crowded situation could be reduced with the provision of accurate information about both spatial and nonspatial concerns. In this regard it was predicted :

4.1 that subjects whose spatial expectations were confirmed would report less annoyance at being crowded than (no information) control subjects.

Similarly, it could be argued that inaccurate spatial information would increase subjects' annoyance levels under crowded conditions when compared to control subjects. It was therefore predicted :

4.2 that subjects whose spatial expectations were disconfirmed would report

more annoyance at being crowded than (no information) control subjects.

The effect of disconfirmed nonspatial expectations was examined by the next hypothesis. It was expected:

4.3 that disconfirmed nonspatial expectations would increase subjects annoyance at being crowded when compared to subjects whose nonspatial expectations were confirmed.

Interpersonal Relationships

On a wide range of measures, Study One failed to provide any support for a key prediction of the two factor model. The crowded conditions in the first experiment did not negatively influence interpersonal relationships. The model attempts to explain why some research has found negative consequences (Karlin, Katz, Epstein, & Woolfolk, 1979) while others (Freedman, 1979) have failed to do so. The current attempt to explain these differences is embodied in the prediction that where spatial expectations are confirmed, crowding will not have a negative influence on interpersonal relationships.

The information expectancy model predicts that many of the negative concomitants associated with crowding may be ameliorated by providing people with accurate information relevant to their spatial concerns. It was expected that on a series of measures:

5.1 spatial and nonspatial disconfirmation would result in increased punitiveness, perceptions of others aggressiveness, and decreased liking for others.

Affect

Previous research has shown that negative feelings may be associated with spatial density (Smith & Knowles, 1979) and also social density (Evans, 1975). Study One has also documented increases in anxiety and depression in crowded subjects. It is the contention of the information expectancy model that if subjects are provided with accurate spatial information prior to the experience of crowding, then the impact of that experience on mood may be reduced. Specifically, it was predicted that:

6.1 subjects whose spatial expectations were confirmed would report less negative emotion than subjects whose spatial expectations were disconfirmed.

Also that:

6.2 subjects whose spatial expectations were confirmed would report less negative emotion than (no information) control subjects.

Performance

Performance decrements associated with crowding have been reported by a

number of studies (e.g., Evans, 1978; Paulus et al., 1976). The effect is especially notable when performance is measured on a complex task (Nagar & Pandey, 1987). However, a number of studies have failed to find performance decrements on complex tasks under conditions of high density (Freedman et al., 1971; Marshall & Heslin, 1975). The current study examined the influence of confirmed and disconfirmed nonspatial expectations on task performance, combined with confirmation and disconfirmation of spatial expectations. Nonspatial expectancies were operationalised by way of performance on a set of simple anagrams, with the expectation that these were a practice set. The subsequent anagrams were, for the nonspatial confirmation condition, easy (as anticipated). However, for subjects in the nonspatial disconfirmation condition, the subsequent anagrams were more difficult. Verification of the effectiveness of the manipulation was examined by the hypothesis which anticipated that:

7.1 subjects given easy anagrams would outperform those subjects given difficult anagrams.

The present study examined the influence of confirmed and disconfirmed spatial and nonspatial expectations on task performance. It was therefore predicted that:

7.2 subjects whose spatial expectations were confirmed would outperform those subjects whose spatial expectations were disconfirmed.

Also, that:

7.3 subjects whose nonspatial expectations were confirmed would outperform subjects whose nonspatial expectations were disconfirmed.

Sex

Much of the previous research examining sex differences under crowded conditions has provided equivocal results. However, in reviewing this literature, Nicosia et al. (1979) have concluded that men react more negatively than women when crowded. In line with this general conclusion it was expected that:

8.1 women would report being less crowded than men.

Similarly, that:

8.2 women would report being less annoyed than men.

This chapter has introduced the information expectancy model. The model has been discussed in terms of predictions which have further been broken down into specific hypotheses, to be examined by the next study. The final section of this chapter examines measurement issues, specifically with regard to the concepts of arousal and crowding.

MEASUREMENT OF AROUSAL AND CROWDING

An auxiliary aim of the second study was to improve on the rather limited manner in which the pivotal concepts of arousal and crowding were measured in the first study.

Arousal

Previous crowding research has defined and measured the notion of arousal in a variety of ways. As was apparent from Chapter One, the exact meaning and usage of the term " arousal" in the crowding literature unfortunately is rather muddied. Some writers have made a significant contribution in this respect by using the terms arousal and stress interchangeably (e.g., Worchel & Yohai, 1979). Aiello et al. (1977) also link the two concepts by referring to stress-related arousal. Increased physiological responses in crowded conditions are described as "stress reactions". Others are more straightforward; for example, Karlin and Epstein (1979) simply refer to arousal as physiological arousal, which they operationalise in terms of skin conductance, pulse rate and blood pressure. In addition to the concepts of arousal and stress, other more peripheral notions are sometimes used. These terms include "crowding-related arousal", "crowding stress" and also "spatial discomfort", although the last of these is more frequently used in conjunction with other negative aspects of crowding.

In general, the literature suffers from a paucity of conceptual definitions of these notions and researchers offer little in the way of clarification of terms, except by way of outlining the style in which they have chosen to measure "arousal". These styles of measurement are fascinatingly varied. A number of studies, (for example, Aiello et al., 1977; Epstein & Karlin, 1975; and Patterson et al., 1979) have used cognitive tasks as indices of arousal. Presumably, this practice is based on the relationship between arousal and task performance which has emerged from social facilitation research. Epstein and Karlin employed two cognitive tasks together to measure arousal. Aiello et al. also used two cognitive tasks to assess the cognitive correlates of arousal. Awareness of bodily changes in arousal (e.g., heart rate and sweating palms) was employed as the measure of arousal by Webb et al. (1987). Worchel and Brown (1984) asked subjects about the extent to which they had found particular types of films arousing. Evans (1979) adopted a more comprehensive approach and took physiological measures (pulse rate and blood pressure) in conjunction with performance and observational measures.

Physiological measurement can be problematic in crowded experimental conditions as was the case for Worchel and Yohai (1979) who abandoned the collection of palmar sweat measures as a result of subjects' complaints and logistical difficulties. It is interesting to note that Worchel and Yohai argue that the theoretical position they adopt with respect to arousal is that it does not rely on physiological measurement. They argue that such measurement, while of interest, is not absolutely necessary. The two factor model deals with how people

handle perceived arousal and for this reason the focus of measurement should be on individuals' perceptions of arousal. This argument contributes little to the question of how best to measure perceived arousal, which remains problematic.

Schaeffer and Patterson (1980) adopted three separate measures for arousal. They included a behavioural observation (frequency of self- manipulative behaviours), a performance measure, and a self-report check list of arousal symptoms. The results of this study are interesting as the performance measure and the self-report measures were significantly correlated (r = -.69). The frequency of self-manipulative behaviour was poorly associated with both the self-report measure and the performance measure. Schaeffer and Patterson note that on the basis of the correlations among these arousal measures, and from past research supporting the validity of the self- report and performance measures, it is likely that these two measures did reflect arousal.

The task of measuring arousal for the second study was assigned to two self-report measures which had both been previously used. The first (an **index of somatic arousal**) was initially reported in the literature in 1977 by Aiello et al. The index of somatic arousal comprises five items asking the subject the extent to which they experienced sweating palms, rapid breathing, rapid heartbeat, tense muscles and nervous tension. The reported intercorrelations for this index were (mean r = .23, median r = .23). The study by Nicosia et al. (1979) used the same index of somatic arousal (representing the mean of the same five items). These five items were reported to be "highly" intercorrelated (r =.35). The third

study to report the use of the somatic arousal index was the Patterson et al. (1979) study. Finally, the somatic arousal index was utilised by Schaeffer and Patterson (1980), although they refer to it as a checklist of symptoms of nervous tension.

The index of somatic arousal has received some use, no doubt encouraged by the acceptable alpha coefficients suggesting reasonable internal consistency. Given that the somatic arousal index may possess some reliability, the other important question concerns its validity. Aiello et al. (1977) note that during crowding, subjects reported a greater degree of somatic arousal. This would support the construct validity of the instrument while the fact that Aiello et al. report that somatic arousal measures paralleled the results for skin conductance would be suggestive of the convergent validity of the index. In this respect it was found that interpersonal distance preference mediated both skin conductance and reported somatic arousal. Simply stated, this meant that subjects who preferred greater distances had greater somatic arousal levels and skin conductance levels while in crowded conditions. Nicosia et al. (1979) found that crowded men reported more somatic arousal than did noncrowded men, while men in a crowded but no touch condition were intermediate in their reported somatic stress. Further, these results parallel results for skin conductance, annoyance and expressed bother by spatial intrusion. Finally, Schaeffer and Patterson (1980) found that increased intimacy (operationalised by direct gaze) resulted in increased levels of somatic arousal.

In sum, it appears as though the somatic arousal index possesses sufficient support for its psychometric properties to warrant continued use. As a measure it has good internal consistency and several lines of support for its validity.

The second arousal measure (an **arousal scale**), was based on a scale developed by Mehrabian and Russell (1974). The scale consisted of seven items. Each item was presented as two bipolar adjectives which subjects were asked to respond to (e.g., "How dull or jittery did you feel during the experiment?"). The six original items were retained, with the only change being the "sluggish / frenzied" item being altered to "sluggish / alert". The term "frenzied" seemed inappropriate for the setting in which it was to be used. The additional item was the "relaxed / ill-at-ease" item which had previously been used as the sole index of arousal in the first study. Based originally on intuitive descriptors, the arousal scale has undergone considerable factor analytic development. Mehrabian and Russell conceptualise arousal as a feeling state which varies along a single dimension ranging from sleep to frantic excitement. They cite research by Thayer (1967, 1970) supporting the view that physiological indices are highly correlated with verbal self report measures. They conclude that arousal is a feeling state that is most directly assessed by verbal report.

Within the crowding literature, this arousal scale has been used by Paulus and Mathews (1980) who found that arousal increased (along with discomfort and unpleasantness) as subjects spent more time in a crowded experimental room. Similarly, Elliot and Cohen (1981) employed the Mehrabian and Russell (1974)

scale and found that crowded subjects were more aroused than uncrowded control subjects. Additionally, they found that of the close, moderate and far interpersonal distances utilised, the close interpersonal distance resulted in the most arousal.

Crowding

The measurement of crowding has a history at least as varied as that associated with the notion of arousal. Due to the nature of the construct Choi, Mirjafari, and Weaver (1976) argue that crowding cannot be measured directly but must be inferred from indirect measures. Such inferences are usually taken from self-report measures which have included a number of different elements including the setting, the room, the individual and the extent of discomfort engendered by the experience.

Setting-related measures include the Baum and Greenberg (1975) study of anticipatory crowding in which subjects were asked to respond on a seven point scale examining the degree to which the setting appeared crowded. Greenberg and Firestone (1977) asked a similar question, but additionally asked subjects if they felt crowded. Evans (1979) asked subjects whether they perceived the situation as crowded. This question was used as a manipulation check. The results indicated that subjects in high density conditions perceived their situation as considerably more crowded than their low density counterparts. In this respect the notion of crowding seems to be remarkably robust. It seems to matter little

whether questions are directed at the setting, the room or how the individual feels. Crowded subjects almost without exception report a more crowded setting, a more crowded room or feeling more crowded than uncrowded subjects.

A large number of studies have examined various perceptions of crowded rooms. These perceptions range from "how crowded was the experimental room ?" (Heller et al., 1977), to measures which consider various aspects of the crowded environment. Epstein and Karlin (1975), for example, examined perceptions of the experimental room in terms of its lack of privacy; how crowded, confined and small it felt; and the degree to which subjects felt as though they were competing for space. Klein and Harris (1979) adopted a similar environmental focus in asking for room ratings in terms of prettiness, illumination levels, stuffiness, size, adequacy, cheerfulness, dampness, pleasantness, how much physical discomfort was induced, and how crowded it appeared. More recent studies have also included room ratings (Kuykendall & Keating, 1984; Nagar & Pandey, 1987).

The third area in which crowding measurement is often taken concerns not perceptions of the environment, but the impact of that environment on the individual in terms of how that person felt while in a crowded situation. Kalb and Keating (1981) suggest that there are distinct differences between asking people how crowded they feel and asking them to rate how crowded they perceive a setting to be. They asked both questions (using a between subjects design) of customers in a busy book shop. The two measures were factor analysed and found to be conceptually distinct. The factor loadings for the feeling item were

things like behavioural constraint, restriction, confinement and stressfulness. The environmental rating, on the other hand, loaded with high density and negative affect.

The most popular single item used to assess feelings of crowdedness is the question, " How crowded did you feel?". Other individual responses have included the extent to which subjects have felt tense, calm and friendly (Patterson et al., 1979). Other common areas to be considered by researchers are the questions of confinement (e.g., Mueller, 1984), and crampedness (e.g., Nicosia et al., 1979).

The notion of confinement is conceptually linked to other issues concerning the extent to which subjects experience discomfort while crowded, and the extent to which others in the crowded situation are perceived as bothersome to the individual. These concerns derive directly from the behavioural constraint perspective which defines crowding in terms of its constraining properties. Baum and Greenberg (1975) assessed physical discomfort by asking subjects how much physical discomfort they had been caused while in the crowded room. Aiello et al. (1977) developed a spatial discomfort index which comprised seven items looking at aspects of crowding such as limited privacy, others being too close, and being in competition for space. Heller et al. (1977) asked about the extent to which the presence of others interfered with performance. Similarly, Gochman and Keating (1980) asked subjects about the degree to which they were hindered by the number of people in the room. The interference value

associated with other subjects was also examined by McCallum et al. (1979).

For the purposes of the second study it was decided to use two measures of crowding which had been previously used in experimental crowding research. The first of these was an **index of spatial intrusion** developed by Nicosia et al. (1979). This index consisted of three items asking subjects how bothered they were by territorial invasion, by the number of people in the room, and by close interpersonal distances. The authors report an inter-item coefficient ($r = .45$) which they describe as suggesting the items were highly intercorrelated. The reported results for this index are in accordance with theoretical predictions about crowding, thus providing some supporting information about the construct validity of the index. Specifically, the authors report that male subjects were more bothered by spatial intrusion than females. Also subjects who were in the crowded touching condition were more bothered by spatial intrusion than those subjects who were in the no touch crowded condition.

The second measure, an **index of individual crowding**, was based on the study by Worchel and Teddlie (1976). These authors asked four questions to measure subjects' experience of crowding. These questions asked subjects how comfortable, confined, and ill-at-ease they felt, and also how crowded they found the experimental room. These four items yielded similar results and were therefore combined to form one index of crowding. The validity of this index was supported by the result that reduced interaction distance was associated with increased reports of crowding on this index. Walden and Forsyth (1981) used the

same index, the only change being that the item asking about crowding was altered to focus on how crowded the subject felt during the research procedure. The results of this study suggest that three of the four items were useful in differentiating between subjects who were seated at close as opposed to far interpersonal distances. The ill-at-ease item was the item which appeared to contribute nothing. For this reason, as well as the fact that this item had been included in the arousal measure, this item was dropped from the current index. It was replaced by an item asking how cramped subjects felt while in the experimental room. This item, in modified form ("how cramped was the experimental room ?") was taken from Nicosia et al. (1979) who reported it as being highly successful in differentiating subjects' reports between crowded and uncrowded conditions. The change in focus from room to how the individual felt was in keeping with the earlier definition of crowding as being a subjective experience.

CHAPTER EIGHT

STUDY TWO: METHOD

OVERVIEW AND DESIGN

The general aim of Study Two was to examine the predictions derived from the information expectancy model.

The experiment was a 3 x 2 factorial design in which SPATIAL EXPECTATION was crossed with NONSPATIAL EXPECTATION. The two independent variables were operationalised by way of **information** (for spatial expectation) and **task difficulty** (for nonspatial expectation). All subjects in this experiment experienced close interpersonal distance. The focus of the study was to examine processes which occur while crowded, so for that reason it seemed unnecessary to include a "far" condition. This procedure of running subjects only at close interpersonal distances has previously been employed in crowding research (Patterson et al., 1979). The advantage of this approach is that it reduces the already large number of subjects required for this type of research. The main disadvantage is that possible interactions between interpersonal distance and the other independent variables are not possible to detect. Comparisons between close and far interpersonal distance groups are also not possible, although Study One clearly showed that the distance manipulation was successful.

Spatial expectation was manipulated by informing subjects of the experimental aim which was to examine the effect of distance on behaviour, and leading them to expect to be seated at either an unusually close distance, or at a distance that would usually be regarded as normal. The control subjects received no information, and therefore should have had no particular expectations about the spatial aspects of the experiment.

Nonspatial expectation was manipulated by leading all subjects to expect a series of easy tasks (anagrams) and either subsequently doing very well on such tasks (as expected), or (unexpectedly) doing very poorly on such tasks. This type of manipulation has previously been used in crowding research by Gochman and Keating (1980).

SUBJECTS

The subjects were 240 male and female first and second year psychology students who volunteered for the study. Subjects received course credit for participation. Their participation meant they were required to attend one less laboratory class. A certain level of attendance was required to successfully complete these courses.

Subjects were run in same sex groups of five previously unacquainted subjects. Three quarters of the subjects were female (180), with one quarter being male

(60). This ratio of three to one fairly represented the composition of the classes from which the subjects were drawn.

The decision to use male subjects was made so as to allow an examination of sex differences under these particular laboratory conditions. Although no sex differences were noted in the Worchel and Yohai (1979) study, it was still regarded as possible that sex may have been an explanatory factor for the curious results from Study One, which was run with groups of female subjects only.

At the point when subjects were solicited they were told that the study was looking at group performance and would take approximately 50 minutes. The educational benefits of participation were mentioned, after which volunteers were asked to complete a consent form. This form included name and telephone number, and subjects were told to expect to be contacted later to arrange a date and time to complete the procedure. All volunteers were told to expect to receive a summary of the results following the conclusion of the study.

Subjects were allocated to groups on the basis of availability and nonacquaintance. Once constituted, groups were then randomly assigned to one of the six experimental conditions.

EXPERIMENTAL MATERIALS

The **pre-experimental room** was a large room adjacent to the experimental room where subjects were issued with initial instructions and completed the first set of anagrams. At the conclusion of the experiment subjects returned to this room for completion of post-experimental questionnaires and debriefings.

The **experimental room** was the same small room as used in the first study. The room was labelled "Small Group Research Lab", and was furnished with five armless chairs. The chairs were arranged in a closed circle in the center of the room. In the center of the circle a microphone was suspended from the ceiling.

Experimental pre-instructions (see Appendix G) were all pre-recorded. These three sets of instructions had an identical beginning which introduced the practice anagrams and led subjects to expect the second set to be similar to the practice set. The pre-instructions controlled the timing of the practice anagrams. The three sets of instructions corresponded to the three information conditions. This information aimed to manipulate subjects' spatial expectations. Subjects in the CONTROL condition were given no information about what to expect in the experimental room. SPATIAL CONFIRMATION subjects were informed that the study was interested in the effect of distance on behaviour and they should therefore expect to be seated at an unusually close distance to others. Subjects in the SPATIAL DISCONFIRMATION condition were also told the study would be examining the effect of distance on behaviour, but they should expect to be

seated at a distance which would usually be considered normal.

In addition to the three sets of pre-instructions there was also a set of pre-recorded instructions which standardised the conditions under which the test anagrams were completed. The instructions indicated that there would be 10 anagrams and they would be allowed 30 seconds to work on each one before they were to begin the next one. These instructions ensured the timing was the same for all groups. These instructions are included in Appendix G.

The **practice anagrams** were provided to subjects in the form of a "Practice Anagrams Booklet" with an accompanying answer sheet (see Appendix H). These anagrams were modelled on anagrams used by Feather and Simon (1971). There was, however, a need to develop both an easy and a difficult set. Two sets of 10 anagrams were developed and pilot tested with 10 colleagues. The mean number correct for these two sets was 8.1 for the easy set and 3.5 for the difficult set. The practice anagrams comprised three very easy anagrams which Feather and Simon had also used to induce the expectation of success at the task. The **test anagrams** (see Appendix H) were either easy or difficult. The practice anagrams were different from those appearing in the easy set of test anagrams.

The same **identification badges** used in Study One were used again. These badges were labelled "A" to "E" and were helpful in assisting subjects identify individuals when completing the post-experimental questionnaire.

A **group word task** similar to the task used in Study One was intended to provide a measure of group performance. The task involved extracting smaller words from a master word (INDUSTRIOUSLY). As a group, subjects worked together with the aim of deriving as many words as possible within the prescribed time limit.

The **group discussion/decision task** was the same as that used in Study One. The Johnny Rocco task requires subjects to read the details of the case study about a young offender and then decide on the most appropriate treatment. The range of treatment available is limited to seven options on the Love-Punishment scale. This task has previously been seen as an index of interpersonal relationships.

A **post-experimental questionnaire** (see Appendix I) consisting of 37 items similar to the questionnaire used in the previous study measured subjects' responses to the experimental room, and to their fellow group members. One aim in developing this questionnaire was to improve the psychometric properties of the measurement of the concepts of crowding and arousal. An implication of Study One was that the measurement of these concepts was based on a response to a single item and was therefore psychometrically questionable in terms of reliability and validity. Single item measures are notoriously unstable (Anastasi, 1988). Other things being equal, the longer a test the more reliable it will be. The reason for this is that larger samples of behaviour will produce more adequate and consistent measures. However, in Study One the decision to use

these single item measures was made out of the need to keep essential aspects of the study the same as the Worchel and Yohai (1979) study.

On the basis of a review of the measurement practices previously employed in crowding research, it was decided to develop four scales to attempt to more accurately measure the key concepts most relevant to the experimental hypotheses.

These four scales were CROWDING, ANNOYANCE, AROUSAL and SOMATIC. The CROWDING scale comprised four items ("How crowded/ confined/ cramped/ comfortable did you feel?"). This scale attempted to measure the extent to which subjects were crowded in the experimental room.

The ANNOYANCE scale attempted to measure the extent to which, under the experimental conditions, the presence and closeness of other people was a bother to subjects. The three items used were as follows: "How bothered were you by the number of people in the room/ invasion of your own personal space / the closeness of other subjects?".

Both the AROUSAL and SOMATIC scales were designed to measure perceived arousal at a general level (AROUSAL) and also at the level of more specific awareness of physiological symptoms (SOMATIC). The AROUSAL scale comprised seven items: "How relaxed/ aroused/ alert/ jittery/ stimulated/ excited/ sleepy did you feel?". The SOMATIC scale was made up of five items: "To what

extent did you experience rapid heartbeat/ nervous tension/ rapid breath/ muscle tension/ sweating palms?".

Affect was measured by the MAACL-R. This revision (Zuckerman & Lubin, 1985) of the MAACL attempted to overcome a number of psychometric weaknesses in the original scale. These relate to the fact that scales were highly correlated, and further that the scales suffered from an acquiescent response set. More specifically, the subscales of the MAACL typically correlated too highly with each other to infer that the individual scales had good discriminant validity. These suspicions about discriminant validity were highlighted by the report that the subscales typically correlated between .7 and .9 on any given occasion (Zuckerman & Lubin, 1965).

The MAACL-R subscales are moderately correlated, with the manual (Zuckerman & Lubin, 1985) reporting correlations among the three negative affect scales falling between .4 and .6. While this represents a considerable improvement over the correlations among the old scales, the authors maintain that the three subscales are representative of the larger dysphoria scale. The dysphoria scale is the sum of the raw scores of the three negative affect scales. The reduced interscale correlations are at least suggestive of greater discriminant validity.

The problem of acquiescent response set meant that MAACL scales correlated significantly with the number of items checked. In the case of the MAACL-R this

response set has been controlled through a standardisation process which has reduced the correlations for the negative affect scales from .66 -.68 to .37 -.43.

In reviewing the MAACL-R Templer (1987) refers to it as being brief and easy to administer, with good reliability, relative independence of response set, and commendable construct validity.

PROCEDURE

Subjects were contacted by telephone to arrange a suitable time. Such times were usually set days in advance of the actual meeting and a second call on the eve of the arranged time was made. This procedure was similar to that employed in Study One where it was found that a second "reminder" call increased the likelihood of subjects' attendance.

On arrival, all subjects were met by the experimenter and introduced to the female experimental assistant. This woman was not the same person who conducted the first experiment, but was a senior graduate student experienced in experimental procedure. She was blind to the experimental hypotheses.

The experimental assistant ushered subjects into the pre-experimental room where they were given an identification badge to pin on. They were then seated and informed that the instructions for that part of the study had been

prerecorded. At this point the appropriate instructions were played. The three possible sets of instructions (control, spatial confirmation, spatial disconfirmation), all had identical beginnings (see Appendix G). The instructions introduced the practice anagrams and subjects were provided with a copy of the practice anagram booklet. They were requested to read the instructions on the cover of the booklet and asked to complete the three items. The timing of the practice items was controlled by the prerecorded taped instructions which allow 30 seconds for the completion of each item.

At the conclusion of the third item the taped instructions varied the information which was provided for subjects before they proceeded to the next phase of the experiment. Control subjects were not given any information. Subjects in the spatial confirmation condition were told the aim of the experiment (to study the effect of interpersonal distance on behaviour), and they should expect to sit at an unusually close distance to the other subjects. The spatial disconfirmation information also informed subjects of the aim of the experiment and told them to expect to sit at a normal distance to other subjects. The experimental assistant then collected the practice anagram booklets and answer sheets, and showed subjects into the experimental room which was across the hall and adjacent to the pre-experimental room.

The experimental room (the same as used in Study One) contained five armless chairs, the front legs of which touched those of adjacent chairs. The experimental assistant broke this circle of chairs by drawing back one of the

chairs and inviting four subjects to be seated. The fifth subject was also seated after which the fifth chair was pushed in to complete the circle.

Once seated, all subjects were asked not to remove their chairs as the session was being recorded and the chairs had been specially placed to ensure optimum recording quality. They were further told that this was important as voice levels would later be analysed. At this point the experimental assistant pointed to the microphone which was suspended to the ceiling, equidistant from each of the five chairs.

Following the request to retain the seating positions, subjects were introduced to the anagram test task by way of tape-recorded instructions. They were provided with an anagram test booklet, answer sheet and pencil. Half the groups received a booklet containing easy anagrams while the remaining groups received a test booklet containing difficult anagrams. Those subjects who received easy anagrams comprised the nonspatial confirmation condition, while those who received difficult anagrams experienced nonspatial disconfirmation. At the completion of the first item, the experimental assistant left the room and returned on the completion of the last of the 10 anagrams.

After collecting the materials used for the anagram task the group word task was introduced. Subjects were instructed to work together to produce a single list within the 10 minute time limit. One subject acted as a recorder for the group and was handed a clipboard, paper and pen. After checking to ensure that all

subjects understood the task the experimental assistant left the room. She returned after exactly 10 minutes and collected the list.

The Johnny Rocco case was next introduced by providing each subject with a copy of the case study and also the Love / Punishment scale. Groups were then asked to discuss the case and try to reach a group decision as to which of the seven treatments they would recommend for Johnny. Five minutes was allocated for this task. Again, the experimental assistant left the room for the duration of the task, returning at the conclusion to collect the materials.

Finally, subjects were handed a copy of the MAACL-R and asked to complete the checklist. The directions for the completion of the checklist were read out and they were asked to identify themselves by the identification letter which corresponded to the badge they had worn. When all subjects had finished, the checklists were collected and it was explained that the experiment was over, but that one final task remained. Subjects were taken back to the pre-experimental room, seated at desks and asked to complete a copy of the post-experimental questionnaire.

Following the completion of the post-experimental questionnaire, the experimental assistant collected the materials and thanked subjects for their participation. At this point, she departed and the experimenter debriefed the subjects and answered any remaining questions before dismissing them. Subjects were asked to respect the confidentiality which the study required.

ETHICAL CONSIDERATIONS AND DEBRIEFING

Some deception accompanied each of the independent variables. In the case of spatial expectation, subjects entered the experimental room with either an accurate expectation of spatial arrangements, an inaccurate expectation, or no expectation. Thus, one third of the subjects were correctly informed, while one third were misinformed, with the final third being uninformed. Those subjects either misinformed or uninformed were subject to experimental deception.

Nonspatial expectation was manipulated by exposure to either easy or difficult anagrams. In the case of the easy anagrams these were consistent with what would have been expected following the trial anagrams, with no deception involved. Subjects unexpectedly exposed to a set of difficult anagrams had purposefully been deceived about the nature of the task they could expect. This misinformation was seen as necessary in order to examine the effect of disconfirmed nonspatial expectations on the experience of crowding.

A third form of deception involved the ruse which all subjects received as a "rationale" for retaining their allocated seating positions. They were misinformed that the close seating was necessary as the sessions were recorded and voice levels were monitored for later analysis. This ruse was necessary to encourage subjects to remain in the close seating formation. The cover story was, however, based on a half truth. It was correct that the sessions were recorded, but voice levels were unimportant. The sessions were recorded so the experimental

assistant could monitor the sessions when she was not present and also the recordings were taken so they could be re-examined for any casual comments which subjects may have made about the nature of the seating arrangements.

Any overt signs of distress or discomfort shown by the subjects was to be attended to by the experimental assistant who was close to the subjects at all times. When the procedure required the experimental assistant to be out of the room she had been instructed to wait in an adjacent room where the voices of the subjects were being recorded, and also played into the room for the experimental assistant to monitor. As previously, the experimental assistant had been instructed to disband the group if the procedure became obviously distressing for any subject. This precaution proved to be unnecessary.

In accordance with Tesch's (1977) recommendations, the debriefing procedure addressed the issues of ethics, methodology and education. The debriefing revealed all deceptions to which that particular group had been exposed. The use of the deception was explained and justified. The main aims of the study were explained and essential aspects of the methodology were outlined. Subjects were asked if they had any questions and these were answered fully. In the case of some groups, the questions indicated a level of real curiosity about certain aspects of the study, while in other groups there were no questions at all.

After all questions had been dealt with satisfactorily, subjects were reminded that following the conclusion of the experiment when the data had been analysed,

they would be posted a copy of the results in summary form. These notes (see Appendix J) outlined the aims, procedure and results of the study. It was hoped in this way to maximise the educational value of participation in the experiment by emphasising how their individual contributions make research possible and the value of such research.

CHAPTER NINE

STUDY TWO: RESULTS

PSYCHOMETRIC PROPERTIES OF THE SCALES MEASURING AROUSAL AND CROWDING

The concepts of arousal and crowding were each measured by two scales. Arousal was measured by a seven item **AROUSAL** scale and a five item **SOMATIC** scale. Crowding was measured by a four item **CROWDED** scale, and a three item **ANNOYANCE** scale. One aim of the second study was to employ measurement instruments which improved on the single item measures used in Study One. Accordingly, each of these scales was subjected to an examination of the inter-item reliability (alpha) coefficient, as an index of reliability. The alpha coefficient represents a measure of the extent to which the scale is internally consistent. Internal consistency estimates of reliability are based on the average intercorrelations among the items on the scale. If the items intercorrelate then the scale will have some internal consistency, and is more likely to be measuring the same construct.

Another issue concerned the question of whether this reliability analysis should be based on individual or group data. The analysis of the results for the first study was conducted on the basis of using the group as the unit of analysis. The

reason was that analysis of variance assumes independence of subjects. The nature of experimental crowding research is likely to defy this assumption, and for that reason the unit of analysis for the first study was the group. For the same reason the following reliability analysis was based on the group as the unit of analysis. Following each alpha coefficient a second (bracketed) coefficient will appear. This second alpha denotes the alpha based on the individual as the unit of analysis. As will become clear, the differences between the two sets of figures are minimal.

Perceived arousal was represented by two scales, AROUSAL and SOMATIC. The arousal scale consisted of the sum of seven items. It was assumed that the items (examining, for example, awareness of excitement, alertness and stimulation) would represent subjects' general level of awareness of their arousal. A reasonable level of internal consistency was recorded for the arousal scale with alpha = .64 (.68).

The somatic scale comprised five items asking subjects about specific awareness of physiological symptoms such as heartbeat, rapidity of breathing and sweating palms. A high level of internal consistency was recorded, with alpha = .83 (.77).

Two scales were used to measure crowding, a CROWDED scale designed to measure the extent to which people felt crowded, and an ANNOYANCE scale which looked at the extent to which others were seen as annoying in the

experimental setting. The crowded scale was made up of four items asking subjects about crowding, confinement, crampedness and comfort. The alpha coefficient was high at .85 (.83).

The annoyance scale comprised three items asking about the extent to which others were of bother in the experimental setting. For this scale, the internal consistency was again high, alpha = .90 (.81).

In summary, the levels of internal consistency for these scales was sufficient to justify their use. The alpha levels were more than encouraging and the subsequent analysis was able to proceed with some confidence in the measures.

MANIPULATION CHECKS

Manipulation checks were concerned with several issues. Firstly, the effectiveness of the distance manipulation. Secondly, the effectiveness of the information manipulation in leading subjects to expect to sit at close or normal distances. Thirdly, the issue of the relative difficulty of both the practice and test anagrams.

DISTANCE MANIPULATION

The standard practice in examining the effectiveness of distance manipulations is

to compare the ratings of how crowded subjects felt between close distances and far distances. In this study there were no far interpersonal distance groups. It was assumed, on the basis of extensive and conclusive previous research, that the interpersonal distance manipulation would be effective in inducing feelings of crowding in subjects. While this assumption seemed reasonable, it also seemed prudent to examine subjects' responses which may have a bearing on this assumption.

In this regard, subjects were asked whether their personal space had been invaded or not. Such invasion has previously been seen as an important dimension in the experience of crowding, and the information expectancy model similarly relied on spatial invasion as being important to the experience of crowding. Of the 240 subjects, 97 (40.4%) indicated that their personal space had not been invaded. The remaining 143 (59.6%) reported that their personal space had been invaded. This result was a surprise in view of definitions which are predicated on the notion of a personal space invasion being a prerequisite for the experience of crowding. Of further interest is the fact that, when asked to quantify the extent of the personal space invasion, only a small number reported this as a severe invasion. This information is detailed in Table 5 below.

Table 5 shows that very few subjects felt as if their personal space had been severely invaded. Over half the 59.6% of subjects who reported a spatial invasion, rated the extent of the personal space invasion as being either 7, 8 or 9, that is, of minor magnitude.

TABLE 5

FREQUENCIES FOR EXTENT OF PERSONAL SPACE INVASION

	VALUE	FREQUENCY	PERCENT
	0	4	1.7
	1	11	4.6
	2	7	2.9
	3	13	5.4
	4	8	3.3
	5	12	5.0
	6	12	5.0
	7	28	11.7
	8	22	9.2
	9	26	10.8
TOTAL		143	59.6

Note: 0 = severely invaded, 9 = slightly invaded.

INFORMATION MANIPULATION AND SUBJECTS' APPRAISAL

The three information conditions were designed to induce subjects either to expect to be seated at an unusually close distance, or a normal distance, or in the case of the control group no particular expectations about seating arrangements were conveyed. As a manipulation check subjects were asked how close they had expected to be seated to other subjects. On a scale for which higher values indicated an expectation of greater closeness, the condition which had the highest mean value (5.6) was the condition which had led subjects

to expect to be seated at an unusually close distance (spatial confirmation). The next highest expectation for closeness was recorded for the condition in which subjects were provided with inaccurate spatial information (4.54). Subjects in this condition (spatial disconfirmation) were told to expect to be seated at a normal distance from other subjects. Finally, the control condition recorded the lowest mean value (3.74) suggesting that they were less likely to have expected to be seated at close interpersonal distances. On the omnibus ANOVA (see Appendix K for all summary ANOVA tables for Study Two) the main effect for information was highly significant, $F(2, 36) = 11.03$, $p < .001$. This showed that subjects in the spatial confirmation condition expected to be seated at significantly closer distances than the control group lending support to the effectiveness of the manipulation.

Further, on a specific contrast the difference between spatial confirmation and spatial disconfirmation conditions was also significant, $F(1,36) = 7.10$, $p < .025$. This result confirms hypothesis 1.1 which predicted that subjects would use available information about spatial concerns in the development of spatial expectations. It therefore appears that the information manipulation had a significant impact on subjects spatial expectations.

DIFFICULTY OF ANAGRAMS

It was important to show that practice anagrams were similarly easy for subjects

in all conditions, and that the test anagrams were in fact difficult and easy for the respective conditions. Table 6 sets out the group means for the average number of practice anagrams correct.

TABLE 6

MEANS AND STANDARD DEVIATIONS FOR NUMBER OF PRACTICE ANAGRAMS CORRECT PER CONDITION

INFORMATION	DIFFICULTY	
	EASY	DIFFICULT
CONTROL	2.50 0.32	2.70 0.30
SPATIAL CONFIRM.	2.60 0.15	2.57 0.42
SPATIAL DISCONFIRM.	2.62 0.36	2.75 0.28

Note: each mean is based on group means, with each of these cells representing eight such groups.

These means look very similar. Two things are clear from Table 6. Firstly, the practice anagrams were easy, as can be seen from the magnitude of the means (maximum mean value = 3). Furthermore, 71.2% (171 subjects) got three out of three anagrams correct. A further 21.3% (51 subjects) were successful with two anagrams, while 6.3% (15 subjects) were successful with only one anagram. The remaining 1.2% (three subjects) failed on all three anagrams. The fact that over

90% of subjects were correct on either two or three of the three practice anagrams testifies to their ease.

Secondly, the similarity among the means suggested that no differences existed among the conditions. In fact, an overall ANOVA indicated ($F < 1$) that this was the case. Not only were the practice anagrams easy, but they were of similar ease for subjects in all conditions. Note that for the analysis of variance of most of the dependent variables for Study Two sex was included in the analysis as a control factor (Keppel, 1982). The two exceptions to this were for both practice and test anagrams where this procedure was not necessary.

In the case of the test anagrams it was important to demonstrate that those subjects provided with easy anagrams did perform in accordance with the ease of the task, and similarly that the difficult anagrams were of sufficient difficulty. Table 7 shows that with difficult anagrams on average most subjects only got about two out of a possible 10 correct. In the case of the subjects given easy anagrams this figure was closer to being eight out of 10.

An ANOVA revealed a highly significant main effect, $F(1, 42) = 610.88$, $p < .001$, for the differences between easy and difficult anagrams. This result confirms hypothesis 7.1 which suggested that subjects given easy anagrams would outperform those subjects given difficult anagrams. These results indicate that subjects' nonspatial expectations were confirmed in the case of the easy anagrams and disconfirmed in the case of the difficult anagrams.

TABLE 7

MEANS AND STANDARD DEVIATIONS FOR NUMBER OF TEST ANAGRAMS CORRECT PER CONDITION

INFORMATION	DIFFICULTY	
	EASY	DIFFICULT
CONTROL	7.92 0.57	2.10 0.67
SPATIAL CONFIRM.	7.67 0.90	1.97 0.85
SPATIAL DISCONFIRM.	7.35 0.95	1.67 0.91

Note: each mean is based on group means, with each of these cells representing eight such groups.

In summary, there appeared to be some doubt about the effectiveness of the distance manipulation (although this was examined indirectly), while both the information and difficulty of anagrams manipulations were effective. The following section will examine specific hypotheses beginning with those related to the issue of sex of subject.

SEX

It was predicted that women would report feeling less crowded than men (hypothesis 8.1), and that women would report feeling less annoyed than men (hypothesis 8.2). As expected, women on the CROWDED scale (mean = 14.34) reported feeling less crowded than men (mean = 16.03). This difference was

significant, F (1, 36) = 5.07, p = .031. Similarly, on the ANNOYANCE scale women reported feeling less annoyed (mean = 5.80) than their male counterparts (mean = 8.25). Again, the difference between the means was significant, F (1, 36) = 5.46, p = .025.

In view of the clear support for these two hypotheses it was decided to examine the results for both sexes separately for all hypotheses which related to either crowding or annoyance.

CROWDING

It was predicted that subjects whose spatial expectations were confirmed would report reduced perceptions of crowding compared to control subjects (hypothesis 2.1).

For women, the means shown in Table 8 were in the expected direction but the planned comparison revealed no significant effect, F (1,36) = 2.30, p < .20. Interestingly, for male subjects the means were in the opposite direction to that predicted. This suggests that for males accurate information failed to reduce subjects' perceptions of crowding. If anything the means were suggestive of increased crowding for male subjects who were exposed to accurate information.

TABLE 8

MEANS AND STANDARD DEVIATIONS FOR RATINGS OF CROWDING AS A FUNCTION OF SEX AND INFORMATION

INFORMATION	SEX	
	WOMEN	MEN
CONTROL	14.88	15.50
	2.25	0.99
SPATIAL CONFIRM.	13.48	18.00
	2.72	3.11
SPATIAL DISCONFIRM.	14.65	14.60
	1.31	1.84

Note: for women each mean was based on 12 groups, and for men each mean was based on four groups.

The second crowding-related prediction was that disconfirmed spatial expectations would increase perceptions of crowding for subjects when contrasted with control subjects (hypothesis 2.2). It is apparent from Table 8 that there is no support for this hypothesis. For both male and female subjects the means were in the opposite direction to that predicted.

Hypothesis 2.3 examined the effect of disconfirmed nonspatial expectations on perceptions of crowding. It was anticipated that disconfirmed nonspatial expectations (difficult anagrams) would serve to increase subjects' perceptions of crowding compared to subjects whose nonspatial expectations were confirmed.

TABLE 9

MEANS AND STANDARD DEVIATIONS FOR RATINGS OF CROWDING AS A FUNCTION OF SEX AND TASK DIFFICULTY

DIFFICULTY	SEX	
	WOMEN	MEN
EASY	13.58 2.29	14.70 2.31
DIFFICULT	15.10 1.90	17.37 1.65

Note: means for women are based on 18 groups and those for men on six groups.

As can be seen from Table 9 the disconfirming of nonspatial expectations did increase subjects' perceptions of crowding. For women the means were in the predicted direction and on the basis of a planned comparison proved to be significant, $F(1,36) = 4.08$, $p < .05$. For men the means were in the predicted direction and the difference between the means also was significant, $F(1,36) = 4.19$, $p < .05$.

ANNOYANCE

Each of the three hypotheses related to crowding were paralleled by three hypotheses related to the extent to which subjects were annoyed or bothered.

These hypotheses examined the degree to which the experience of crowding and the hypothesised variables, which influence that experience, were seen by subjects to have an aversive element.

Hypothesis 4.1 predicted that spatial confirmation would reduce annoyance when compared to control subjects. As Table 10 indicates, annoyance levels were certainly not reduced for spatial confirmation conditions for either female or male subjects.

TABLE 10

MEANS AND STANDARD DEVIATIONS FOR RATINGS OF ANNOYANCE AS A FUNCTION OF SEX AND INFORMATION

INFORMATION	SEX	
	WOMEN	MEN
CONTROL	5.10 1.17	6.55 4.60
SPATIAL CONFIRM.	5.73 3.12	10.40 5.66
SPATIAL DISCONFIRM.	6.57 2.43	7.80 0.28

Note: means for women are based on means of 12 groups while those for men are based on four groups.

Hypothesis 4.2 predicted that spatial disconfirmation would result in increased annoyance for subjects when contrasted with control subjects. As Table 10

shows, the predicted increases were apparent for both sexes. Planned comparisons revealed the comparative increase for women, $F(1,36) = 1.31$, n.s., and men, $F(1,36) < 1$, was not sufficiently large to attain significance.

The third hypothesis (4.3) relating to annoyance considered the effect of disconfirmed nonspatial expectations on perceptions of annoyance. It was expected that nonspatial disconfirmation (difficult anagrams) would increase subjects' annoyance at being crowded compared to subjects whose nonspatial expectations were confirmed (easy anagrams). Table 11 details the mean annoyance ratings for both women and men as a function of task difficulty.

TABLE 11

MEANS AND STANDARD DEVIATIONS FOR ANNOYANCE RATINGS AS A FUNCTION OF SEX AND TASK DIFFICULTY

DIFFICULTY	SEX	
	WOMEN	MEN
EASY	5.28 1.73	7.43 5.04
DIFFICULT	6.32 3.18	9.07 1.98

Note: means for women are based on 18 groups and those for men are based on 6 groups.

As is clear from Table 11, nonspatial disconfirmation did result in comparative

increases in subjects' ratings of annoyance. These increases occurred for both sexes but in neither case was the increase significant. For women, $F(1,36) < 1$, and for men, $F(1,36) < 1$.

AROUSAL

The hypotheses relating to arousal predicted no significant differences between subjects whose spatial expectations were confirmed and subjects whose spatial expectations were disconfirmed (hypothesis 3.1). Similarly, it was anticipated that nonspatial disconfirmation would not increase subjects' arousal in comparison with subjects whose nonspatial expectations had been confirmed (hypothesis 3.2). For each of these hypotheses two measures of arousal were taken (AROUSAL and SOMATIC). Table 12 presents the means for arousal, while Table 13 presents the means for the somatic measure of arousal.

The uniformity of the means for both measures of arousal presented in Tables 12 and 13 suggest strong support for both hypotheses 3.1 and 3.2. On both arousal scales no significant main effects or interactions were noted. On the overall ANOVA for arousal the main effect for information was not significant, $F < 1$. On the overall ANOVA for somatic arousal the main effect for information also failed to reach significance, $F < 1$.

TABLE 12

MEANS AND STANDARD DEVIATIONS FOR AROUSAL AS A FUNCTION OF INFORMATION AND TASK DIFFICULTY

INFORMATION	DIFFICULTY		
	EASY	DIFFICULT	MEAN TOTAL
CONTROL	34.92 1.56	35.85 2.50	35.39
SPATIAL CONFIRM.	35.92 1.98	33.92 1.45	34.92
SPATIAL DISCONFIRM.	36.20 2.10	35.00 2.34	35.60
MEAN TOTAL	35.68	34.92	

Note: means are all based on eight groups per cell.

Similar results were obtained for task difficulty. On the ANOVA for arousal the main effect for task difficulty had little appreciable effect, $F(1, 36) = 1.70$, $p = .20$. Also on the overall ANOVA for somatic arousal the main effect for task difficulty failed to reach significance, $F < 1$. Therefore, on both measures of arousal neither of the manipulated variables had any significant impact on subjects' reported levels of arousal.

TABLE 13

MEANS AND STANDARD DEVIATIONS FOR SOMATIC AS A FUNCTION OF INFORMATION AND TASK DIFFICULTY

INFORMATION	DIFFICULTY		
	EASY	DIFFICULT	MEAN TOTAL
CONTROL	26.57 1.13	27.30 1.16	26.94
SPATIAL CONFIRM.	27.02 3.05	27.37 1.63	27.20
SPATIAL DISCONFIRM.	27.10 1.63	26.55 1.40	26.82
MEAN TOTAL	26.90	27.07	

Note: means are all based on eight groups per cell.

INTERPERSONAL RELATIONSHIPS

Interpersonal relationships were indexed by ratings of punitiveness, perceived aggressiveness of others and liking for others. The general expectation (hypothesis 5.1) was that interpersonal relationships would suffer in the face of both spatial and nonspatial disconfirmation.

PUNITIVENESS

Table 14 shows the respective means on the Love - Punishment scale which indexes punitiveness. Higher scores indicate greater levels of punishment.

It was expected that punitiveness would be increased as a result of both spatial and nonspatial disconfirmation. The omnibus ANOVA showed no main effect for information, $F < 1$, indicating that spatial disconfirmation failed to significantly increase subjects punitiveness even though the means were in the expected direction.

TABLE 14

MEANS AND STANDARD DEVIATIONS FOR THE LOVE-PUNISHMENT SCALE AS A FUNCTION OF INFORMATION AND TASK DIFFICULTY

INFORMATION	DIFFICULTY		
	EASY	DIFFICULT	
INFORMATION			MEAN TOTAL
CONTROL	2.75 0.71	3.25 0.71	3.00
SPATIAL CONFIRM.	2.38 0.52	3.38 0.74	2.88
SPATIAL DISCONFIRM.	3.25 0.71	2.88 0.64	3.06
MEAN TOTAL	2.79	3.17	

Note: means are all based on eight groups per cell.

With respect to nonspatial disconfirmation, Table 14 shows that subjects provided with difficult anagrams were more punitive (mean = 3.17) than subjects given easy anagrams (mean = 2.79). On the overall ANOVA this difference was significant, $F(1, 36) = 4.19$, $p = 0.048$.

There was also a significant interaction, $F(2, 36) = 4.81$, $p = 0.014$, between information and task difficulty such that subjects given easy anagrams but disconfirmed spatial expectations were more punitive than subjects who had easy anagrams but confirmed spatial expectations. Less punitive subjects were likely to be those who were given easy anagrams but disconfirmed spatial expectations, or difficult anagrams but confirmed spatial expectations.

AGGRESSIVENESS

It was anticipated that both spatial and nonspatial disconfirmation would result in increased judgments for aggressiveness of other group members. The means for subjects' ratings of aggressiveness of others in their group are shown in Table 14. These means are based on the total aggressiveness rating of the other four members of each group; these five totals have then been averaged.

The overall ANOVA indicated no main effect for information, $F < 1$, suggesting that spatial disconfirmation did not result in increased ratings of aggressiveness for fellow group members. A visual examination of the direction of the means shown in Table 15 confirms this conclusion.

TABLE 15

MEANS AND STANDARD DEVIATIONS FOR AGGRESSIVENESS AS A FUNCTION OF TASK DIFFICULTY AND INFORMATION

INFORMATION	DIFFICULTY		
	EASY	DIFFICULT	
INFORMATION			TOTAL MEAN
CONTROL	25.30 2.81	27.97 4.71	26.64
SPATIAL CONFIRM.	24.02 2.63	26.42 5.09	25.22
SPATIAL DISCONFIRM.	21.60 3.18	27.67 2.88	24.64
TOTAL MEAN	23.64	27.36	

Note: means based on eight groups per cell.

The ANOVA, however, revealed a main effect for task difficulty, $F(1, 36) = 7.99$, $p = 0.008$. Subjects who had their nonspatial expectations disconfirmed (exposed to difficult anagrams) rated their fellow group members as being significantly more aggressive compared to those subjects given easy anagrams.

LIKING FOR OTHERS

It was anticipated that disconfirmation of both spatial and nonspatial expectations would result in decreased liking for other people in the group. There was no

main effect for either information, F (2, 36) = 1.86, p = 0.171; or for task difficulty, F < 1. These results indicate that the disconfirmations which were manipulated in this study had no significant effect on subjects' ratings of the extent of their liking for each other.

On the variable of liking for others there was an unanticipated main effect for sex of subject, F (1, 36) = 6.61, p = 0.014. This meant that women subjects liked their fellow group members (mean = 6.37) more than the men subjects liked their fellow participants (mean = 5.78).

In summary, on two of the three measures used, disconfirmation of nonspatial expectations resulted in some disruption to interpersonal relationships. Disconfirmed spatial expectations failed to have a significant effect on interpersonal relationships.

AFFECT

The hypotheses relating to affect suggested that confirmation of spatial expectations would reduce negative affect. On each of the three main scales of the MAACL-R (anxiety, hostility and depression) no main effects were evident. On the anxiety scale, while there was no main effect, there was a significant interaction, F(2, 36) = 6.28, p = 0.005. This interaction, between spatial information and sex of subject, suggested that providing men with accurate

information served to increase their anxiety while for women this same information reduced anxiety.

PERFORMANCE

The study had an exploratory interest in the effect of confirmed and disconfirmed spatial and nonspatial expectations on task performance. The task concerned involved the group compiling as large a list as possible of smaller words derived from a larger word.

TABLE 16

MEANS AND STANDARD DEVIATIONS FOR GROUP PERFORMANCE AS A FUNCTION OF INFORMATION AND TASK DIFFICULTY

INFORMATION	DIFFICULTY		
INFORMATION	EASY	DIFFICULT	TOTAL MEAN
CONTROL	63.75 10.21	72.88 10.26	68.31
SPATIAL CONFIRM.	63.63 9.05	65.50 5.16	64.56
SPATIAL DISCONFIRM.	59.38 6.68	65.63 9.33	62.50
TOTAL MEAN	62.25	68.00	

Note: means based on eight groups per cell.

On the overall ANOVA there was no main effect for information but there was for task difficulty, $F(1, 36) = 4.92$, $p = 0.033$. Subjects whose nonspatial expectations were disconfirmed and who were exposed to difficult anagrams (mean = 68.00) outperformed subjects whose nonspatial expectations were confirmed (mean = 62.25). This result is the opposite of that predicted in hypothesis 7.3. Having accurate nonspatial information failed to enhance performance in any way, with the better performance coming from the subjects whose nonspatial expectations were disconfirmed.

CHAPTER TEN

STUDY TWO DISCUSSION

MEASUREMENT OF AROUSAL AND CROWDING

In order to overcome some possible deficiencies in the measurement of arousal and crowding, this study employed two specific scales to measure each of these key concepts. The alpha coefficients for these scales indicate that these measures were internally consistent.

The indices of inter-item reliability compare favourably with previously published reliability measures for these scales. Of the two scales measuring arousal (SOMATIC & AROUSAL) only the first had previously been subjected to a consideration of internal consistency. In comparison with previous research by Aiello et al. (1977) and Nicosia et al. (1979) the current study compared very well with alpha = .83. In the case of the arousal scale, there were no previously published studies with which to compare. However, even relative to the alpha coefficient for the somatic scale, the alpha level of .64 for the arousal scale looks encouraging, and is suggestive of good internal consistency.

Of the two crowding scales only the ANNOYANCE scale had any previously reported information about its reliability. The results from the current study

compare very favourably (alpha = .90) with the previously published research by Nicosia et al. (1979). The CROWDED scale has no previously published data with which to compare but in a relative sense looked impressive (alpha = .85).

In sum, the four scales each demonstrated a high level of internal consistency. Anastasi (1982) notes that good internal consistency implies the scale is homogeneous. Such homogeneity is important for unambiguous interpretation of scores.

MANIPULATION CHECKS

Manipulation checks were conducted in three areas. The first of these considered the effectiveness of the distance manipulation. The second looked at the effect the differing information conditions had on subjects' spatial expectations. The third manipulation check was concerned with establishing that subjects performed differentially on the test anagrams after receiving practice anagrams of uniform ease.

Interpersonal Distance

The standard procedure in assessing the effectiveness of distance manipulations is to compare ratings of subjects seated at close distance with ratings of subjects seated at far distance. Without exception, the literature reveals that close

subjects report higher levels of crowding, on whatever measures of crowding have been taken, than far subjects. Reduced interpersonal distance results in increased reports of crowding. The consistency of this finding was the reason no far interpersonal distance conditions were included in the current study. On the basis of a large body of supporting evidence it was assumed that a similar "close" manipulation would be effective. While this assumption seemed reasonable it was only an assumption and it therefore seemed prudent to examine any information which may have a bearing on it.

For the reason mentioned above there was no **comparative** information available to determine whether the subjects in this study experienced spatial invasion relative to subjects seated at far distances. There was, however, some descriptive information available in the form of two questions which subjects responded to in an **absolute** sense. Subjects were asked whether or not their personal space had been invaded, and if so, to what extent.

Only 60% of subjects indicated that their personal space had been invaded. The surprising aspect of this is that, given the closeness of the other subjects (they sat with adjacent knees touching), not more subjects felt as though their personal space had been invaded. This result is noteworthy in view of the definitions of crowding which are predicated on the belief that personal space invasions are necessary for the experience of crowding. While this view has been challenged by the present result, it may be as well to remember that for the majority of subjects the operationalisation of crowding **was** effective in inducing an invasion

of personal space. That is, 60% of subjects said that they felt as though their personal space had been invaded.

Nevertheless 40% of subjects failed to report an invasion of personal space under conditions which had been specifically designed to induce such invasions. However, this result should be interpreted with caution because it is unusual to measure spatial invasion in this fashion. The preferred methods being naturalistic observation or the stop-distance technique (Hayduk, 1983). Neither of these methods were appropriate in the present situation, so a direct question method was employed. This measure is reasonable provided results are interpreted with due caution.

Another point to consider is the wording of the question. Subjects were asked about an "invasion" of personal space. While a sizable proportion of subjects said "no" to that question, they may have agreed to something less strongly worded. More subjects, for example, may have been prepared to endorse the notion of an "infringement" of their personal space.

Subjects who acknowledged a spatial invasion were asked about the severity of the invasion. The results indicate that the vast majority of subjects experiencing a spatial invasion reported this as being of only slight magnitude. However, there are no particular theoretical expectations about the severity of spatial invasions necessary for the experience of crowding to occur. In other words, the minimal invasions reported may well have been sufficient to induce feelings of

crowding.

Again, if this information is taken at face value, it suggests that even minimal invasions of personal space may have profound consequences for individuals' experiences of crowding. Perhaps the most remarkable aspect is that not more subjects acknowledged the severity of the personal space invasion. Each subject sat in a confined seating arrangement with knees touching the knees of two other subjects who were unknown to the individual. Given the ethical constraints it is difficult to imagine a situation where subjects could have their personal space more invaded. Yet curiously, subjects described this as being only a slight spatial invasion.

By way of explanation it may be helpful to consider the nature of the experimental situation. In this study, subjects were provided with advance warning (in two of the three information conditions) that distance between subjects was a variable to be manipulated. And in one of these cases subjects were told to expect close interpersonal distances. Perhaps it was a response to the pre-exposure information which accounted for the restricted endorsements of the nature of the spatial invasions. Similarly, informing subjects about the likelihood of spatial manipulations may have been responsible for the large number of subjects who failed to report an invasion of their personal space. However, these conjectures are not supported by the fact that 64% of subjects in the control condition acknowledged a spatial invasion compared to 50% and 65% of subjects in the two conditions which were alerted to the importance of

distance as a variable.

Another reason for the limited reports of spatial invasion may stem from the fact that although subjects sat very close, they were able to achieve the set tasks without any disruption or interference from others. In short, the lack of behavioural interference may have reduced the extent to which subjects felt their space had been invaded. Certainly, the various behavioural constraint models of crowding would argue for this possibility. At issue here is the question of whether subjects' reports of spatial invasions are dependent on the invasion itself or on the aversive consequences which may accompany the invasion.

A further point worth considering is that these questions were asked within the context of an experimental setting. The unique nature of the setting may have contributed to the extent to which subjects were prepared to expose themselves to unusual conditions, and then subsequently regard these conditions as not especially unusual. This degree of experimental compliance has previously been documented (Orne, 1962), and would suggest that there may be few limits to the extent to which subjects will go in order to appease experimental demands.

The absence of comparative information makes it impossible to draw firm conclusions about the effectiveness of the distance manipulation. The assumption that the distance manipulation would result in the personal space invasions necessary to induce feelings of crowding has received reserved support. On the other hand, the results also suggest that perceptions of crowding

may not be contingent upon spatial invasion.

Information

Three information conditions were included in the design in order to influence subjects' expectations about the distance they would be seated from other subjects. Subjects were led to expect close seating, normal seating, or were provided with no information about seating. They were subsequently asked how close they had expected to be seated. As expected, those led to expect close interpersonal distances reported they had expected to be seated closer than either control subjects, or subjects who had been misinformed to expect a normal interpersonal distance. This confirmed hypothesis 1.1 which predicted subjects would use available spatial information in developing spatial expectations. It can therefore be concluded that this information had a significant impact on expectations about closeness to others. This suggests spatial information is likely to be appraised, and this appraisal will have a bearing on subsequent spatial expectations. This result supports the information expectancy model in consolidating the link between information and spatial expectations.

Anagrams

The manipulation checks involving anagrams were completed in order to demonstrate the ease of the practice anagrams and the difficulty of the test anagrams. This was important as these differences represented the

operationalisation of confirmation and disconfirmation of nonspatial expectations. Relevant to the ease of the practice anagrams was the fact that over 90% of the subjects got either two or three out of three correct. A majority of subjects (71%) got all three anagrams correct. Not only were the practice anagrams easy, but they were of uniform ease for subjects in all conditions. The results indicate that the mean number of anagrams correct ranged from 2.5 to 2.75 for the eight conditions, with an overall mean of 2.62. There was no significant difference between these means which supports the conclusion that they were of similar ease for subjects in all conditions.

In the case of the test anagrams, it was important to show that the easy anagrams were in fact easy and that the difficult anagrams were likewise difficult. Clear differences emerged with subjects given easy anagrams outperforming those subjects provided with difficult anagrams. This result supports hypothesis 7.1. It seems safe to conclude that the manipulation designed to confirm and disconfirm subjects' nonspatial expectations was effective.

SEX

The issue of sex of subject has resulted in equivocal results within the crowding literature (Hayduk, 1983). One theme which recently has received some support (Nicosia et al., 1979) is that men respond more negatively to being crowded than women. Thus, it was predicted (hypothesis 8.1) that women would report feeling less crowded than men, and (hypothesis 8.2) that they would feel less annoyed

than their male counterparts.

The results supported these two predictions. On the CROWDED scale, women were significantly less crowded than men. Similarly a sex difference emerged on the ANNOYANCE scale. These results provide further support for the view that there are differences in the way in which men and women respond to crowded situations. The results lend support to Nicosia et al.'s (1979) conclusion that men respond more negatively to being crowded.

The issue of sex of subject was considered as an explanatory factor in the failure of the first study to induce arousal in crowded subjects. This possibility arose because if women adapt better in crowded conditions, then a study based on women subjects may be open to the criticism that arousal was unlikely to be induced due to the adaptive nature of the subjects under those conditions. If this had been the case then sex differences on the arousal measures should have been evident in the second study. Yet on both measures of arousal no main effect for sex was apparent showing that subjects of both sex were equally aroused, or nonaroused, by the experience of crowding.

CROWDING AND ANNOYANCE

One of the key predictions of the information expectancy model was that confirmation of spatial expectations would reduce the extent to which subjects

reported feeling both crowded (hypothesis 2.1), and annoyed (hypothesis 4.1). As a result of the sex differences found on both crowding measures these results were considered separately for men and women.

In the case of women subjects on the crowding measure there was a nonsignificant decrease in crowding for those subjects whose spatial expectations were confirmed. However, this marginal reduction in crowding was not supported by any reduction in the level of reported annoyance. For men, spatial confirmation failed to produce the predicted reductions in either crowding or annoyance. For subjects of both sexes, the provision of accurate information failed to reduce perceptions of crowding or annoyance. This may have been due to the ineffectiveness of the distance manipulation which may have failed to induce strong feelings of crowding and annoyance. Or it may have been a result of the fact that subjects were able to function adequately and complete tasks without interference by the presence of the other subjects. On at least one of the tasks the cooperative requirements of the task would have increased the desirability of having others present. Whatever the reason, this result represents a serious failure to support one of the main predictions of the information expectancy model.

It was expected that disconfirmed spatial expectations (inaccurate spatial information) would result in increased perceptions of crowding (hypothesis 2.2) and annoyance (hypothesis 4.2) in comparison to subjects who were provided with no spatial information. The results failed to support the first of these

hypotheses for both men and women. There was no increase in subjects' perceptions of crowding following inaccurate spatial information. The lack of support for the second of these hypotheses was almost as complete. On the annoyance scale the increases for both men and women were not significant. As for the provision of accurate information, it would seem that inaccurate spatial information also failed to have any real influence on the way in which subjects subsequently perceived the extent to which they were crowded or annoyed.

One of the cornerstones of the information expectancy model is that spatially relevant information would be used in establishing spatial expectations and confirmation or disconfirmation of these expectations would influence the way in which the individual perceived the experience of crowding. It seems that spatially relevant information is likely to be used in establishing spatial expectations but the accuracy of that information will have little effect on the experience, in terms of seeing it as more crowded or more annoying. This may imply that expectations are rather more malleable than was previously assumed. Within the context of experimental crowding, however, the utility of pre-exposure information now seems questionable.

This failure to demonstrate the efficacy of accurate information has a number of implications for some models of crowding. Epstein and Karlin's (1975) normative expectations model holds that environmental cognition will operate to exacerbate the experience of crowding when there is a mismatch between what is expected and what is subsequently experienced. Indeed, Study Two attempted to engineer

such a mismatch with the result that information and expectations mattered little in influencing the subsequent experience. An important consideration is the fact that these expectations were set in the context of an experiment where wider normative expectations may operate. Altman's (1975) privacy control model is perhaps less relevant given that all subjects knew that they would be participating with a small group of others. However, the privacy control model is based on the assumption that crowding will be increased by any loss of psychological control. One perspective on the current study is that it attempted to increase subjects' predictive control by providing accurate pre-exposure information. This measure proved to be ineffective in mediating subjects' perceptions of crowding. This suggests that the information is not especially useful as a control mechanism or, alternatively, that control is less important when the crowding experience contains no obviously aversive aspects.

One contradiction deserving comment is that accurate information in the first study did result in a reduction in crowding, but this was not the case in the second study. The pre-exposure information in the first study consisted of two aspects, information that the variable of experimental interest was the distance between people and that they may experience negative effects as a consequence. Study Two provided accurate information to subjects by telling them that the study was looking at the effects of distance on behaviour (similar to the information provided in the first study). Unlike the first study, however, they were not informed of possible negative effects of sitting so close to others. One reason for this omission was the serious inconsistency it would have

presented for subjects who were led to expect "normal" seating.

Thus, with the benefit of hindsight it seems likely that the information about possible negative effects of crowding may have been important. It is also possible that anticipatory negative expectations if not confirmed by the experience lead to a cognitive reinterpretation of the experience. Subjects may think that being crowded is usually associated with negative consequences and the failure to experience these may lead them to believe they were not feeling crowded, or as crowded as they had been led to expect. On the basis of previous research it seemed as though the important dimension for pre-exposure information was accuracy. Given this constraint, it would have seemed questionable to tell subjects that they could expect to feel "stressed and uncomfortable" when, on the basis of the first study, they had not reported feeling stressed at all. Also, the inclusion of such information is open to the criticism that it would serve as a demand characteristic.

The final set of hypotheses relating to crowding and annoyance predicted that disconfirmed nonspatial expectations (difficult anagrams) would increase perceptions of crowding (hypothesis 2.3) and increase the level of annoyance (hypothesis 4.3) for both men and women. Hypothesis 2.3 was supported with disconfirmed nonspatial expectations resulting in increased perceptions of crowding. Hypothesis 4.3 was not supported with disconfirmed nonspatial expectations failing to increase annoyance. The results complimented those achieved for ratings of crowding. It appears that providing subjects with a more

difficult task than they had been led to expect resulted in increased perceptions of crowding.

This finding is similar to the results reported by Gochman and Keating (1980) who found that factors independent of density can affect attributions to crowding. Their results were obtained in field and laboratory settings where disconfirmed expectations (positive and negative) affected attributions to crowding. Subjects were prepared to blame density related factors (crowding) for disconfirmed performance expectations. Subjects whose performance was inconsistent with what they had expected attributed this unexpected result to "the number of people in the room". While Gochman and Keating highlight the nature of the relationship between nonspatial and spatial factors, it is a finding which is less direct than the present one as it considered attributions to crowding rather than the extent to which subjects reported feeling crowded.

Unexpectedly increasing task difficulty in a crowded situation resulted in increased perceptions of crowding. This suggests nonspatial information may have a more potent role to play in the experience of crowding than that of spatial information. Inaccurate nonspatial information leading to a disconfirmation of nonspatial expectations increased subjects' perceptions of crowding while inaccurate spatial information failed to have a similar effect. In other words, an unexpectedly difficult task increased perceptions of crowding while unexpectedly close distances did not increase perceptions of crowding.

To summarise, it seems possible to steer spatial expectations via information about the ensuing spatial arrangements. However, the confirmation or disconfirmation of these expectations has little impact on subsequent perceptions of how crowded or annoyed subjects feel. Failure to find support for one of the key predictions of the information expectancy model is seen as a serious flaw in the model. Within the context of experimental crowding these results raise questions about the importance of pre-exposure information.

The results for disconfirmation of nonspatial expectations were more in line with predictions. While disconfirmed nonspatial expectations increased perceptions of crowding, perceptions of annoyance were unaffected. Providing subjects with a more difficult task than expected resulted in subjects feeling more crowded than subjects whose nonspatial expectations were confirmed. This suggests that perceptions of crowding are affected by factors not usually considered to be related to the notion of crowding. Disconfirmation of nonspatial expectations should be added to the factors, such as size of room, number of people and distance between them, which have a bearing on the experience of crowding.

Although this result was predicted, it was predicted in conjunction with similar effects for the disconfirmation of spatial expectations. On its own, it suggests that information which is not directly relevant to spatial concerns may be of importance in determining the extent to which subjects feel crowded in experimental settings. Clearly, the activity one engages in while in crowded conditions is of importance.

AROUSAL

Extending the view from Study One that arousal need not necessarily be involved in the experience of crowding, it was predicted that confirmation or otherwise of both spatial and nonspatial expectations would not influence arousal levels. There is no way of knowing whether or not subjects were comparatively unaroused (as may have been established by including a far interpersonal distance condition). Hypothesis 3.1 predicted that spatial disconfirmation would not increase arousal on either of the arousal measures. On both measures, this hypothesis was supported. Similarly disconfirmed nonspatial expectations showed no effect when compared to confirmation of nonspatial expectations (hypothesis 3.2). Therefore, it would appear that neither of the manipulated variables (information or task difficulty) had any significant impact on subjects' reported levels of arousal.

INTERPERSONAL RELATIONSHIPS

The general expectation was that interpersonal relationships would suffer in the face of disconfirmed spatial and nonspatial expectations. Three indices of interpersonal relationships were taken, a punitiveness measure, a measure of aggressiveness of group members, and a measure of liking for group members.

On the Love-Punishment scale it was found that spatial disconfirmation failed to significantly increase punitiveness. However, subjects whose nonspatial

expectations were disconfirmed were significantly more punitive than subjects whose nonspatial expectations were confirmed. Exposing crowded subjects to a series of difficult tasks after leading them to expect easy tasks increased their punitiveness. This may reflect anger or disappointment at having been misled as to the level of performance they could have expected. This in turn may have manifested itself in advocating more punishment. There was also a significant interaction, the interpretation of which is problematic due to the lack of any clear theoretical relationship between the two independent variables. Subjects whose spatial expectations were disconfirmed (inaccurate information) but whose nonspatial expectations were confirmed (easy anagrams) were significantly more punitive than subjects whose nonspatial expectations were confirmed and who received either accurate spatial information or were in the control group. Further, for the nonspatial disconfirmation group those subjects whose spatial expectations were also disconfirmed were less punitive than subjects given difficult anagrams who received accurate spatial information or were in the control condition.

For perceived aggressiveness of other group members the influence of spatial expectations was not significant. However, the disconfirmation of nonspatial expectations resulted in higher ratings of the perceived level of aggression displayed by fellow group members than when nonspatial expectations were confirmed.

The third index of interpersonal relations was reported liking of fellow group

members. For disconfirmed spatial and nonspatial expectations there was no main effect. Such disconfirmations had no influence on the degree to which subjects reported liking each other. Neither information nor difficulty of task influenced the extent to which the subjects liked each other while in close contact with each other. This is consistent with impressions which were gained at the debriefing sessions where subjects typically gave the impression that they had got along well with each other in spite of the cramped nature of their interaction.

Disconfirmed spatial expectations failed to have the predicted negative effect on interpersonal relationships. However, disconfirmed nonspatial expectations, on two of the three measures, resulted in disrupted interpersonal relationships. This result is consistent with a pattern which emerged from the study. This is characterised by no effect for the influence of spatial expectations, but a consistent effect for thwarted nonspatial expectations. Disconfirmed nonspatial expectations have increased the extent to which subjects felt crowded, and have disrupted the interpersonal relationships of crowded subjects. This result was expected on the basis of previous research which indicated that accurate information would decrease the negative aspects associated with crowding. Inaccurate information was expected to have the opposite effect, which proved to be the case. This effect may operate such that inaccurate nonspatial information effectively removes the neutral perceptions associated with others in the situation and replaces them with more negative perceptions. In some way, which is far from clear, inaccurate information may have the effect of increasing the

interpersonal stress involved in crowded situations.

For liking of others there was an unexpected influence for sex of subject, with women subjects reporting greater liking for their fellow group members than men. This result, although not expected, is consistent with the previous findings that women subjects reported feeling less crowded and less annoyed than their male counterparts. This finding also adds to the overall picture which has emerged and which typifies the experience of women in crowded conditions as less negative than the males.

AFFECT

It was expected that the MAACL-R measures would be sensitive to the confirmation of spatial expectations. The results indicate that this was not the case, with no significant main effects being found. There was, however, an interaction between spatial information and sex of subject on the measure of anxiety. This interaction was interpreted to mean that when men were provided with accurate spatial information this increased their anxiety, while the same information for women resulted in reduced anxiety. While the overall result for affect is rather disappointing, the emergence of yet another sex difference is of interest, especially as this difference is one of a series which have come to light in this study. Not only are women more adaptable in crowded conditions but they apparently do not experience the same anxiety as men when informed about the experience.

PERFORMANCE

Spatial disconfirmation groups did not perform as well as control groups; however, this difference was not significant. The disconfirmation of nonspatial expectations did result in those groups performing significantly better than groups for whom nonspatial expectations were confirmed. This is a curious result, suggesting possible reactivity on the part of subjects who expected an easy task, only to be confronted with a difficult task. Following this, the performance task may have presented an opportunity to re-establish a sense of control or a degree of mastery over the experimental tasks. The superior performance would suggest increased levels of effort.

The result for performance stands in contrast to the general effect of nonspatial disconfirmation, which has been to exacerbate crowding, annoyance and to disrupt interpersonal relations. If these effects can be regarded as deleterious or negative, then improved performance on the group task is the only positive outcome of nonspatial disconfirmation.

SUGGESTIONS FOR FURTHER RESEARCH

The present study has provided information about the internal consistency of scales measuring arousal and crowding. Two suggestions arise out of this. Firstly, that future research should use measures which are reliable. Consistency

of measurement is important, and within the crowding literature has suffered some neglect. Secondly, having reliable measures is important, but the next step should be the establishment of the validity of these measures. This task awaits future researchers.

A number of suggestions for further research follow from the fact that not more subjects reported spatial invasion. The relationship between personal space and crowding needs further investigation. It has previously been assumed that the two are closely linked but the current findings cast doubt on this. While this assumption has not been toppled, it has been shaken. There are measurement issues which have already been alluded to, which center around the wording of spatial "invasion/ infringement/ adjustment". These words denote differing degrees of the spatial relationships between individuals. As suggested, it is possible subjects considered "invasion" to be an overstatement of what they actually experienced within the context of this study. It may also help explain the present rather curious result.

As indicated, the information concerning the effect of interpersonal distance on personal space lacked comparative data. This must, in the light of the results which emerged, be seen as a weakness of the study. It also, however, highlights the need for such comparative information in future studies. The most interesting question concerns the comparative differences between subjects at close as opposed to far interpersonal distances, in terms of the reported invasions of personal space.

This study has contributed to the question of sex differences by supporting Nicosia et al.'s (1979) conclusion that men respond more negatively to crowded situations. These differences represent a challenge to future researchers as it would seem that women are less negatively influenced by the closeness of members of the same sex. A suggestion for future research would be to examine these differences further, ultimately with the aim of understanding the reasons for the differences.

The possibility of utilising noninteractive groups of subjects under crowded conditions should be considered. The advantage of such a strategy would be the reduction in numbers of subjects required. The high demand on subject numbers makes experimental studies of crowding seem unattractive to prospective researchers. Smaller numbers of noninteractive subjects may encourage further research in this area. The disadvantage of this move would be the limits placed on the range of tasks that could be undertaken under these conditions.

Other suggestions for future research arise from the finding that inaccurate information about a task which is to be undertaken in crowded conditions, led to increased perceptions of the extent to which subjects felt crowded. This task was a simple anagram task and it would be instructive to examine the extent to which these results may generalise to other tasks. The role of nonspatial information is an area where further research may be usefully directed. The present study employed an inaccuracy which was almost the exact opposite of that to which subjects had been led to expect. Will less extreme inaccuracies also have a

similar effect? Just how incorrect does nonspatial information need to be before it will have the effect of increasing perceptions of crowding? Is it possible, for example, for subjects to tolerate minor inaccuracies in the pre-task information they receive?

Finally, one area warranting further research is the extent to which accurate spatial information may be more influential when supported by information concerning how subjects are likely to be affected by the experience of close interpersonal distance. In Study One the combination of accurate spatial information and information about the possible negative effects on individuals reduced the impact of crowding. Accurate spatial information in the second study failed to have the same effect. Some important questions could well be pursued in an attempt to delineate the role which information about the possible negative effects has on those subsequent effects, and more widely on the experience of crowding itself.

This chapter has reviewed and discussed the results of the second study. Measurement issues have been considered, the effectiveness of the manipulations, and the key results for each of the dependent measures have also been discussed. Finally, a number of suggestions for future research have been put forward. The final section of this chapter will address the implications which these results have for the information expectancy model.

IMPLICATIONS FOR THE INFORMATION EXPECTANCY MODEL

The information expectancy model of crowding was founded on two assumptions. Firstly, that the experience of crowding is initiated by an invasion of personal space, and secondly, that spatial information would be appraised and formed into specific expectations. These assumptions led to two central predictions, that confirmation of spatial expectations would have an ameliorative effect while disconfirmation would exacerbate the impact of crowding; and, finally, that nonspatial expectations would (if confirmed or disconfirmed) act in a manner consistent with the role of spatial expectations.

The initiating function of personal space invasions received restrained support. The approach to determining the exact nature of personal space invasions was novel and for this reason the restrained degree of support for this idea must be viewed with circumspection. At this stage it is possibly best to acknowledge support for this aspect of the model, but also to signal that this support was not the wholesale endorsement which may have been expected on the basis of the previous literature. Some interesting possibilities for further research have emerged and these have already been alluded to.

The notion of information appraisal leading to spatial expectations received strong support. Subjects do utilise spatial information and, furthermore, this information is incorporated in spatial expectations.

The information expectancy model makes predictions about the usefulness or otherwise of spatial information. The results in this area were not supportive of the role of spatial information. Confirmation or disconfirmation of spatial expectations effectively had no impact on subjects perceptions of how crowded or annoyed they felt. This finding is theoretically disappointing. This is also the most important area, as the information expectancy model is centered around the assertion that accurate spatial expectations are useful, and the current study casts serious doubt on this view.

Finally, the role of nonspatial expectations have been firmly implicated in the experience of crowding. Disconfirmed nonspatial expectations were predicted to enhance the degree to which subjects reported feeling crowded and this is exactly what happened. In this respect, the importance of nonspatial information cannot be overstated, apparently being more important than spatial information in determining the extent to which subjects will feel crowded. This finding is of particular interest as it suggests that nonspatial variables do interact with the experience of crowding.

CHAPTER ELEVEN

SUMMARY AND CONCLUSIONS

This thesis has attempted to answer some questions about the nature of human crowding. The experience of crowding is one with which we are all familiar and, if populations continue to increase, may become increasingly familiar in the future. In spite of the ready availability of this experience we have relatively little knowledge of its nature or the variables which are important to it. This thesis has attempted to redress this balance.

SUMMARY

The brief history of the academic study of crowding was reviewed in the first chapter. The psychology of crowding was introduced as a development of the earlier work in the sociological and animal literature. A legacy of this work was the view that under crowded conditions negative consequences would follow. This view has continued to underpin the psychological literature, with the prevailing notion that crowding is an aversive experience, even when extreme conditions are not present, and is to be avoided or reduced if at all possible. The importance of this theme should not be ignored, as it is apparent in contemporary writing that the negative elements of the experience still dominate the manner in which the experience is interpreted. The psychological study of crowding and its consequences occurs within the context of an interest in the

behaviour of the individual in a group. This remains of fundamental interest for those concerned with social behaviour.

The difficulties in studying such a complex phenomenon as crowding are compounded by the myriad of conceptual and definitional problems which were also discussed in the first chapter.

The range of psychological models of crowding reflect the numerous perspectives which may impinge on this particular human experience. One of these perspectives may be referred to as the spatial cognitive perspective, where varying factors associated with the experience of crowding are linked to attributional processes. Three overlapping yet distinctive attributional models were reviewed in Chapter Two.

In Chapter Three the attributional arousal model was scrutinised closely. This model holds that a sequence of two factors (spatial invasion resulting in arousal followed by an attributional search for the source of arousal) will result in the experience of crowding. The attributional arousal model regards crowding as a negative experience and predicts performance deficits and deteriorated interpersonal relationships to be associated with the experience. A number of studies, based on the two factor model, were reviewed. These studies aimed to reduce reports of crowding by manipulating nonspatial factors. One study (Worchel & Yohai, 1979) demonstrated that subjects could be induced to misattribute the source of their arousal to an alternative (fictitious) source.

Providing subjects with an alternative source of arousal resulted in reductions in the extent to which they reported feeling crowded. This demonstration provided the impetus for Study One as it provoked a number of interesting questions.

The most fundamental of these questions was, why do crowded subjects opt for an alternative source to which they may attribute their arousal? A further source of intrigue was the question of why crowded subjects would attribute arousal to an unverifiable alternative source in preference to the actual source? One line of reasoning developed to answer these questions was based on the suggestion that people are typically unaware of their spatial behaviour. If this was so then in an experimental setting, presenting an alternative source of arousal to subjects may have simply been effective due to the obvious salience of that potential source. Study One examined this salience hypothesis by presenting crowded subjects with a number of equally salient sources of arousal. Among these was an alternative as well as the actual source of arousal. The actual source of arousal (spatial invasion) was presented with equal salience with the alternative source to see if the alternative was still the preferred choice.

The results of Study One were both unexpected and provocative. The most important finding was the fact that crowded subjects failed to report feeling more aroused than uncrowded subjects. This result proved to be extremely disruptive as it made it impossible to subsequently examine the predictions which stem from the two factor model. The comparative nonarousal of crowded subjects suggested that the basic dynamics of the experience of crowding (as outlined by

the two factor model) were not seen to be functioning. The failure to document significant increases in arousal in crowded subjects was a particularly damaging finding for the model which is predicated on the foundation that spatial invasions do cause arousal. A number of interpretations of this finding were discussed (Chapter Six) including the theoretical implications, measurement problems and the possible effects of using only female subjects.

In spite of the nonarousal of crowded subjects, these subjects still felt more crowded, confined and uncomfortable than their noncrowded counterparts. If crowded subjects were not aroused and yet still reported feeling crowded, then this result has especially critical consequences for the two factor model. These are firstly, that one of the fundamental predictions of the model failed to receive any support from this study. Secondly, this result suggests the experience of crowding may occur without the associated high levels of arousal.

Chapter Seven saw the introduction of the information expectancy model, which was developed due to the inability of the two factor model to explain the nonarousal of crowded subjects and the fact that accurate information about the nature of the experience of crowding provided before the event had the power to reduce the impact of the experience. The cornerstone of the information expectancy model is the notion that confirmation of expectations will serve to reduce the impact of crowding. A key distinction may be drawn between the two factor and information expectancy models. Supporting evidence for the two factor model depended on the provision of deceptive information about a nonexistent

variable. It was intended to find supporting evidence for the information expectancy model by simply providing information about the actual variables involved.

Study Two aimed to clarify the role of both information and expectations, in an experimental context, with regard to the experience of crowding. Auxiliary aims included collecting information on the efficacy of two measurement scales for each of the key concepts of arousal and crowding.

The psychometric properties of the four measurement scales were characterised by high indices of internal consistency. These results were encouraging and suggested that the four scales were highly homogeneous. Furthermore, the measures of internal consistency compared favourably with previous results, where these were available.

Concerning the role of spatial information the results were disappointing. Accurate spatial information failed to have the predicted effect and this result called into question the utility of accurate pre-exposure information. The disconfirmation of nonspatial expectations resulted in increases in reported levels of crowding, a result which highlighted the importance of accurate information about the nature of the activity which was to occur while subjects were in a crowded situation. A further result was the clear sex difference such that women reported feeling less crowded and less annoyed than men. This result contributes to the literature on sex differences which has to date been equivocal,

with a leaning toward the suggestion that women are more adaptable under conditions of restricted interpersonal distance, and do not report the negative aspects of crowding to the same extent as men.

Finally, a number of suggestions for further research were advanced. These included the suggestions that firstly, the relationship between the experience of crowding and personal space invasions be examined more closely, and secondly, that the impact which nonspatial information may have on the experience of crowding may previously have been underestimated and future research could usefully explore this.

CONCLUSIONS

Conclusions from this research may be drawn at a methodological or practical level, at a theoretical level and finally at a more general level.

There exist a number of barriers to conducting experimental crowding research. The work is demanding of subject numbers, and access to large pools of volunteers is important. One way of overcoming this problem would be to utilise noninteractive groups. Organisational difficulties may also arise when arranging groups of subjects to arrive at agreed times. Thus, at a practical level, there are some difficulties in conducting research of this type.

Another problem concerns the doubts about whether we are actually studying

crowding by putting five people together in a room for an hour. This approach brings a high degree of artificiality to the study of crowding, with the added advantage of increasing the level of experimental control. These costs and benefits need to be considered carefully before a decision is reached as to the most appropriate setting in which to study human crowding. Perhaps the term "small group crowding" may more accurately describe this type of experimental research.

Conceptually, the area has drawn from a number of disciplines which have an interest in human spatial relationships. This diversity of inputs has resulted in a degree of conceptual confusion. The definitions of basic constructs are less than clear. This situation has done nothing to enhance the state of knowledge in the area, and has resulted in little agreement about important measurement issues. In some small way it is hoped that this thesis has contributed to the information available about possible measuring instruments for the concepts of crowding and arousal.

Theoretically, this research has attempted to throw light on two models of crowding. The two factor attributional arousal model was initially examined, but was found unexpectedly to be wanting at a fundamental but crucial level. This led to the conclusion that arousal is not as essential to the experience of crowding as the two factor model suggests. In short, one of the main links in the sequence of events predicted by the two factor model was found to be missing, and yet subjects still reported feeling crowded. This lack of support for the two

factor model led to two conclusions. Firstly, that the model had previously been supported by only a handful of studies and the results of Study One were incompatible with the basic predictions of the model. Secondly, that the results of Study One could have simply been regarded as anomalous and ignored or they could have signalled a weakness in the two factor model, in which case an alternative interpretation was invited. The care taken to replicate the methodology of the key study supporting the two factor model counted against the possibility of the results of Study One being a simple experimental anomaly.

The inability of the two factor model to account for key aspects of the findings of Study One prompted the development of an information expectancy model. This model did not rely on arousal-based mechanisms which had apparently not been present in otherwise crowded subjects in the first study. Rather, the model focused on the impact of information and expectations on the experience of crowding.

The results of Study Two which examined hypotheses derived from the model were encouraging. Spatial information did shape spatial expectations and subjects processed information relevant to nonspatial concerns within the crowded situation. There was also qualified support for the idea that spatial invasions are linked to the experience of crowding. While key aspects of the model were supported, including the highlighting of the importance of nonspatial information, one fundamental prediction of the model failed to receive support. Study Two was unable to demonstrate that accurate information (and

presumably also accurate spatial expectations) was of any assistance in reducing subjective reports of crowding. This failure must lead to the conclusion that while the results were encouraging, the information expectancy model has some distance to travel before it is in a position to tell the complete story about how people come to feel crowded.

In the process of examining the predictions of these two models of crowding, this research has exposed evidence which runs contrary to assumptions which are fundamental to the models. In Study One the arousal assumption was not supported and in Study Two the utility of accurate pre-exposure spatial information was found wanting. These findings emphasise the importance of examining assumptions carefully.

Finally, at a more general level, the contribution of this thesis must be considered in the light of the experience which we are all so familiar with, yet know so little about. In its simplest form this research has raised the possibility of feeling crowded without the need to involve arousal related explanations. Arousal may still be present, but may operate independently of feelings of crowding.

This thesis has further contributed to our understanding of the many variables which may impact on the experience of crowding, by stressing the importance of both information and subsequent expectations. Information about the activities that one will engage in while in a crowded situation clearly may have an impact on the manner in which the experience of crowding is interpreted. Crowding is

not something which simply happens to people, but rather is an experience which people will actively think about, develop expectations about and anticipate. Such activities are important because they have the power to influence the nature of the experience. Furthermore, these activities are highly likely to be stimulated by the availability of information about the things people are expected to do while in the situation. In this regard this research has taken an important step in attempting to delineate the role of the context within which crowding occurs.

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APPENDIX A: EXPERIMENTAL PRE-INSTRUCTIONS (STUDY ONE)

Four sets of experimental pre-instructions corresponding to the four information conditions were used.

The subjects in the **NO EXPLANATION** condition were played the following instructions:

> "Hello, thank you for volunteering for this experiment in which we are interested in studying group performance and group interaction...
>
> The experimenter will now explain the first task."

Subjects in the **DISTANCE EXPLANATION** condition heard the following instructions:

> "Hello, thank you for volunteering for this experiment in which we are interested in studying group performance and group interaction under varying interpersonal distances. In everyday life we are often exposed to distances between ourselves and others that we are unconscious of but that may affect our behaviour. Our aim is to study the effects of interpersonal distance (such as the distance at which you are now seated) on performance. Previous studies have shown that this distance may

cause you to feel somewhat stressed and uncomfortable.

The experimenter will now explain the first task."

Subjects in the **NOISE EXPLANATION** condition were played the following instructions:

"Hello, thank you for volunteering for this experiment in which we are interested in studying group performance and group interaction under varying types of subliminal stimuli. In everyday life we are often exposed to stimuli that we are unconscious of but that may affect our behaviour. Our aim is to study the effects of subliminal noise on performance. A subliminal noise will be played into the room while you work on the tasks. This noise will not be detectable to the naked ear. Previous studies have shown that this noise may cause you to feel somewhat stressed and uncomfortable.

The experimenter will now explain the first task."

The **DUAL EXPLANATION** condition subjects received the following instructions:

"Hello, thank you for volunteering for this experiment in which we are interested in studying group performance and group interaction under varying types of subliminal stimuli and varying interpersonal distances. In

varying types of subliminal stimuli and varying interpersonal distances. In everyday life we are often exposed to distances between ourselves and others, and stimuli that we are unconscious of but that may affect our behaviour. Our aim is to study the effects of both interpersonal distance (such as the distance at which you are now seated) and subliminal noise on performance. A subliminal noise will be played into the room while you work on the tasks. This noise will not be detectable to the naked ear. Previous studies have shown that this noise and this distance may cause you to feel somewhat stressed and uncomfortable.

The experimenter will now explain the first task."

APPENDIX B: POST-EXPERIMENTAL QUESTIONNAIRE (STUDY ONE)

INSTRUCTIONS

The following questions are designed to assess your reactions to the experiment. For each question place a cross (x) in the space which most accurately reflects your answer.

Consider, for example, the following question:

How warm do you expect the weather to be today?

Extremely ___:_X_:___:___:___:___:___:___:___:___ Extremely

hot cold

The above response indicates an expectation of a very hot day.

---

1. Generally do you prefer to work alone or in a group?

Alone___:___:___:___:___:___:___:___:___:___ In a group

2. How much did you like the people in your group?

Disliked ___:___:___:___:___:___:___:___:___:___ Like very much

3. How bothered were you by the lighting in the experimental room?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very bothered

bothered

4. How confined did you feel during the experiment?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very confined

confined

5. During the experiment did you find the experimenter helpful or unhelpful?

Very helpful ___:___:___:___:___:___:___:___:___:___:___ Very unhelpful

6. Was there a leader in your group? YES/NO (Circle one response)

If so, identify by letter A B C D E (Circle one response)

7. In completing the tasks were you able to concentrate?

Unable to ___:___:___:___:___:___:___:___:___:___:___ Able to concentrate

concentrate

8. How pleasant did you find the experimental room?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very pleasant

pleasant

9. During the experiment how bothered were you by noise?

Very bothered ___:___:___:___:___:___:___:___:___:___:___ Not at all bothered

10. How happy were you with the performance of your group?

Very happy ___:___:___:___:___:___:___:___:___:___:___ Not at all happy

11. How crowded did you feel during the experiment?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very crowded

crowded

12. How bothered were you by the temperature in the experimental room?

Very bothered ___:___:___:___:___:___:___:___:___:___:___ Not at all bothered

13. Rate how aggressive each group member was (excluding yourself)

Group Member

A Very aggressive___:___:___:___:___:___:___:___:___:___:___Not at all aggressive

B Very aggressive___:___:___:___:___:___:___:___:___:___:___Not at all aggressive

C Very aggressive___:___:___:___:___:___:___:___:___:___:___Not at all aggressive

D Very aggressive___:___:___:___:___:___:___:___:___:___:___Not at all aggressive

E Very aggressive___:___:___:___:___:___:___:___:___:___:___Not at all aggressive

14. How comfortable did you feel during the experiment?

Very ___:___:___:___:___:___:___:___:___:___:___ Very uncomfortable

comfortable

15. How enjoyable was your experience as a subject in this experiment?

Very ___:___:___:___:___:___:___:___:___:___:___ Not at all enjoyable

enjoyable

16. How relaxed or ill at ease did you feel during the experiment?

Relaxed ___:___:___:___:___:___:___:___:___:___:___ Ill at ease

17. How distracted did you feel during the experiment?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very distracted

distracted

18. Rate how friendly each group member was (excluding yourself)

Group Member

A Not at all ___:___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

B Not at all ___:___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

C Not at all ___:___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

D Not at all ___:___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

E Not at all ___:___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

19. Rate how nervous each group member was (excluding yourself)

Group Member

A Calm ___:___:___:___:___:___:___:___:___:___:___ Nervous

B Calm ___:___:___:___:___:___:___:___:___:___:___ Nervous

C Calm ___:___:___:___:___:___:___:___:___:___:___ Nervous

D Calm ___:___:___:___:___:___:___:___:___:___:___ Nervous

E Calm ___:___:___:___:___:___:___:___:___:___:___ Nervous

20. How willing would you be to participate in another, similar experiment?

Very willing ___:___:___:___:___:___:___:___:___:___:___ Not at all willing

APPENDIX C : NOTES TO SUBJECTS (STUDY ONE)

KEITH TUFFIN

DEPARTMENT OF PSYCHOLOGY

MASSEY UNIVERSITY

Firstly I would like to thank you again for volunteering as research subjects for the experiment which was conducted earlier this year. You may recall that following the experiment you were debriefed. The major purpose of the debriefing was to reveal the deceptions involved and also to inform you of the questions which the research hoped to answer. You were also told that at the conclusion of the research you would be posted a summary of the findings of the research. The reason for this summary is my commitment to the idea that as research subjects you deserve to be informed about the research you were involved in. You have volunteered your time and I believe you are entitled to something in return - in this case it takes the form of information relevant to the experiment in which you participated.

This summary will be presented in four parts : (1) Theory, (2) Design, (3) Results, (4) Conclusion.

THEORY

The experiment that you took part in was designed to examine some aspects of an attributional/arousal based theory of crowding. This theory suggests that the initial stage in the experience of crowding involves a violation of personal space. One way of thinking about personal space is to regard it as the distance which we like to maintain between ourselves and others. The theory says that spatial invasions are a prerequisite to feeling crowded and spatial invasions may cause the individual to feel aroused. Once aroused, the theory suggests that individuals will attempt to find an explanation for their arousal. This is often referred to as the "attributional search", whereby if the arousal is attributed to the presence and closeness of others, then the individual will experience crowding.

DESIGN

The purpose of this section is to give you an idea of the way the experiment was "set up", or organised. Two variables were manipulated. The first of these was distance, with two levels, either close or far. As some of you will recall, you were asked to sit very close to the others in your group, while others sat at a more conventional distance.

The second variable which was manipulated was the information which subjects received. Some subjects were told nothing about the purpose of the experiment; others were told that we were examining the effects of subliminal noise on

behaviour; still others were informed that we were examining the effect of varying distances on behaviour; the final group were told we were interested in the effect of both distance and noise.

RESULTS

The results reported here are based on a preliminary analysis of the data.

The theory predicts that crowded subjects will feel more aroused than noncrowded subjects. To measure arousal subjects were asked to report how relaxed or ill-at-ease they felt. The crowded subjects reported feeling no more aroused than uncrowded subjects.

The theory predicts that crowded subjects will not perform as well as their uncrowded counterparts. To measure performance, groups of subjects were asked to extract words from a master word (OBSERVATIONALLY). Contrary to predictions crowded subjects performed no differently when compared to uncrowded subjects.

The interpersonal relationships of crowded subjects were expected to suffer. Three measures were examined; ratings of how friendly the fellow group members were, how aggressive they were , and also how much the subjects liked the people in their group. Crowded subjects rated their fellow group members to be as friendly as did noncrowded subjects. A similar pattern of

results emerged for both aggressiveness and liking for others in the group.

To measure subjects' perceptions of crowding two questions were asked. Subjects were asked how crowded they felt and also how confined they felt. On both these measures subjects in the close condition reported feeling more crowded/confined than subjects in the far condition. Contrary to predictions, informing subjects that they were exposed to subliminal noise failed to reduce perceptions of crowding or confinement. An interesting result was that informing subjects that distance was a key variable, actually reduced the crowded subjects perceptions of confinement.

CONCLUSION

Unexpectedly we found that the experience of crowding was not arousing for subjects. Crowded subjects did not experience impaired performance on the word task, nor did the experience of crowding result in interpersonal hostility.

In general, the present study failed to support the predictions of the theory which it set out to examine.

I hope this brief note is informative and serves to answer any questions which you, as subjects, have about the experiment. If you have any further questions

then please contact me.

During working hours I may be found in my office (P.322) on the third floor of the Psychology Department. Telephone : work 69 099 extension 7924, or home 76 234.

Thank you for your participation.

Keith Tuffin

APPENDIX D: ANOVA TABLES FOR KEY DEPENDENT MEASURES FOR STUDY ONE (GROUP ANALYSIS)

SUMMARY ANOVA TABLE FOR **AROUSAL**

SOURCE	SS	DF	MS	F	P
Main Effects	6.725	4	1.684	1.110	0.361
Distance	2.890	1	2.890	1.906	0.173
Information	3.845	3	1.282	0.845	0.475
2-Way Interactions					
Distance Inform.	3.465	3	1.155	0.762	0.520
Explained	10.200	7	1.457	0.961	0.468
Residual	84.920	56	1.516		
Total	95.120	63	1.510		

SUMMARY ANOVA TABLE FOR **CROWDING**

SOURCE	SS	DF	MS	F	P
Main Effects	141.227	4	35.307	17.242	0.000
Distance	133.402	1	133.402	65.148	0.000
Information	7.825	3	2.608	1.274	0.292
2-Way Interactions					
Distance Inform.	11.662	3	3.887	1.898	0.140
Explained	152.890	7	21.841	10.666	0.000
Residual	114.670	56	2.048		
Total	267.560	63	4.247		

SUMMARY ANOVA TABLE FOR **CONFINEMENT**

SOURCE	SS	DF	MS	F	P
Main Effects	44.495	4	11.124	4.783	0.002
Distance	36.602	1	36.602	15.738	0.000
Information	7.892	3	2.631	1.131	0.344
2-Way Interactions					
Distance Inform.	6.362	3	2.121	0.912	0.441
Explained	50.857	7	7.265	3.124	0.007
Residual	130.240	56	2.326		
Total	181.097	63	2.875		

SUMMARY ANOVA TABLE FOR **PERFORMANCE**

SOURCE	SS	DF	MS	F	P
Main Effects	1414.437	4	353.609	1.538	0.204
Distance	19.141	1	19.141	0.083	0.774
Information	1397.297	3	465.099	2.023	0.121
2-Way Interactions					
Distance Inform.	1107.922	3	369.307	1.607	0.198
Explained	2522.359	7	360.337	1.567	0.164
Residual	12873.332	56	229.881		
Total	15395.691	63	244.376		

SUMMARY ANOVA TABLE FOR **PUNITIVENESS**

SOURCE	SS	DF	MS	F	P
Main Effects	2.805	4	0.701	2.609	0.045
Distance	0.640	1	0.640	2.381	0.128
Information	2.165	3	0.722	2.685	0.055
2-Way Interactions					
Distance Inform.	0.585	3	0.195	0.726	0.541
Explained	3.390	7	0.484	1.802	0.105
Residual	15.050	56	0.269		
Total	18.440	63	0.293		

SUMMARY ANOVA TABLE FOR **FRIENDLINESS**

SOURCE	SS	DF	MS	F	P
Main Effects	2.020	4	0.505	0.671	0.615
Distance	0.062	1	0.062	0.083	0.774
Information	1.958	3	0.653	0.867	0.463
2-Way Interactions					
Distance Inform.	2.478	3	0.826	1.098	0.358
Explained	4.499	7	0.643	0.854	0.548
Residual	42.131	56	0.752		
Total	46.629	63	0.740		

SUMMARY ANOVA TABLE FOR **AGGRESSION**

SOURCE	SS	DF	MS	F	P
Main Effects	5.195	4	1.299	1.277	0.290
Distance	0.114	1	0.114	0.112	0.739
Information	5.081	3	1.694	1.665	0.185
2-Way Interactions					
Distance Inform.	0.926	3	0.309	0.304	0.823
Explained	6.121	7	0.874	0.860	0.544
Residual	56.984	56	1.017		
Total	63.069	63	1.001		

SUMMARY ANOVA TABLE FOR **LIKING**

SOURCE	SS	DF	MS	F	P
Main Effects	2.153	4	0.538	0.912	0.463
Distance	0.526	1	0.526	0.891	0.349
Information	1.627	3	0.524	0.920	0.437
2-Way Interactions					
Distance Inform.	2.947	3	0.982	1.666	0.185
Explained	5.099	7	0.728	1.235	0.299
Residual	33.025	56	0.590		
Total	38.124	63	0.605		

SUMMARY ANOVA TABLE FOR **HOSTILITY**

SOURCE	SS	DF	MS	F	P
Main Effects	8.662	4	2.166	0.808	0.526
Distance	4.306	1	4.306	1.605	0.210
Information	4.357	3	1.452	0.542	0.656
2-Way Interactions					
Distance Inform.	2.227	3	0.742	0.277	0.841
Explained	10.889	7	1.556	0.580	0.769
Residual	150.185	56	2.682		
Total	161.074	63	2.557		

APPENDIX E: ANCOVA TABLE FOR CROWDING (STUDY ONE) CONTROLLING FOR AROUSAL.

SUMMARY ANCOVA TABLE FOR CROWDING

SOURCE	SS	DF	MS	F	P
Covariates					
Arousal	42.793	1	42.793	26.249	0.000
Main Effects	118.619	4	29.655	18.190	0.000
Distance	111.646	1	111.646	68.482	0.000
Information	6.861	3	2.287	1.403	0.252
2-way Interactions					
Distance Inform.	16.482	3	5.494	3.370	0.025

APPENDIX F: ANOVA TABLES FOR SELECTED DEPENDENT VARIABLES SHOWING INDIVIDUAL ANALYSIS FOR STUDY ONE.

SUMMARY ANOVA TABLE FOR **AROUSAL**

SOURCE	SS	DF	MS	F	P
Main Effects	33.675	4	8.419	1.577	0.180
Distance	14.450	1	14.450	2.706	0.101
Information	19.225	3	6.408	1.200	0.310
2-Way Interactions					
Distance Inform.	17.325	3	5.775	1.802	0.357
Explained	51.000	7	7.286	1.365	0.220
Residual	1665.800	312	5.339		
Total	1716.800	319	5.382		

SUMMARY ANOVA TABLE FOR **CROWDING**

SOURCE	SS	DF	MS	F	P
Main Effects	706.137	4	176.534	25.876	0.000
Distance	667.012	1	667.012	97.770	0.000
Information	39.125	3	13.042	1.912	0.128
2-Way Interactions					
Distance Inform.	58.313	3	19.438	2.849	0.038
Explained	764.450	7	109.207	16.007	0.000
Residual	2128.550	312	6.822		
Total	2893.000	319	9.069		

SUMMARY ANOVA TABLE FOR **CONFINEMENT**

SOURCE	SS	DF	MS	F	P
Main Effects	222.475	4	55.619	7.489	0.000
Distance	183.013	1	183.013	24.642	0.000
Information	39.462	3	13.154	1.771	0.153
2-Way Interactions					
Distance Inform.	31.813	3	10.604	1.428	0.235
Explained	254.287	7	36.327	4.891	0.000
Residual	2317.200	312	7.427		
Total	2571.487	319	8.06		

APPENDIX G : EXPERIMENTAL PRE-INSTRUCTIONS (STUDY TWO)

The three sets of experimental pre-instructions differed for each of the three information conditions. These three conditions were; control, spatial confirmation, and spatial disconfirmation.

Control condition.

"Hello, thank you for volunteering for this experiment.

Before the experiment begins you will be provided with the opportunity to practice some of the kinds of tasks which you will be asked to complete later.

The experimental assistant, Helen, will now hand you a copy of the practice anagrams booklet and an answer sheet. Please read the instructions on the cover of the booklet but do not begin the first item until you are instructed to do so."

[25 seconds silence to allow subjects reading time]

"You may begin the first item, and each subsequent item on hearing the sound of the prompt."

PROMPT

[30 seconds]

PROMPT

[30 seconds]

PROMPT

[30 seconds]

"If you have not already finished, please stop work now. Helen will collect your answer sheets and practice anagram booklets. You will then be shown into the experimental room."

Spatial confirmation condition.

These instructions were exactly as for the control condition, with the following addition after "experimental room".

"In this experiment we will be looking at group performance and group interaction under varying interpersonal distances. In everyday life we are often exposed to distances between ourselves and others that we are

unconscious of but that may affect our behaviour. The aim of the experiment is to examine the effect of interpersonal distance on behaviour. You should, therefore, expect to sit at an unusually close distance to other subjects."

Spatial disconfirmation condition.

These instructions were identical to the spatial confirmation condition, with the exception of the last sentence which read as follows:

"You should, therefore, expect to sit at a normal distance to other subjects."

APPENDIX H : PRACTICE AND TEST ANAGRAMS

PRACTICE ANAGRAMS

The three practice anagrams were presented to subjects in the form of a four page booklet. The cover of the booklet was titled, "PRACTICE ANAGRAMS" and contained the following instructions:

> "This booklet contains three practice anagrams similar to the type you will be expected to complete later in the experiment. Each item is presented on a separate page, with the first item appearing on the next page.
>
> Your task is to rearrange each group of letters so they make a meaningful English word.
>
> You have 30 seconds to complete each item. When you hear the prompt on the tape recorded message, please turn the page and begin the first item. Do not turn the page for the next item until you hear the prompt.
>
> Do not write in this booklet, but place your answers on the answer sheet provided."

The three anagrams appeared, one on each of the next three pages of the

booklet. The actual anagrams were taken from Feather & Simon (1971) and were as follows: **evoltr, middel, tmomen.** The actual anagrams for these words were: revolt, middle, moment. During the debriefing session subjects were asked if they found these easy to complete and nearly all subjects reported getting all three correct.

TEST ANAGRAMS

Two sets of test anagrams were required, an easy set and a difficult set. The easy set was the same as that used by Feather & Simon (1971), while the difficult set they had used was comprised of both difficult and insoluble items. The requirement for the current study was for a set of difficult items; therefore, a new set was developed.

The set of easy items was as follows : **withni, wadnet, bunmer, poliec, onersp, damaeg, gencha, teffec, mnegaa, ariver.** The actual anagrams for these words were : within, wanted, number, police, person, damage, change, effect, manage, arrive.

The set of difficult items were as follows : **ddeoii, tcajeb, aseccr, ppoerl, bilmre, ccorus, ibesrd, iowutt, ptrodi, ratply.** The corresponding anagrams were as follows : iodide, abject, scarce, propel, limber, crocus, brides, outwit, torpid, paltry.

To ensure that the two sets of anagrams were in fact sufficiently "easy" or "difficult", the two sets were pilot tested on ten individuals for each set. As one of these two sets of anagrams had never previously been used, it seemed important to establish that the two sets were in fact different, and that one was much more difficult than the other. The results of this proved to be satisfactory with the pilot group only averaging **3.5** correct out of 10 possible for the difficult set. On the easy set the scores reflected the ease of the items with an average of **8.1** correct out of a possible 10.

APPENDIX I : POST-EXPERIMENTAL QUESTIONNAIRE (STUDY TWO)

INSTRUCTIONS

The following questions are designed to assess your reactions to the experiment. For each question place a cross (X) in the space which most accurately reflects your answer. Consider, for example, the following question :

How warm do you expect the weather to be today?

Extremely hot ___:_X_:___:___:___:___:___:___:___:___ Extremely cold

The above response indicates an expectation of a very hot day.

---

1. Before entering the experimental room, how close did you expect you would be seated to other subjects?

Not at all close ___:___:___:___:___:___:___:___:___:___ Very close

2. During the experiment to what extent did you experience rapid heartbeat?

Very much ___:___:___:___:___:___:___:___:___:___ Not at all

3. Was there a leader in your group? YES/NO (Circle one response)

If so, identify by letter A B C D E (Circle one response)

4. Was your personal space invaded? YES/NO (Circle one response)

If so, to what extent?

Severely ___:___:___:___:___:___:___:___:___:___:___ Slightly

5. In completing the tasks were you able to concentrate?

Unable to ___:___:___:___:___:___:___:___:___:___:___ Able to concentrate

concentrate

6. How bothered were you by the temperature in the experimental room?

Very bothered ___:___:___:___:___:___:___:___:___:___:___ Not at all bothered

7. How willing would you be to participate in another, similar experiment?

Very willing ___:___:___:___:___:___:___:___:___:___:___ Not at all willing

8. To what extent did you experience nervous tension?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very much

9. How bothered were you by invasion of your own space?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very bothered

bothered

10. Rate how nervous each group member was (excluding yourself).

Group member

A Calm ___:___:___:___:___:___:___:___:___:___ Nervous

B Calm ___:___:___:___:___:___:___:___:___:___ Nervous

C Calm ___:___:___:___:___:___:___:___:___:___ Nervous

D Calm ___:___:___:___:___:___:___:___:___:___ Nervous

E Calm ___:___:___:___:___:___:___:___:___:___ Nervous

11. During the experiment did you find the experimenter helpful or unhelpful?

Very helpful ___:___:___:___:___:___:___:___:___:___ Very unhelpful

12. How bothered were you by the number of people in the room?

Not at all ___:___:___:___:___:___:___:___:___:___ Very bothered

bothered

13. How relaxed or ill at ease did you feel during the experiment?

Relaxed ___:___:___:___:___:___:___:___:___:___ Ill at ease

14. How crowded did you feel during the experiment?

Not at all ___:___:___:___:___:___:___:___:___:___ Very crowded

crowded

15. How aroused or unaroused did you feel during the experiment?

Aroused ___:___:___:___:___:___:___:___:___:___ Unaroused

16. To what extent did you experience rapid breathing?

Very much ___:___:___:___:___:___:___:___:___:___:___ Not at all

17. How much did you like the people in your group?

Disliked ___:___:___:___:___:___:___:___:___:___:___ Liked very much

18. How enjoyable was your experience as a subject in this experiment?

Very enjoyable ___:___:___:___:___:___:___:___:___:___:___ Not at all enjoyable

19. How bothered were you by the closeness of other subjects?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very bothered

bothered

20. How confined did you feel during the experiment?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very confined

confined

21. How sluggish or alert did you feel during the experiment?

Sluggish ___:___:___:___:___:___:___:___:___:___:___ Alert

22. During the experiment how bothered were you by noise?

Very bothered ___:___:___:___:___:___:___:___:___:___:___ Not at all bothered

23. Generally do you prefer to work alone or in a group?

Alone ___:___:___:___:___:___:___:___:___:___:___ In a group

24. To what extent did you experience tense muscles?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very much

25. How bothered were you by the lighting in the experimental room?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very bothered

bothered

26.How pleasant did you find the experimental room?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very pleasant

pleasant

27. To what extent did you experience sweating palms?

Very much ___:___:___:___:___:___:___:___:___:___:___ Not at all

28. How distracted did you feel during the experiment?

Not at all ___:___:___:___:___:___:___:___:___:___:___ Very distracted

distracted

29. How cramped did you feel during the experiment?

Very cramped ___:___:___:___:___:___:___:___:___:___:___ Not at all cramped

30. Rate how friendly each group member was (excluding yourself)

Group member

A Not at all ___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

B Not at all ___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

C Not at all ___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

D Not at all ___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

E Not at all ___:___:___:___:___:___:___:___:___:___ Very friendly

friendly

31. Rate how aggressive each group member was (excluding yourself)

Group member

A Very ___:___:___:___:___:___:___:___:___:___ Not at all aggressive

aggressive

B Very ___:___:___:___:___:___:___:___:___:___ Not at all aggressive

aggressive

C Very ___:___:___:___:___:___:___:___:___:___ Not at all aggressive

aggressive

D Very ___:___:___:___:___:___:___:___:___:___ Not at all aggressive

aggressive

E Very ___:___:___:___:___:___:___:___:___:___ Not at all aggressive

aggressive

32. How happy were you with the performance of your group?

Very happy ___:___:___:___:___:___:___:__:___:___ Not at all happy

33. How comfortable did you feel during the experiment?

Very comfortable ___:___:___:___:___:___:___:___:___:___ Not at all

comfortable

34. How dull or jittery did you feel during the experiment?

Dull ___:___:___:___:___:___:___:___:___ Jittery

35. How stimulated or relaxed did you feel during the experiment?

Stimulated ___:___:___:___:___:___:___:___:___ Relaxed

36. How excited or calm did you feel during the experiment?

Excited ___:___:___:___:___:___:___:___:___ Calm

37. How sleepy or wide awake did you feel during the experiment?

Sleepy ___:___:___:___:___:___:___:___:___ Wide awake

APPENDIX J : CROWDING RESEARCH NOTES TO SUBJECTS (STUDY TWO)

KEITH TUFFIN

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Firstly I would like to thank you again for volunteering as research subjects for the experiment which was conducted earlier this year. You may recall that following the experiment you were debriefed. The major purpose of the debriefing was to reveal the deceptions involved and also to inform you of the questions which the research hoped to answer. You were also told that at the conclusion of the research you would be posted a summary of the findings of the research. The reason for this summary is my commitment to the idea that as research subjects you deserve to be informed about the research you were involved in. You have volunteered your time and I believe that you are entitled to something in return - in this case it takes the form of information relevant to the experiment in which you participated.

This summary will be presented in four parts : (1) Theory, (2) Design, (3) Results, (4) Conclusion.

THEORY

The experiment which you took part in was designed to examine some of the propositions of an information expectancy model of crowding. Essentially the model predicts that people develop spatial expectations (ideas about how close they will be to others) based on information which they have about the particular environment they expect to be in. The information expectancy model predicts that when spatial expectations are confirmed the experience of crowding will be reduced, i.e. perceptions of crowding will be lessened; subjects will feel less discomfort and performance deficits will not be evident. Also the model predicts that disconfirmation of spatial expectancies will serve to exacerbate the experience of crowding, i.e. increase perceptions of crowding, increase discomfort and possible performance deficits.

DESIGN

The purpose of this section is to give you an idea of the way the experiment was "set up", or organised. Two variables were manipulated. The first of these was spatial expectation, with three levels of information, control (no information), spatial confirmation (accurate information), and spatial disconfirmation (inaccurate information). All subjects sat very close with only subjects from the spatial confirmation condition expecting to sit at this distance.

The second variable which was manipulated was the level of difficulty of the

anagrams which all subjects completed. Subjects were initially led to expect easy anagrams, this expectation being either confirmed in the case of easy anagrams or disconfirmed in the case of difficult anagrams.

RESULTS

These results are based on a preliminary analysis of the data. The information expectancy model is based on the premise that subjects will use available information in formulating expectations about spatial concerns. This prediction was supported by the results which showed that subjects who were led to expect crowding reported anticipating less distance between themselves than subjects who expected "normal" spacing, or subjects who were not told what to expect.

A key prediction was that confirming spatial expectations (accurate information) would reduce perceptions of crowding. Crowding was measured by asking subjects how crowded, confined and cramped they felt. On none of these three measures was the prediction supported. A further prediction which was partially supported was that disconfirmed nonspatial expectations would increase perceptions of crowding. This was so for the measure of crowding but not the other two measures.

The prediction that confirming subjects spatial expectations would reduce their perceptions of arousal and discomfort was unsupported. However subjects confronted with difficult anagrams (disconfirming their nonspatial expectation)

reported being slightly more ill-at-ease. The same subjects also reported feeling significantly less comfortable.

Contrary to predictions either confirming or disconfirming spatial expectations failed to influence subjects' interpersonal relations. Concerning the treatment of Johnny Rocco, a significant interaction was noted with spatial confirmation subjects becoming more punitive when nonspatial expectations were disconfirmed, while the reverse occurred for subjects whose spatial expectations were disconfirmed. Unexpectedly, subjects whose nonspatial expectations were disconfirmed rated their fellow group members as less aggressive.

No significant differences were noted on subjects' reports of negative affect (hostility, depression or anxiety). Group performance was measured by asking subjects to derive a number of smaller words from a master word. Spatial expectations appeared to have no influence on performance, while subjects whose nonspatial expectations were disconfirmed, outperformed their counterparts whose nonspatial expectations (easy anagrams) were confirmed.

CONCLUSION

Contrary to predictions this study has shown that spatial expectations being confirmed or disconfirmed has little impact on the experience of crowding. Disconfirming nonspatial expectations did exacerbate the experience of crowding where subjects reported feeling more crowded and less comfortable. They also

showed improved performance on the group task and rated their fellow group members as less aggressive.

I hope this brief note is informative and serves to answer any questions which you, as subjects, have about the experiment. If you have any further questions then please contact me.

During working hours I may be found in my office (P.322) on the third floor of the Psychology Department. Telephone : work 69 099 extension 7924 or home 76 234.

Thank you for your participation.

Keith Tuffin.

APPENDIX K : ANOVA TABLES FOR KEY DEPENDENT MEASURES FOR STUDY TWO (GROUP ANALYSIS)

SUMMARY ANOVA TABLE FOR **HOW CLOSE SUBJECTS' EXPECTED TO BE SEATED FROM EACH OTHER**

SOURCE	SS	DF	MS	F	P
Main Effects	29.349	4	7.337	5.793	0.001
Information	27.935	2	13.968	11.027	0.000
Difficulty	0.480	1	0.480	0.379	0.542
Sex	0.934	1	0.934	0.738	0.396
2-Way Interactions	1.517	5	0.303	0.239	0.942
Info. Difficulty	0.105	2	0.053	0.041	0.959
Info. Sex	1.194	2	0.579	0.471	0.628
Difficulty Sex	0.218	1	0.218	0.172	0.681
3-Way Interactions					
Info. Diff. Sex	4.144	2	2.072	1.636	0.209
Explained	35.010	11	3.183	2.513	0.018
Residual	45.600	36	1.267		
Total	80.610	47	1.715		

SUMMARY ANOVA TABLE FOR **PRACTICE ANAGRAMS**

SOURCE	SS	DF	MS	F	P
Main Effects	0.215	3	0.072	0.642	0.592
Information	0.095	2	0.048	0.425	0.656
Difficulty	0.120	1	0.120	1.075	0.306
2-Way Interactions					
Info. Difficulty	0.150	2	0.053	0.470	0.628
Explained	0.320	5	0.064	0.573	0.720
Residual	4.690	42	0.112		
Total	5.010	47	0.107		

SUMMARY ANOVA TABLE FOR **TEST ANAGRAMS**

SOURCE	SS	DF	MS	F	P
Main Effects	396.495	3	132.165	204.680	0.000
Information	2.042	2	1.012	1.581	0.218
Difficulty	394.453	1	394.453	610.8791	0.000
2-Way Interactions					
Info. Difficulty	0.052	2	0.026	0.040	0.961
Explained	396.547	5	79.309	122.824	0.000
Residual	27.120	42	0.646		
Total	423.667	47	9.014		

SUMMARY ANOVA TABLE FOR **CROWDING**

SOURCE	SS	DF	MS	F	P
Main Effects	66.901	4	16.725	3.278	0.022
Information	1.820	2	0.910	0.178	0.837
Difficulty	39.241	1	39.241	7.692	0.009
Sex	25.840	1	25.840	5.065	0.031
2-Way Interactions	51.802	5	10.360	2.031	0.098
Info. Difficulty	12.347	2	6.173	1.210	0.310
Info. Sex	36.509	2	18.254	3.578	0.038
Difficulty Sex	2.947	1	2.947	0.578	0.452
3-Way Interactions					
Info. Diff. Sex	1.129	2	0.564	0.111	0.896
Explained	119.833	11	10.894	2.135	0.043
Residual	183.660	36	5.102		
Total	303.492	47	6.457		

SUMMARY ANOVA TABLE FOR **ANNOYED**

SOURCE	SS	DF	MS	F	P
Main Effects	92.728	4	23.182	2.343	0.073
Information	21.665	2	10.833	1.095	0.346
Difficulty	17.041	1	17.041	1.722	0.198
Sex	54.023	1	54.023	5.459	0.025
2-Way Interactions	32.144	5	6.429	0.650	0.664
Info. Difficulty	9.182	2	4.591	0.464	0.633
Info. Sex	22.182	2	11.091	1.121	0.337
Difficulty Sex	0.780	1	0.780	0.079	0.780
3-Way Interactions					
Info. Diff. Sex	8.927	2	4.464	0.451	0.640
Explained	133.799	11	12.164	1.229	0.304
Residual	356.233	36	9.895		
Total	490.032	47	10.426		

SUMMARY ANOVA TABLE FOR **SOMATIC**

SOURCE	SS	DF	MS	F	P
Main Effects	4.499	4	1.125	0.361	0.835
Information	1.185	2	0.593	0.190	0.828
Difficulty	0.368	1	0.368	0.118	0.733
Sex	2.947	1	2.947	0.945	0.337
2-Way Interactions	10.308	5	2.062	0.661	0.655
Info. Difficulty	3.435	2	1.718	0.551	0.581
Info. Sex	5.051	2	2.525	0.810	0.453
Difficulty Sex	1.823	1	1.823	0.585	0.450
3-Way Interactions					
Info. Diff. Sex	12.352	2	6.176	1.981	0.153
Explained	27.159	11	2.469	0.792	0.647
Residual	112.233	36	3.118		
Total	139.392	47	2.966		

SUMMARY ANOVA TABLE FOR **AROUSAL**

SOURCE	SS	DF	MS	F	P
Main Effects	13.013	4	3.253	0.799	0.534
Information	3.812	2	1.906	0.468	0.630
Difficulty	6.901	1	6.901	1.696	0.201
Sex	2.300	1	2.300	0.565	0.457
2-Way Interactions	22.073	5	4.415	1.085	0.385
Info. Difficulty	18.282	2	9.141	2.246	0.120
Info. Sex	1.284	2	0.642	0.158	0.855
Difficulty Sex	2.507	1	2.507	0.616	0.438
3-Way Interactions					
Info. Diff. Sex	19.067	2	9.534	2.343	0.111
Explained	54.142	11	4.923	1.210	0.316
Residual	146.487	36	4.069		
Total	200.639	47	4.269		

SUMMARY ANOVA TABLE FOR **PUNITIVENESS**

SOURCE	SS	DF	MS	F	P
Main Effects	1.986	4	0.479	1.233	0.314
Information	0.292	2	0.146	0.362	0.699
Difficulty	1.688	1	1.688	4.190	0.048
Sex	0.007	1	0.007	0.017	0.896
2-Way Interactions	3.979	5	0.796	1.976	0.106
Info. Difficulty	3.879	2	1.937	4.810	0.014
Info. Sex	0.097	2	0.049	0.121	0.887
Difficulty Sex	0.007	1	0.007	0.017	0.896
3-Way Interactions					
Info. Diff. Sex	4.514	2	2.257	5.603	0.008
Explained	10.479	11	0.953	2.365	0.026
Residual	14.500	36	0.403		
Total	24.979	47	0.531		

SUMMARY ANOVA TABLE FOR **AGGRESSION**

SOURCE	SS	DF	MS	F	P
Main Effects	213.023	4	53.256	2.567	0.055
Information	33.815	2	16.907	0.815	0.451
Difficulty	165.763	1	165.763	7.989	0.008
Sex	13.444	1	13.444	0.648	0.426
2-Way Interactions	52.099	5	10.420	0.502	0.773
Info. Difficulty	33.522	2	16.761	0.808	0.454
Info. Sex	13.287	2	6.644	0.320	0.728
Difficulty Sex	5.290	1	5.290	0.255	0.617
3-Way Interactions					
Info. Diff. Sex	5.612	2	2.806	0.135	0.874
Explained	270.733	11	24.612	1.186	0.331
Residual	746.947	36	20.749		
Total	1017.680	47	21.653		

SUMMARY ANOVA TABLE FOR **LIKING**

SOURCE	SS	DF	MS	F	P
Main Effects	4.929	4	1.232	2.610	0.052
Information	1.755	2	0.878	1.858	0.171
Difficulty	0.053	1	0.053	0.113	0.739
Sex	3.121	1	3.121	6.609	0.014
2-Way Interactions	2.040	5	0.408	0.864	0.515
Info. Difficulty	0.802	2	0.401	0.849	0.436
Info. Sex	0.701	2	0.350	0.742	0.483
Difficulty Sex	0.538	1	0.538	1.139	0.293
3-Way Interactions					
Info. Diff. Sex	1.841	2	0.920	1.949	0.157
Explained	8.810	11	0.801	1.696	0.114
Residual	17.000	36	0.472		
Total	25.810	47	0.549		

SUMMARY ANOVA TABLE FOR **ANXIETY**

SOURCE	SS	DF	MS	F	P
Main Effects	1.509	4	0.377	1.234	0.314
Information	0.662	2	0.331	1.081	0.350
Difficulty	0.563	1	0.563	1.841	0.183
Sex	0.284	1	0.284	0.930	0.341
2-Way Interactions	4.252	5	0.850	2.780	0.032
Info. Difficulty	0.163	2	0.081	0.264	0.769
Info. Sex	3.841	2	1.920	6.277	0.005
Difficulty Sex	0.250	1	0.250	0.817	0.372
3-Way Interactions					
Info. Diff. Sex	1.972	2	0.986	3.222	0.052
Explained	7.733	11	0.703	2.298	0.030
Residual	11.013	36	0.306		
Total	18.747	47	0.399		

SUMMARY ANOVA TABLE FOR **HOSTILITY**

SOURCE	SS	DF	MS	F	P
Main Effects	0.900	4	0.225	0.825	0.518
Information	0.860	2	0.430	1.577	0.220
Difficulty	0.030	1	0.030	0.110	0.742
Sex	0.010	1	0.010	0.037	0.849
2-Way Interactions	1.770	5	0.354	1.299	0.286
Info. Difficulty	1.260	2	0.630	2.311	0.114
Info. Sex	0.260	2	0.130	0.477	0.625
Difficulty Sex	0.250	1	0.250	0.917	0.345
3-Way Interactions					
Info. Diff. Sex	0.607	2	0.303	1.113	0.340
Explained	3.277	11	0.298	1.093	0.394
Residual	9.813	36	0.273		
Total	13.090	47	0.279		

SUMMARY ANOVA TABLE FOR **DEPRESSION**

SOURCE	SS	DF	MS	F	P
Main Effects	0.833	4	0.208	0.698	0.598
Information	0.612	2	0.306	1.025	0.369
Difficulty	0.141	1	0.141	0.472	0.496
Sex	0.080	1	0.080	0.269	0.607
2-Way Interactions	0.745	5	0.149	0.499	0.775
Info. Difficulty	0.332	2	0.166	0.556	0.578
Info. Sex	0.351	2	0.175	0.588	0.561
Difficulty Sex	0.063	1	0.063	0.209	0.650
3-Way Interactions					
Info. Diff. Sex	0.462	2	0.231	0.774	0.469
Explained	2.039	11	0.185	0.621	0.798
Residual	10.740	36	0.298		
Total	12.779	47	0.272		

SUMMARY ANOVA TABLE FOR **PERFORMANCE**

SOURCE	SS	DF	MS	F	P
Main Effects	735.986	4	183.997	2.281	0.080
Information	277.875	2	138.938	1.723	0.193
Difficulty	396.750	1	396.750	4.919	0.033
Sex	61.361	1	61.361	0.761	0.389
2-Way Interactions	155.833	5	31.167	0.386	0.855
Info. Difficulty	106.625	2	53.313	0.66	0.523
Info. Sex	22.514	2	11.257	0.140	0.870
Difficulty Sex	26.694	1	26.694	0.331	0.569
3-Way Interactions					
Info. Diff. Sex	133.764	2	66.882	0.829	0.445
Explained	1025.583	11	93.235	1.156	0.350
Residual	2903.667	36	80.657		
Total	3929.250	47	83.601		