DISTANCE ESTIMATION AS A FACTOR OF THE PROXIMITY AND HUMANNESS OF THE TARGET

by

TIMOTHY MICHAEL BOEHLER GALLAGHER
B.A., McGILL UNIVERSITY

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

In the Department
of
Psychology

We accept this thesis as conforming
to the required standard

[redacted]

Dr. Robert Gifford

[redacted]

Dr. Loren Edward Acker

[redacted]

Dr. R. Vance Peavy

[redacted]

Dr. Paul M. Baker

UNIVERSITY OF VICTORIA
OCTOBER 1984

Supervisor: Professor Robert Gifford

ABSTRACT

This paper examines the effects of changes in interpersonal distance on the accuracy of distance estimation. The 32 estimated interpersonal distances were either closer or farther than the Preferred Interpersonal Distance (PID). The experimental design was developed to apply Argyle and Dean's (1965) Affiliative-Conflict Theory to a covert behavior (estimation of distances). Two additional factors tested were Crowdedness (of the subject) and Humanness (of the target). The results indicate that the subject compensates for inappropriate interpersonal distances by perceptually adjusting these distances in the direction of PID, clearly supporting Affiliative-Conflict Theory. There was no effect due to Crowdedness, indicating that simply increasing the number of people in a room will not necessarily intensify a person's response to the stimuli evoked by those people. Results relevant to the Humanness factors were unclear but suggest that estimation of distances to inanimate targets are generally accurate except when they closely resemble distances to a human target.

Examiners:

[redacted]

Dr. Robert Gifford

Dr. Loren Edward Acker

[redacted]

Dr. R. Vance Peavy

[redacted]

Dr. Paul M. Eaker

CONTENTS

TITLE PAGE i

ABSTRACT ii

TABLE OF CONTENTS iv

LIST OF TABLES vi

LIST OF FIGURES vii

ACKNOWLEDGEMENT viii

DEDICATION ix

page

INTRODUCTION 1

Proxemics Theory 4

Dyads and Proximity 4

Crowds 8

PID Standards 13

Visual Perception 17

Perceptual Judgement of Distances 17

Hypotheses 26

METHOD 28

Design 28

Subjects 28

Procedure and Materials 29
General Procedure 29
Setting 29
Targets 29
Test Distances 32
Subjects Location 32
Procedure 34
RESULTS 38
Testing Sequence and Sex 38
Target Proximity 45
Crowdedness 47
Humanness 47
Interactions 48
DISCUSSION 49
Target Proximity 49
Research Design Differences: Ford's Studies . . 50
Crowdedness 51
Coping 53
Attribution 54
Humanness 57
Adaptation-Level Theory 58
Interaction Effects 62
Research Proposals 65
Summary 71

LIST OF TABLES

Table page

1. Distances, Estimation Order and Conditions in the Study. 33
2. Mean Estimated Error as a Function of Sex, Set and Order. 39
3. Means of EE for the Ten Distance Estimations. 40
4. ANOVA of EE with Ten Repeated Measures, No Groups. 43
5. Planned Orthogonal Comparisons. 44
6. Means of EE for Orthogonal Comparisons 46
7. Predicted Estimated Error for Interpersonal Distances. 67
8. Predicted EE for Human and Inanimate Targets. 70

LIST OF FIGURES

Figure page

1. Layout of both waiting area and experimental area, in the Alone condition. 30
2. Layout of vital targets: In the Crowded condition with experimenter at a far distance. 35
3. Means for ten distances and their confidence intervals at a 95% level. 41

ACKNOWLEDGEMENT

Most of all I wish to thank my wife, Inga Boehler, for the endless hours of labour that she provided in the editing of this thesis and moreover, for her unquestioning love.

I would like to thank my advisor, Dr. Robert Gifford, for his direction and patience. I would also like to thank the subjects that participated in this study for all of their cooperation and interest.

Finally, I wish to thank my three brothers: Patrick, Sean and Casey, my four sisters: Mary, Karen, Noreen and Bridget, my mother, Shirley and my father, Patrick for all of their love.

DEDICATION

This thesis is dedicated to Inga.

Introduction

The study of nonverbal social interactions that occur as people approach and associate with each other is complex. It includes the analysis of ongoing adjustments in social behavior. An individual attempts to maintain his or her preferred level of immediacy (a multidimensional distance) to another person in a given situation. (Hall (1963, 1966) hypothesized that interpersonal distance is a medium of communication utilizing the sensory modalities (i.e., sight, sound, smell and touch).) The present study will examine the effect of interpersonal distance on an individual's estimation of the physical distance between self and other.

Two theories explaining some of the responses to changes in interpersonal distance are Argyle and Dean's (1965) Affiliative-Conflict Theory and Freedman's (1975) Density-Intensity Theory. Argyle and Dean (1965) postulate that within social interaction, the immediacy between individuals is continuously adjusted through various behaviors by each individual. For example, if a person feels uncomfortable because of the intense gaze of another person, this discomfort could be relieved by a change in body orientation away from the other person (i.e., the invader). Each individual has compensatory control over the incoming stimuli resulting in some control over the level of immediacy experienced. There is an ongoing covert negotiation in the subtle exchange of immediacy behavior to maintain preferred interpersonal distance.

Freedman's (1975) Density-Intensity Theory examines the effect that crowd density has on individuals. He defines the density of people as being dependent on the "...space relative to the number of people" (p. 9). In other words, "The less space per person, the more crowded the situation" (p. 9). He distinguished between the physical condition (i.e., density of people) and the sensation of being crowded, (i.e., experience of crowdedness). He focused on density of people, asserting that attempts to include phenomenological variables would obstruct the predictive capacity of the theory. He proposed that it is more effective to examine the process of how people react to uniform changes in density. Freedman proposed that as the density of people increases (e.g., people move closer) so does the salience of the stimuli they evoke. He used the example of increasing the volume of music. "If a person likes the music and is enjoying it, increasing the volume will usually make him enjoy it more. He will hear it better, pay more attention to it, be able to appreciate more subtleties and overtones, and generally find the music itself more enjoyable" (p. 90). Freedman added that, "Increasing density does not produce stress or arousal, but it does make the presence of the other people and their characteristics more important. An individual will pay more attention to them, and whatever the individual's reactions, they will be stronger" (p. 96). In this theory there is no account of compensatory behaviors. It predicts only an intensification or magnification of stimuli evoked by the present condition and in turn, an increase in response to these stimuli in conditions with higher density of people.

In contrast to Density-Intensity Theory, Affiliative-Conflict Theory is less static and focuses on social interaction. Numerous behaviors can be initiated to compensate for changes in the immediacy of people (e.g., experience of crowdedness) so as to maintain the level of behavior in which one is presently engaged.

The intent of the present study was to investigate a perceptual-cognitive (phenomenological) effect of interpersonal distancing (i.e., the estimation of interpersonal distance). At the same time it intended to examine the validity of the two aforementioned theories (Affiliative-Conflict Theory and Density-Intensity Theory) in relation to this effect. Each subject estimated distances to various targets, both human and inanimate. These distances did not conform to Preferred Interpersonal Distance (PID), that is, between people, they were socially inapproriate distances. In agreement with Affiliative-Conflict Theory, the main predictions of the present study are: (a) when people are closer to each other than PID, they will overestimate their interpersonal distance; (b) when interpersonal distance is judged to be greater than PID the distance will be underestimated. These predictions are not supportive of Freedman's (1975) Density-Intensity Theory, which predicts that whatever the effect was when in one condition, the effect would increase in a more crowded condition. In other words, if the subject was underestimating far interpersonal distances, the underestimation of distances should increase for close interpersonal distances. The following discussion of proxemics research forms the basis of these predictions in support of Affiliative-Conflict Theory.

Proxemics Theory

Dyads and Proximity. Hall (1963) defined the term proxemics as "...the study of how man unconsciously structures microspace - the distance between men in the conduct of daily social interactions, the organization of space in his houses and buildings, and ultimately the layout of his towns" (p. 1003).) Proxemics research has extensively examined the effects of interpersonal distance within dyads on task performance, affect, various distancing behaviors, and physiological responses.

Hall's (1963, 1966) postulation that individuals adjust their immediacy to others during social interaction was elaborated by Argyle and Dean (1965). They proposed that approach and avoidance drives are important factors of the social interaction process. For example, a person's affiliative needs may conflict with his or her fear of self-disclosure. When these conflicting drives are in balance with each other and thus cancelling each other out, the situation may be considered optimal. A person will feel more comfortable when he or she is not aware of a drive to either disclose more or to back away from the conversation. This is a continuously changing condition. The preferred level of immediacy is at the point where the conflicting drives are in equilibrium. During dyadic interaction both persons attempt to balance the combined functions of physical proximity, eye contact, facial expression, intimacy of topic, etc. A major corollary of the equilibrium proposal is that: "...if one of the components of intimacy is changed, one or more of the others will shift in the reverse direction in order to maintain the equilibrium" (Argyle and Dean, 1965, p. 293).

Both desired and undesired immediacy can occur within any dyad. In the literature, there has been a growing concern to obtain a meaningful distinction between different forms of close proximity. Sundstrom and Altman's (1976) review of PID research distinguished distancing in "ongoing interaction" from that in "spatial invasion". In "ongoing interaction", each of the individuals has judged the present social behavior as appropriate and expects the social interaction to continue in the same manner and direction. In "spatial invasion", the social interaction at the current level is not expected and has been judged as inappropriate. The present study does not include an examination of the effects of "ongoing interaction". It is for the most part restricted to the effects of "spatial invasion". Altman and Vinsel (1977) concluded from their review of 106 empirical studies that Argyle and Dean's (1965) Affiliative-Conflict Theory is generally supported. The results from these numerous studies showed compensatory behavior in conditions defined by Sundstrom and Altman (1976) as "spatial invasion".

Research on proximity and dyadic interaction frequently measures one or a combination of the following responses to changes in interpersonal distance: body orientation (Haase and Pepper, 1972; Patterson, 1973; 1977), eye contact (Argyle and Dean, 1965; Kendon, 1967), physical distancing and fleeing (Barefoot, Hoople and McClay, 1972; Becker and Mayo, 1971; Knowles, 1972)); facial responses, fidgeting (Efran and Cheyne, 1974); affect (Dinge and Oetting, 1972; Haase, 1970); self-disclosure (Johnson and Dabbs, 1976) and physiological responses (Midlemist, Knowles and Matter, 1976). All of these studies demonstrated that a violation of a person's PID can evoke compensatory behaviors.

Behavioral compensation to maintain PID has been empirically demonstrated in structured field studies. For example, the closer one person is to a hallway water fountain, the less other people will use it (Barefoot, Hoople and McClay, 1972; Baum, Reiss and O'Hara,1974).

While Freedman (1975) almost exclusively hypothesized about the intensification of the prominent behavior as the density of people increases, he did make some reference to proximity and dyads. "Research on personal space [PID] demonstrates that people do respond to to variation in space around them and have rules about what is appropriate. This makes it even more likely that population density affects people's behavior" (p. 73). Here, Freedman (1975) has related proximity with population density. Later, he relates the amount of space two people have with the concept of density of people. "In one experiment, some of the two-man teams were given two rooms... while the other teams had only one room...In other words, a situation in which there was very little space and no chance for privacy was compared with one in which there was twice as much space and the opportunity for privacy" (p. 74-75). Thus, Freedman (1975) extended the applicability of Density-Intensity Theory to changes in proximity within dyads.

Crowds. Research has identifed proximity as one of the factors within crowding effects. (Worchel and Teddlie's (1976) study amalgamates some of the research from both crowding and dyadic interaction theories. They postulate that the arousal component of crowding results from perceived invasion of preferred interpersonal distance) (PID). They differentiate between spatial density and proximity. "...it is not the amount of space available to the individual per se but the distance between individuals that determines the degree of stress...from a particular situation" (p. 31). Thus, in a large room, the same number of people can vary their interpersonal distance and thus vary the degree of crowdedness, even though the spatial density has remained the same. Worchel and Teddlie's study supports the proposal that crowding effects can be accounted for by the interpersonal distance between each person rather than the number of people in a room (spatial density). Other studies have also been supportive of this proposal (e.g., Epstein and Karlin, 1975).

Also, Worchel and Teddlie (1976) proposed that personal response to crowded conditions is a function of attribution. Attribution is defined as the judgment of the cause of one's own arousal. No significant decrement in performance on a word task occurred when subjects attributed their arousal to the interior decorating of the room. It occurred only when subjects attributed their arousal to an invasion of their PID. "...for half of the conditions, pictures (attribution inhibitors) were placed on the walls of the experimental room, and in the other half, the walls were bare...the addition of pictures reduced the experience of crowding" (Worchel and Teddlie, 1976; p. 30). Thus, there is some support for the notion that the effect of crowding is depenedent on the proximity of people and the attribution of the cause of the accompanying arousal. It is not the density of people per se that determines the effect, but the "experience" of crowding. A later study (Worchel and Yohai, 1979) supported this proposed function of attribution in the crowding effect. When the discomfort is attributed to social factors, it is more likely to be judged as a personal threat than when it is attributed to some inanimate object in the environment. The increase in stress intensifies the coping resonse.

This theory, and some other crowding theories, are more in agreement with Affiliative-Conflict Theory than with Density-Intensity Theory. For example, stimulus overload models (Baum and Valins, 1977; Cohen, 1978; Milgram, 1970; Saegert, 1978) suggest that crowded environments increase the degree of stimulation and thus the degree of psychological demand. This in turn can lead to a variety of coping responses to withdraw from the stimulation overload and the resulting stress. Distance less than PID can be defined as stimulation overload. The individual will attempt to withdraw from this level of immediacy.

The stimulus overload model has generally been supported. Noise (Mathews and Canon, 1975), brightly colored clothes (Nesbitt and Steven, 1974), and the number of people within the interaction (Valin and Baum, 1973) can all lead to stimulus overload. Compensatory reactions to excessive immediacy have been shown to occur, both during high room density [e.g., reduced eye contact (Sundstrom, 1975)], and while anticipating a crowd, [e.g., reduced eye contact, head movements away, (Baum and Greenberg, 1975; Baum and Koman, 1976)].

Nesbitt and Steven (1974) tested the stimulus overload model in a natural setting (i.e., an amusement park). The stimulus person and the subjects were waiting in line for a show. The stimulus person represented one of two conditions, high or low stimulus intensity. Photographs from a hidden camera 50 feet away were used to measure the interpersonal distance between the stimulus person and the subject standing next in line behind the stimulus person. They "...found that subjects immediately behind them in line stood further away when the stimulus persons wore brightly colored clothes (high stimulus intensity condition) than when they wore more conservative clothing. Subjects similarly stood further away when the stimulus persons used perfume or after-shave lotion than when they used no scent" (p. 105). A person can moderate the level of stimulation experienced by varying physical proximity to the stimulus.

In summary, the research on crowding is supportive of the propositions that: (a) the experience of crowding is dependent on the attributed cause of arousal, (b) the immediacy of people can be a factor in experiencing crowding, (c) the experience of crowding can lead to stress, (d) the experience of crowding can evoke a variety of coping responses and (e) these coping responses to crowding can be seen as the behavioral compensation predicted by Affiliative-Conflict Theory.

Freedman's Density-Intensity Theory is in opposition to these propositions, in that it does not address: (a)attribution of cause (b) compensatory behaviors and (c) "immediacy" of people (i.e., the "experience" of crowding rather than merely the density of people). His Density-Intensity Theory predicts that an individual's present behavior toward a group of people in a room will be intensified if similar individuals come into the room. The characteristics of these people will become more salient and the prevailing behaviors will increase. Note that in this theory, the function of crowding does not evoke any different responses (i.e., neither stress or coping), only intensification of present responses. An example of what Density-Intensity Theory predicts is what often occurs as the number of people at a party increase; the socializing behavior increases. In Freedman's (1975) words, "Parties in large empty rooms are always unexciting and disappointing. In a small room, as long as it is a good group of people, the party tends to be more successful" (p. 92). The same process of intensification of prominent stimuli occurs whether the stimuli are perceived negatively or positively.

Freedman's (1975) explanation of studies that show subjects' negative reactions to high density of people was that increased density intensified subjects' responses to the already unpleasant condition (e.g., dull task and environment). Here, he has applied Density-Intensity Theory to subjects' respones to the characteristics of the condition and not just the people per se. Still, Density-Intensity Theory emphasises that it can not predict whether a particular situation will evoke a postive or a negative effect. It only predicts an intensification of prevailing responses to a condition if the density of people increases. Outside Freedman's own work, there has not been much support for this theory. It is the intention of the present study to compare the validity of Affiliative-Conflict Theory and Density-Intensity Theory.

PID Standards. There has been some concern regarding research design. One concern is for a standard measurement of PID for a particular situation. The following is a summary of the studies reviewed to determine the absolute distances to be used in the present study.

Dinges and Oetting (1972) measured subjects' projected anxiety for five seating distances. "Photographs depicting a seated male and female model at varying interaction distaces were used as the interaction distance stimuli" (p.

147). The seating distances in the photographs were 76.2, 99.1, 127.0, 172.7 or 223.5 cm (30, 39, 50, 68 or 88 inches respectively). The closest (76.2 cm) and the farthest (223.5 cm) distances were equally and both more anxiety-provoking than the three distances between them.

Other studies have reported similar results. Hayduk's (1981) research was on the relationship between the extent of intrusion of PID and discomfort experienced. He used the stop distance procedure. "Subjects were familiarized with stop distance procedure, in which they halted an approaching experimenter by saying 'stop' when they just began to feel slightly uncomfortable about approacher's closeness" (p. 276). This was measured in several conditions. The means of the conditions for "slightly uncomfortable" were approximately of 74 cm. For "moderately uncomfortable", the means were approximately 50 cm. For "very uncomfortable", they were approximately 32 cm. If 74 cm evoked slight discomfort, it implies that it was less than PID. Possibly PID is approximately 80 cm (31.5 inches). The present study took into account the results of these two studies (Dinges and Oetting, 1972; and Hayduk, 1981) and other studies (Coutts and Ledden, 1977; Gifford, 1983; McDowell, 1972; Sommer, 1967) in the selection of test distances that were to be estimated by the subjects. It is assumed that 45.7 or

50.8 cm (18 or 20 inches) is closer than the average PID for the subjects of the present study during the experimental session. Also, 227.3 and 238.8 cm are assumed to be more than PID.

Interpretation of the results from any study is partially dependent on the research design of that study. Coutts and Ledden (1977) criticized the research design of many previous proxemics studies for not first establishing a standard level of immediacy (the subject's individual reference distance for the appropriate PID for that particular condition) within the study. Coutts and Ledden postulate that compensation occurs following a change in immediacy. If a standard point has not been established for that particular condition, the behavior being measured is not attributable to compensation since there is no change in the level of immediacy.

An earlier example of a research design that complies with Coutts and Ledden's (1977) criteria is McDowell (1972). He examined the effect of violating a person's PID during an interview. Intially, the interviewer stood approximately 86 cm (34 inches) from the interviewee. This procedure established a standard level of immediacy for that interview. In the second part of the interview, the interviewer either came within approximately 56 cm (22 inches) of the interviewee (in the violation condition), or maintained approximately 86 cm in the control condition. Movement of the interviewee was monitored through a one way mirror. The results showed that the violation of PID during an interview evoked sudden moving away by the victim. An important feature in the design of McDowell's study is the establishment of a standard level of immediacy within the study.

Coutts and Ledden (1977) extended the interview technique used by McDowell (1972) to evoke both approach and avoidance compensatory responses. After an initial interview, a female subject was taken to a second female interviewer who either maintained, increased, or decreased the previous seating distance. The results showed that when the interviewer moved closer, the subject smiled less and looked less at the interviewer. When the interviewer moved further away, the subject smiled more, made more eye contact, leaned forward more and oriented her body more directly toward the interviewer. Both groups of subjects were compensating for the disruption of the previously established equilibrium point of the initial interview. In the present study, the standard level of immediacy was established during the explanation of the study to the subjects while sitting in the waiting area. The explanation of the study (with some small talk) took approximately three minutes.

In summary, Argyle and Dean's (1965) Affiliative-Conflict Theory has been supported by the majority of empirical studies of proxemics. When individuals attribute their discomfort to the level of immediacy, they will attempt to compensate for it by one or more of a number of overt behaviors.

Visual Perception

Studies of responses to changes in interpersonal distance have been focused on various levels of overt behavior, from eye gaze to fleeing. The present study is an attempt to get a clearer understanding of some of the covert (internal) processes occurring during social interaction. In particular, the present study will examine an aspect of perceptual-cognitive processing. This is based on the premise that a person's available cognitive systems will influence the momentary perceptual configurations and thus alter the perceived world. In other words, a person has deduced what he perceives, which is partially based upon his expectations derieved from previous experiences (Brunswick, 1955).

Perceptual Judgement of Distances. The present study investigates the estimation of distances in the range of 30 to 300 cm (approx. 1 to 9.8 feet) Much of the research in perception is not applicable to the present study. The judgement of distances in the majority of research uses nonscalar (e.g., ratio) measurements (Gogel, 1972). At the same time, most perception research is under reduced conditions of observation (e.g., using a tachistoscope).

One of the few studies using scalar judgements was by Baird (1903). However, like so many others, subjects were tested under reduced conditions of observation. The apparatus "...shall render inoperative all depth criteria save only that of accomodation and convergence" (p. 171). One of the measurements was the subject's estimation of the absolute distance to a target (a straight edge in a black box). The distance ranged from 29 cm to 90 cm. Almost all judgements were underestimated. The means of these estimation errors for each distance ranged from -14.8% to -22.3%.

Another group of studies used much larger distances. Howard, Chase and Rothman (1973) asked subjects to estimate the absolute distance between points (e.g., buildings) on their university campus. The distances ranged from 200 meters to 1700 meters. Cadwallader (1973) asked for the estimation of the absolute distance to various cities that were within a 65 mile radius of the home town. In this study, like many others, the accuracy level was not documented. It was only indicated that the Pearson correlation coefficient between the real distances and the estimated distances was 0.96. No substantial research was found which investigated scalar judgement of distances of 30 to 500 cm while not being under reduced conditions of observation.

A few studies have demonstrated the effect of contextual variables (such as social status) on the estimation of size or distance to a test person. Studies have supported the prediction that the higher the perceived status of a person, the taller the person will appear to the observer (Dannenmaier and Thumin, 1964; Koulack and Tuthill, 1972; Wilson, 1968).

It has also been shown that the estimation of the size of an object can be affected by the humanness of that object. A group of studies (Hester, 1970; Shontz and McNish, 1972; Koff and Kiekhofer, 1978) compared differences in size estimation of human body parts versus inanimate objects. The results suggest that the more human the stimuli are, the more the perceived size of the stimuli is affected by cognitive or emotional associations with the stimuli (Koff and Kiekhofer, 1978). The size of human body stimuli is estimated with more variability and less accuracy than other stimuli. The pattern of errors in children's results corresponds to that of adults and is consistent across sex (Koff and Kiekhofer, 1978).

The estimation of distance to another human has been measured in a few studies. In one study, not explicitly concerned with personal space, Luft (1966) demomstrated that a subject who responded higher on a self-rating of anxiety than her coworker, "...judged the distance between Ss significantly closer than her partner who had less anxiety, and closer than the actual physical distance" (p. 266). These subjects were seated and not overtly communicating with one another. The distance between them was from 213.4 cm to 274.3 cm (seven to nine feet). In the context of a personal space paradigm, these results may be interpreted as a demonstration of two ideas discussed by other theorists. One is that social interaction is more than just verbal behavior. The interpersonal distance of 200 to 300 cms is uncomfortably far for social interaction amongst peers (Hall, 1966). Another idea is that there may be an effect from affiliative needs. "Anxious subjects may choose 'Together' as a means of reducing their own fear or as a social means of better understanding and evaluating their own feelings" (Schachter, 1959, p. 41). Thus, within the context of a personal space paradigm, Luft's (1966) results may indicate that underestimation of interpersonal distance can be utilized to achieve greater immediacy with another person. In other words, the closer you want another person to be, the closer that other person will appear.

Beloff and his associates (Beloff and Beloff, 1961; Beloff and Coupar, 1968) investigated the influence of social factors on a subject's judgement of a distance to a photograph of a human face. They used a modified version of the Ames Thereness-Thatness apparatus (Ittelson, 1952), in which the reference or standard stimulus was 121.9 cm (four feet) away from the observer and viewed binocularly. The test stimulus (a photograph of a human face) was viewed monocularly. Subjects were instructed to turn a knob that adjusted the distance of the photograph until it was level with the standard stimulus.

In the first study (Beloff and Beloff, 1961), the series of photographs included both positive and negative valent faces. The results showed that estimators placed a photograph of a positive valent face closer to themselves than a negative valent face. That is, a positive valent face evoked greater underestimation than a negative valent face.

In the second study (Beloff and Coupar, 1968), female subjects were grouped by means of their score on a Social

Attitudes Inventory measuring their attitude towards Blacks. High and low scorers, relative to each other, had either a positive or negative social attitude towards Blacks. The series of test stimuli were photographs of Black and White faces. The subjects with positive attitudes towards Blacks placed the photographs of the Black faces closer than did the subjects with negative attitudes. That is, the subjects with a positive attitude underestimated the distance more than the subjects with a negative attitude.

Ford and his associates (Ford and Hoebeke, 1980; Ford, Knight and Cramer, 1977) executed two studies involving distance estimations to humans and objects. The subjects participated in one of four conditions. All subjects were asked to approach a target stimulus (human or object) until they reached a comfortable interpersonal distance appropriate for the task. All subjects were given the same task, which was to dictate a prespecified neutral statement.

In the study by Ford et. al. (1977), the target stimulus in the first condition was a human (an experimenter). After the subject had stopped at the distance that she judged to be appropriate for the task, she then dictated the neutral statement. The subject was then asked to go into another room where she was to replicate the distance to the target stimulus (at the time of the dictation) by walking toward an inanimate target and stopping at the estimated distance. This was the control condition.

The other three conditions all involved the same procedure as the control condition except for a manipulation of the distance to the target, and in two of the conditions, a different target stimulus. As in the control condition, the subjects in the second condition were asked to stop at the distance that they judged to be appropriate for the task (dictation). However, they were then asked to walk to a specific location 30.5 cm from the human target (experimenter). After dictaing the neutral statement, the procedure continued as it did for the subjects in the control condition. The third condition had the same procedure and distance from the target as the second condition. However, the human target was different. Instead of an experimenter, the human target was the subject's spouse. The fourth condition was the same as the latter two, except for the target. Here, it was an inanimate target.

The study by Ford and Hoebeke (1980) replicated this procedure with one exception, the distance variable. In this study, rather than being directed to a location 30.5 cm from the target, they were directed to a location further back (30,5 cm) from the location they had chosen for their task (dictation). Thus, in three of the four conditions, if the subject had chosen a distance of 62 cm from the target, he/she was directed to a location 92.5 cm from the target.

These two studies together demonstrate a function of the relationship between a perciever and a stimulus under various conditions of interpersonal distance. Underestimation of distance (mean average = -39.1%) occured if the condition was an inappropriately close interpersonal distance (human target at a close distance). The estimations of the other three distances were not effected. Overestimation of distance (mean average = 24.0%) occured if the condition was an inappropriately far interpersonal distance (spouse and human target). The estimations of the other two distances were not effected. The results from these two studies are in opposition to the prediction based on Affiliative-Conflict Theory. A possible reason is to do with the research design of Ford's two studies. This will be referred to in the discussion.

Gifford (1983) demonstrated another instance where social factors appear to affect a person's perception of the actual distance between him or herself and another person. Gifford asked subjects to approach a confederate until they reached a comfortable interpersonal distance and then to stay there. This approach-stop technique has often been used as a measurement of PID. In Gifford's study, the average actual interpersonal distance chosen was 62.2 cm (24.49 inches). The subjects were asked to estimate the distance to the confederate. The estimation of the distance was overestimated by an average of 24.6%. That is, most subjects said that the other person was much further away than was actually true. This effect did not occur when the same subject was asked to estimate the distance to various lines. The actual distance to these lines ranged from 12.7 cms to 508 cms. Together, the average estimation to a line was a 3% overestimation. The means for each of these estimations to a line ranged from an underestimation of 4.8% to an overestimation of 6.3%. This is significantly different from the overestimation of 24.6% when estimating interpersonal distance at the periphery of PID.

Together, these studies (i.e., Beloff and Beloff, 1961; Beloff and Coupar, 1968; Dannenmaier and Thumin, 1964; Gifford, 1983; Hester, 1970; Koff and Kiekhofer, 1978; Koulack and Tuthill, 1972; Luft, 1966; Shontz and McNish, 1972; and Wilson, 1968) suggest that while the perception of physical dimensions such as distance will be relatively accurate in some situations (e.g., 3%), that perception of physical dimensions can be highly influenced by contextual variables, such as the humanness of the stimuli, the social status of the stimuli or the type of social interaction occurring at that time.

The three factors selected for the present study are: (a) Target Proximity, (b)Crowdedness and (c) Humanness. The measurements for these three factors are obtained using selected comparisons from ten repeated within-subject variables. The Target Proximity factor allows for a test of Argyle and Dean's (1965) Affiliative-Conflict Theory. The Crowdedness factor allows for a test of Freedman's (1975) Density-Intensity Theory. The Humanness factor allows for a test of the influence of contextual variables, in this case the humanness of the stimuli.

Hypotheses

Hypothesis 1 (Target Proximity), the primary one of the present study, is that when interpersonal distance deviates from PID, subjects will cognitively compensate such that the perceived interpersonal distance is closer to PID than it actually is. Overestimation of distance will occur if interpersonal distance is less than PID. Underestimation will occur if interpersonal distance is greater than PID.

Hypothesis 2 (Crowdedness) is that estimation error will increase with crowding. The prediction is that the perception of a prominent stimulus will be intensified. If subjects underestimating when they are alone, then underestimation will be greater when they are crowded. If subjects are overestimate when they are alone, then overestimation will be greater when they are crowded.

Hypothesis 3 (Humanness) is that estimation error will be increased by the humanness of the stimulus. It is assumed that when another human (a stranger) is too close [approximately 46 cm (18 inches) away], the subject will more often experience discomfort than when the close stimulus is an inanimate object (e.g., a lectern). Assuming that overestimation of interpersonal distance occurs when interpersonal distance is less than PID, it is predicted that: (a) the overestimation of a distance to another human will be greater than the overestimation of a distance to an inanimate object, and (b) the distance to an inanimate object will be estimated relatively accurately (within 5% error).

The same assumptions apply to more distant targets. It is predicted that (a) the underestimation of a distance to a human will be greater than the underestimation of a distance to an inanimate object, and (b) the distance to an inanimate object will be estimated relatively accurately (i.e., within 5% error).

Method

Design

This experiment was a within-subject design, with no between-subject factors. The within-subject variables were ten repeated estimations of distances. The three factors; target proximity, crowdedness and humanness, were derived from these ten variables. Each of the three given hypotheses was tested by using planned orthogonal comparisons of the ten repeated judgements.

Subjects

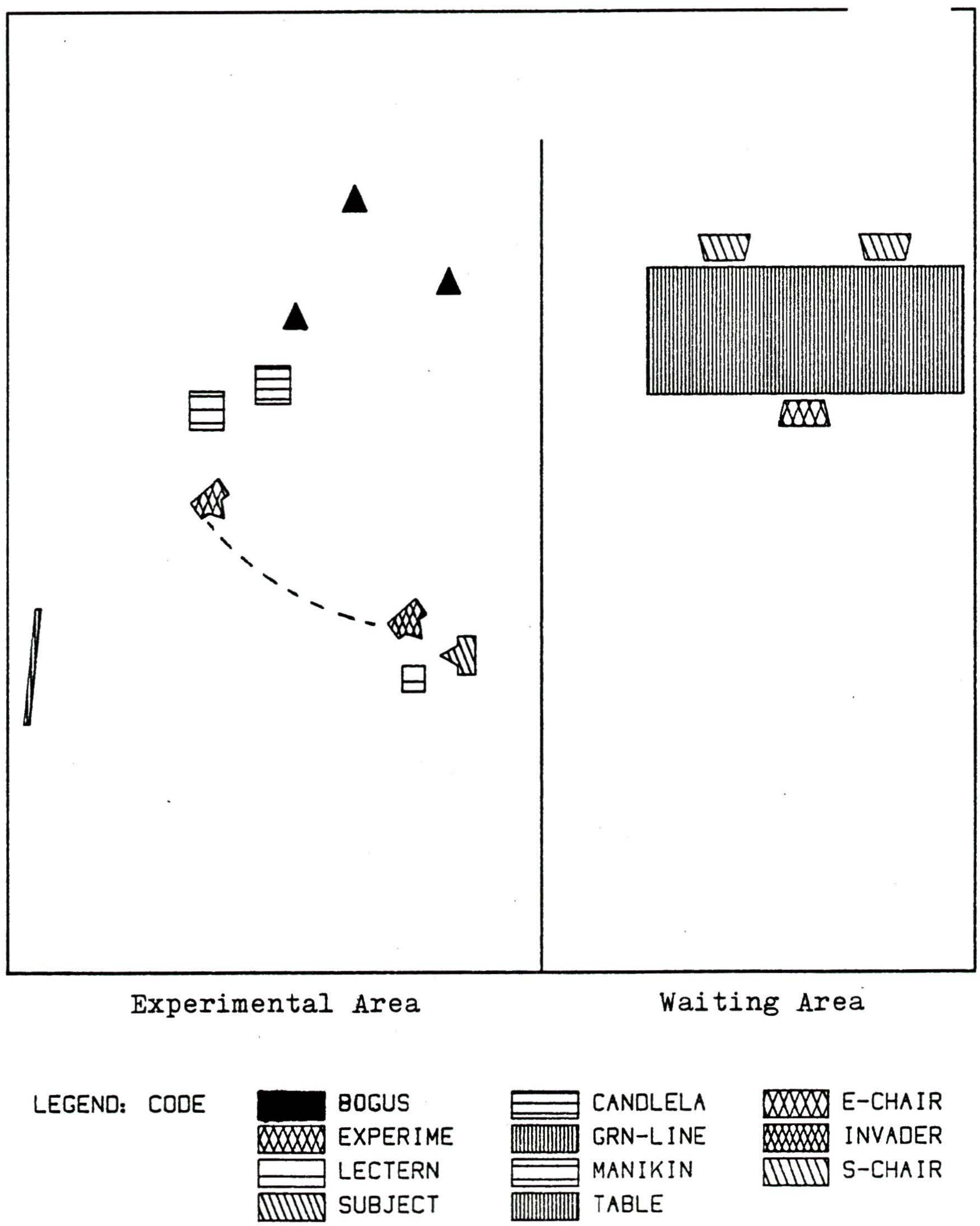
One hundred and twenty University of Victoria undergraduate students between the ages of 17 and 25 were recruited from a volunteer psychology subject pool. Subjects participated in same-sex pairs. Each was recruited individually, reducing the likelihood that they were previously acquainted. Only one pair of subjects (females) indicated that they knew each other.

Procedure and Materials

General Procedure. Each subject estimated the distance to 16 targets in two different conditions. In one condition, subjects participated singly (Alone) and in the other, the participation was in same-sex pairs (Crowded).

Setting. The experimental room was divided into two parts, using partitions; the waiting area (375 cm by 750 cm) and the estimation area(460 cm by 750 cm). (See Figure 1). In the waiting area, there was a long table. The experimenter's chair was facing the door. On the other side of the table, two chairs for the subject's were facing the experimenter. The rest of the area was empty. The distances between the chairs was 90 cm. In the estimation area, the 9-inch square floor tiles were covered by a uniform burgundy rug to reduce the availability of visual aids in estimating distances.

Targets. Targets fell into three categories: human, human-like and non-human. The human target (the experimenter) was a 29 year-old male graduate student. The human-like target was a life-sized manikin, which featured no gender characteristics, and was clothed in jeans, a shirt, a coat and a cap.



Note: The "Experimenter" becomes the "Invader".

Figure 1. Layout of both waiting area and experimental area, in the Alone condition.

Seven inanimate objects were used. They were; the manikin, two candelabra, a lectern, an easel, a floor lamp and a green tape. All of the standing objects had a small green tag placed on the front of the target at approximately chest level. The tag was to be used as the reference point for the estimating of distances. The distance to only three of these objects served as data. The focus of the present study was the estimation of interpersonal distance. The four bogus targets were a diversionary tactic, to reduce attention to interpersonal distance. The aim was for it to appear that the experimenter was standing in the vicinity of the (far) five targets for the task of clearly specifying the target for each estimation question. Thus, the subjects' perception would not be that the distance to the experimenter was the prime variable (as a social interaction variable) in this study. The study was to be viewed by the subject as a cognitive-processing study rather than a social-interaction study.

Two of the objects used as data were placed from 266 to 281 cm, (8 feet 9 inches to 9 feet 2.5 inches) to the subject. These objects were 1) a black and gold upright candelabrum containing candles with artificial flames, and 2) a life-sized manikin. The third inanimate target to serve as data was a lectern placed either 50.8 cm or 53.3 cm (20 inches or 21 inches) in front of a subject.

Three of the bogus targets were an easel, a floor lamp, and a black wrought iron candelabrum. All of these were between 170 to 180 cm tall, (5 feet 7 inches to 5 feet 11 inches). In addition to these three, another bogus target was used. A green tape, 91 by 5 cm (3 feet by 2 inches), was stuck to the floor. The center of the tape was marked with an X for use as a reference point. The distance between the subject and these four bogus targets ranged betweem 271 and 389 cm, (8 feet 11 inches and 12 feet 9 inches).

Test Distances. Each participant estimated 32 distances. Of these, ten distances were used to test the hypotheses. See Table 1 for a list of the abbreviations and their respective distances. Each subject was randomly assigned to first estimate 16 distances alone and then 16 distances in the company of a coworker or the reverse.

Subjects Location. There were two subject locations that were marked on the carpet by small chalk crescents indicating exactly where the toes of each shoe should be placed. Additional markings were used to reduce the likelihood of referring to previous estimations from the prior condition (Alone or Crowded condition), by fostering the belief that each subject was standing in a new location and, possibly, at a different distance from the targets.

Table 1: Distances, Estimation Order and Conditions in the Study.

Condition	Short Title	Order	Absolute Distances in cm for Subject A	B	mean
Alone					
Far					
-Experimenter	A-EXP	12	227.3	238.8	233.05
-Manikin	A-MAK	10	278.1	280.7	279.4
-Candle	A-CAN	7	271.8	266.7	269.25
Close					
-Invader	A-INV	16	48.3	48.3	48.3
-Lectern	A-LECT	15	53.3	50.8	52.05
Crowded					
Far					
-Experimenter	C-EXP	7	238.8	227.3	233.05
-Manikin	C-MAK	10	280.7	278.1	279.4
-Candle	C-CAN	3	266.7	271.8	269.25
Close					
-Invader	C-INV	15	45.7	50.8	48.25
-Other	C-OTH	14	39.4	39.4	39.4

Note: The "Experimenter" became the "Invader" by walking up to the subject.

The distance between the inside edges of each pair of toe placements was approximately 7.6 cm. The two subject locations were at 90 degrees to each other and 39.4 cm (15.5 inches) from subjective center to subjective center. A point 9.5 cm from an imaginary toe line and toward the subject roughly corresponded to the subjective center (i.e., the chest) of the subject and was used to measure the absolute distances. Each subject used one of these two locations in the Alone condition and the other in the Crowded condition. The distance between a subject's location and a target object was slightly different for each of the two locations. There were only two distances to any one target. See Figure 2 for a three dimensional figure of the distances between the subjects (in the Crowded condition) and three targets that were used as data.

Procedure. The experiment was described to each pair of participants while they were in the waiting area. They were told that the intent of the experiment was to measure the difference in cognitive performance in two situations involving the estimation of distances. No subject indicated any previous experience in estimating distances.

The subjects were told that they would each participate in two conditions, one alone and the other as a pair. They were told that in each condition, they would be asked to estimate sixteen distances.

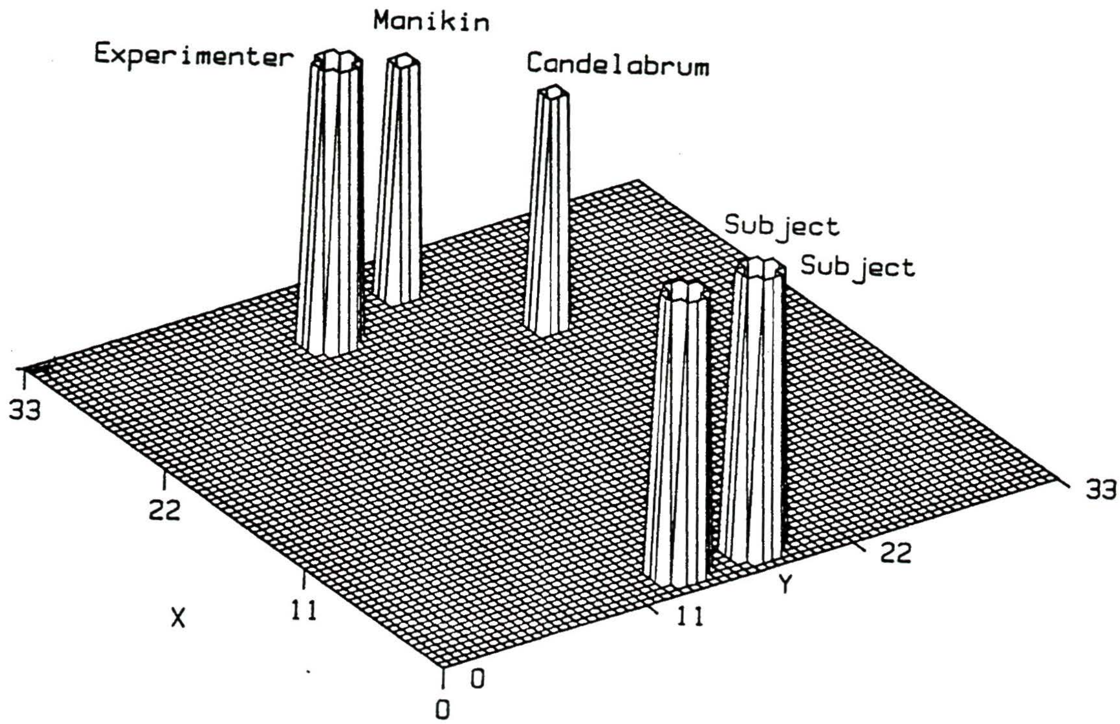


Figure 2. Layout of vital targets; in the Crowded condition with experimenter at a far distance.

Subjects were instructed to record their estimations in imperial or metric units, as they pleased. They were asked not to round off their estimations.

The first subject to participate in the Alone condition was chosen by the toss of a coin. The other subject was asked to complete a filler questionnaire. The experimenter then asked the first subject to accompany him to the estimation area. He instructed the subject to stand in one of two predetermined locations and to use the tags on each of the targets as reference points when estimating distances. Further explanations were given until the subject indicated understanding.

The 16 distances were estimated in the same predetermined order for all subjects. This predetermined order was different for the two conditions (Alone and Crowded). Within each sequence there were 11 filler estimations. It is assumed that subjects perceived all 16 estimations in each condition as pertinent data. The subjects recorded their estimations in a small ring binder provided to each of them. This was to reduce any feedback effect from the other subject or the experimenter.

In the Alone condition, for the first 15 estimations, the experimenter was standing a mean distance of 233.05 cm from the subject. Then for the last estimation, the experimenter walked toward the subject and stopped at a predetermined distance (mean = 48.3 cm) from the subject. The "Experimenter" became the "Invader". When the Alone estimations were completed, the subject was asked to accompany the experimenter back to the waiting area. After the other subject completed the questionnaire (if not already finished...and more than 90% were), the experimenter directed the first subject to begin the questionnaire. He then asked the second subject to accompany him to the estimation area, where the procedure used with the first subject was repeated.

Upon completion of their respective tasks, both subjects were asked to complete another 16 estimations in the Crowded condition. They were not informed that each of them was now in the spot previously occupied by the other. After the subjects completed the second sequence of 16 estimations, they were asked to accompany the experimenter back to the waiting area for an explanation of the experiment. They were thanked for their participation and were given a simple debriefing on an informal basis. In addition to repeating the information given at the beginning of the experiment the experimenter answered any questions the subjects had.

Results

Testing Sequence and Sex

In the design of this experiment, there were three between-subject factors (2 x 2 x 2) for which there were no hypotheses. One factor (Set) was the sequencing of the two conditions (Alone first or Crowded first). Another factor (Order) was the sequencing of the two subjects. The final factor (Sex) was the sex of the pair of subjects.

A 2 x 2 x 2 ANOVA was executed on the subjects' mean Estimation Error. Estimation Error (EE) is the percentage of the difference between the estimation distance (ED) and the absolute distance (AD), [(ED - AD) / AD] x 100. As expected, the three-way ANOVA showed no significant main effects or interactions at the .05 level. These results are presented in Table 2. EE was therefore pooled across these factors in subsequent analyses, since there were no significant differences associated with them. Table 3 presents the means and the confidence intervals for the EEs of the ten distance estimations. Figure 3 charts this data.

Table 2: Mean Estimated Error as a Function of Sex, Set and Order.

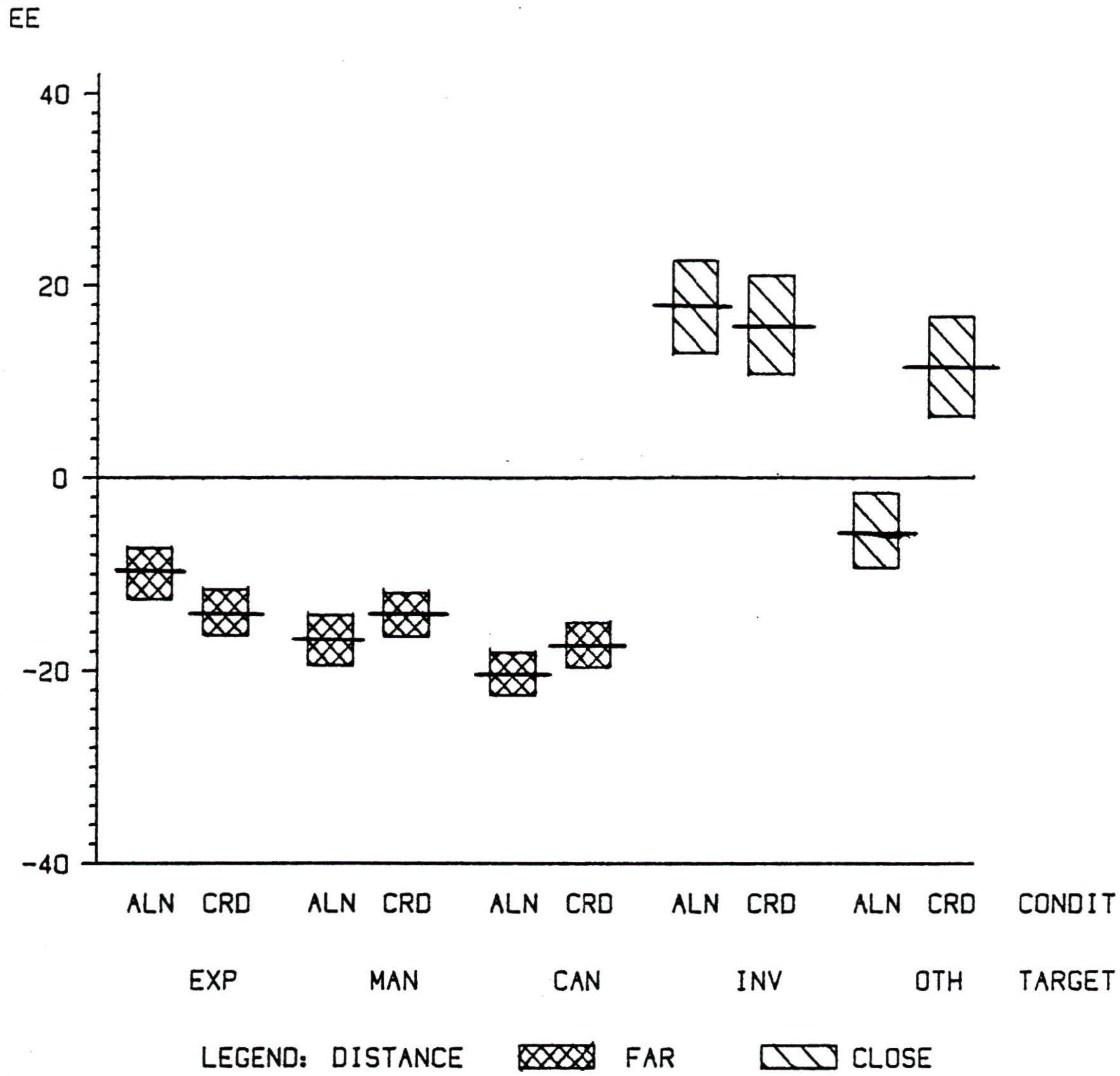
Source	df	MS	F	p<
Main effects				
Sex	1	358.2	2.67	0.11
Set	1	423.8	3.15	0.08
Order	1	181.1	1.35	0.25
2-way interactions				
Sex Set	1	503.8	3.75	0.06
Sex Order	1	0.8	0.01	0.94
Set Order	1	196.5	1.46	0.23
3-way interaction				
Sex Set Order	1	27.5	0.21	0.66
Residual	119	140.7		

Means for the main group effects.

Group	Variable	Mean EE (%)
Sex	Male	-3.56
	Female	-7.02
Set	Alone first	-3.41
	Crowded	-7.17
Order	First subject	-6.52
	Second	-4.06
Grand Mean		-5.29

Table 3: Means of EE for the Ten Distance Estimations.

Condition			Mean EE (%)	Confidence Interval (95%)
Alone				
	Far			
		Experimenter	-9.98	±2.65
		Manikin	-16.88	±2.59
		Candle	-20.39	±2.26
	Close			
		Invader	+17.81	±4.80
		Lectern	-5.47	±3.88
Crowded				
	Far			
		Experimenter	-14.00	±2.38
		Manikin	-14.24	±2.25
		Candle	-17.24	±2.32
	Close			
		Invader	+15.92	±5.10
		Other	+11.56	±5.20
		Grand Mean	-5.29	



ALN...ALONE CRD...CROWDED

TARGETS

EXP...EXPERIMENTER MAN...MANIKIN

CAN...CANDELABRUM INV...INVADER

OTH...(ALONE)...LECTERN OTH...(CROWDED)...COWORKER

Figure 3. Means for ten estimations and their confidence intervals at a 95% level.

A repeated-measures ANOVA with ten dependent variables and no groups was performed on the data. This analysis was needed to determine whether there were any significant differences which would justify the use of the planned orthogonal comparisons.

A significant difference among the dependent measures was found [$F(9, 1071) = 92.5$, $p < .001$]. These results are presented in Table 4. The planned orthogonal comparisons of the EE were required to determine which factors were contributing to the variance. The orthogonal comparisons were computed by calculating the Sum of Squares (SS) and dividing it by the Mean Square Error (MS) (Winer, 1971, p. 268-269). Table 5 presents the F values for these orthogonal comparisons.

The planned comparisons were the following. For target proximity, the means of A-EXP, C-EXP and A-CAN were compared with A-INV, C-INV and A-LECT. For the following two factors, there were two sets of comparisons for each factor, one for Far targets and one for Close targets. For crowdedness and Far targets, A-EXP, A-MAK and A-CAN were compared with C-EXP, C-MAK and C-CAN. For crowdedness and Close targets, A-INV was compared with C-INV. For humanness and Far targets, A-EXP and C-EXP was compared with A-MAK, C-MAK, A-CAN and C-CAN. For humanness and Close targets, C-OTH was compared with A-LECT.

Table 4: *ANOVA of EE with Ten Repeated Measures, No Groups.*

Source	Sum of Squares	*df*	*MS*	*F*	*p*<
EE	234031.20	9	26003.47	92.50	0.001
Residual	301068.25	1071	281.11		
Total	535099.45				

Table 5: Planned Orthogonal Comparisons.

Source		df	F	p <	Percent of Variance
Target Proximity		5	375.3	.001	19.7
Crowdedness					
	Far	5	0.22	n.s.	
	Close	1	0.76	n.s.	
Humanness					
	Far	5	23.05	.001	1.2
	Close	1	61.88	.001	3.3
2-way interactions					
	Proximity x Humanness	3	17.7	.001	0.9
	Proximity x Crowdedness	3	0.49	n.s.	
	Humanness x Crowdedness	3	5.50	.01	
Residual		1071			

Target Proximity

In the first orthogonal comparison, between EEs of Far targets and Close targets, the distances to Far targets were underestimated [mean EE= -14.79% ($\pm$2.03)] and the distances to the Close targets were overestimated [mean EE= +9.42 ($\pm$3.81)]. See Table 6 for of the means and confidence intervals obtained from the orthogonal comparisons.

The Sum of Squares (SS) was calculated by comparing the EEs for the Close targets (A-INV, C-INV and A-LECT) to the Far targets (A-EXP, C-EXP and A-CAN)

$$SS = ((72.63)^2 \times 120)/ 6 = 5275.12 \times 20$$

$$SS = 105502.40$$

$$F(5, 1071) = 105502.40 / 281.11 = 375.3 \ (p < .001).$$

The Percentage of Variance (PV) accounted for is calculated by dividing the sum of squares for Proximity by the total sum of squares (105502.40 / 535099.45). The PV for the Proximity orthogonal comparison is 19.7%. This massive difference is also evident in Figure 3. Because of this pronounced difference, the remaining orthogonal comparisons were computed for the data separated into Far and Close targets.

Table 6: Means of EE for Orthogonal Comparisons.

Hypothesis	Variable		mean EE	confidence interval (95%)
Target Proximity				
	Far		-14.79	±2.03
	Close		+9.42	±3.81
Crowdedness				
	Far			
		Alone	-15.75	±2.24
		Crowded	-15.16	±2.04
	Close			
		Alone	+17.81	±4.80
		Crowded	+15.92	±5.10
Humanness				
	Far			
		Human	-17.19	±2.02
		Inanimate	-11.99	±2.21
	Close			
		Human	+11.56	±5.20
		Inanimate	-5.47	±3.88

Crowdedness

The orthogonal comparisons of EE in which subjects were Alone versus the EE in which subjects were Crowded showed no significant differences. For distance estimations to Far targets, There was no significant difference [$F(5, 1071) = 0.22$, n.s.]. For distance estimations to Close targets, There was no significant difference [$F(1, 1071) = 0.76$, n.s.].

Humanness

For the distance estimations to Close targets, There was a significant difference [$F(1, 1071) = 61.88$, $p < .001$, PV = 3.3%]. For Close targets, the distance to an inanimate target was slightly underestimated [-5.47% ($\pm$3.88)], while the distance to a human target greatly overestimated [+11.56% ($\pm$5.20)].

For the distance estimations to Far targets, There was a significant difference [$F(5, 1071) = 23.1$, $p < .001$, PV = 1.2%]. For Far targets, distances to inanimate targets were underestimated to a greater degree then were distances to human targets [EE means, -17.19% ($\pm$2.02) versus -11.99% ($\pm$2.21) respectively].

Interactions

The 2-way interactions of these factors were analyzed. The higher-order interactions were not analyzed because of unrelability due to empty cells. The interaction between Target Proximity and Humanness was examined using the EEs of A-EXP (-9.98), A-INV (+17.81), A-CAN (-20.39) and A-LECT (-5.47). The interaction between these factors was significant [$F(1, 1071) = 17.7$, $p < .001$, PV = 0.9%].

The interaction between Proximity and Crowdness was examined using the EEs of A-EXP, A-INV, C-EXP and C-INV. The interaction between these factors was not significant [$F(1, 1071) = 0.49$, n.s.].

The interaction between Humanness and Crowdness was examined using the EEs of A-EXP (-9.98), A-CAN (-20.39), C-EXP (-14.00) AND C-CAN (-17.24). The interaction was marginally significant [$F(1, 1071) = 5.50$, $p < .01$, PV = 0.3%].

Discussion

The results indicate that estimation errors of distance are clearly affected by target proximity. Crowding the estimator appears not to affect estimation. The humanness of the target appears to affect distance estimation but there are some difficulties in interpreting this result. The following paragraphs discuss these results in greater detail.

Target Proximity

The first and primary hypothesis of the present study was that subjects' estimations of distances would be in error in certain circumstances. Overestimation of distances was expected if interpersonal distance was less than PID. Underestimation was expected if interpersonal distance was greater than PID.

The results are clearly supportive of Hypothesis 1 (see Figure 3). Subjects underestimated distances that were greater than the assumed PID (Preferred Interpersonal Distance). This occurred with both Human and Non-Human targets. They overestimated distances to Human targets that were less than the assumed PID. They did not overestimate the distance to the Non-Human Target (a lectern) which was less than PID. The factors affecting the perception of distance to inanimate targets will be discussed in more detail in the section pertinent to the humanness hypothesis.

The compensatory effects indicated by the results support Argyle and Dean's (1965) Affiliative-Conflict Theory. Compensation occurs when two people are interacting with one another, and one person perceives the physical distance to the other person not to be the interpersonal distance that he or she prefers (PID). Compensation functions to perceptually adjust the interpersonal distance to be closer to PID.

Research Design Differences: Ford's Studies. The results from the studies of Ford and his associates (Ford and Hoebeke, 1980; Ford, Knight and Cramer, 1977) showed that subjects underestimated distances that were uncomfortably close and overestimated distances that were uncomfortably far. It is proposed that the conflicting results can be attributed to the differences in research design. Ford and his associates directed the subjects from one testing area to another and asked them to replicate the interpersonal distance distance they had just perceived. They were asked to do this estimation by walking toward an inanimate object and stopping at the estimated distance. Thus, the estimations were of distances from the immediate past (memory). In the present study, the subjects were asked to estimate the distance they presently perceived (no memory). A subject's perception of an event from memory can be quite different from his or her perception during the event. This might be especially true if the event is unusual. Another difference in the experimental design is the manner of measurement. In the present study, estimations were written down and in Ford's two studies, they were replicated by the physical distance to a substitute target. Trying to replicate the closeness to a human by moving close to an inanimate object can account for the estimated distance being underestimated. A person can come much closer to an inanimate object than to a human before feeling too close. Alternatively, a person can withdraw much farther from an inanimate object than from a human before feeling of too distant.

Crowdedness

The prediction for Hypothesis 2 (crowdedness) was that whatever effect was obtained in the Alone Condition, it would be intensified in the analogous Crowded condition.

In order to relate the present study to Density-Intensity Theory, certain criteria are important for estimation of distances to the Close targets A-INV (Alone-close experimenter) and C-INV (Crowded-close experimenter). First, the interpersonal distance (for A-INV and C-INV, mean = 48 cm) used can be assumed to be uncomfortable (Hayduk, 1981), and noticeable. For this reason, interpersonal distance here is likely a prominent stimulus. Second, the density of people was increased from the A-INV condition (two people standing on one square meter) to the C-INV condition (three people standing on one square meter), thereby fulfilling the increase in density criterion.

The results were not supportive of Hypothesis 2. The estimation of distances was virtually the same regardless of whether the coworker was present or not. This was true for both Far targets and Close targets. An examination of the confidence intervals (See Table 6 and Figure 3) illustrates that virtually none of the subjects showed a reaction to the crowdedness factor.

Some relevant factors are not specified in Density-Intensity Theory. Except for the proposition that an increase in the density of people will intensify or magnify the effect of prominent stimuli, this theory does not specify any of the factors contributing to this process. It is not always true that increasing the density of people does intensify the effect of prominent stimuli, which in turn intensifies the prevalent behaviors. Two factors for which Density-Intensity Theory does not account are coping and attribution.

Coping. Why is there no difference between A-INV (Alone-close experimenter) and C-INV (Crowded-close experimenter)? Density-Intensity Theory does not specifically address the process of coping responses. Mere intensification of the prevalent behavior is a very passive form of coping. However, social interaction is not static or passive.

In both cases (A-INV and C-INV), a prominent stimulus is the uncomfortably close interpersonal distance the experimenter has just chosen. In both cases, the subject actively copes by perceptually placing the experimenter at a more comfortable distance. The interpersonal distance to the (inconsiderate?) experimenter was a prominent stimulus to the same degree, regardless of whether or not a coworker was standing very close to the subject. Thus, the sensation of close proximity to the experimenter (crowdedness) was no different in the two conditions (Alone, Crowded). The density of people was not the determining factor.

Attribution. Density-Intensity Theory does not include the factor of attribution. However, the perceived cause of another's behavior could be a determining factor in one's responses during social interaction. As Heider (1958) reasoned, a person judges the underlying cause of other people's behavior in one's attempt to have a coherent view of one's environment. The attributed causal factors of behavior can be either internal (within the other person) or external (environment). The relative importance of internal versus external factors contributes to the attribution of responsibility in the person's behavior.

Causal attributions play a major role in the decision making process of how to react to another person (Peplau, Russell and Hiem, 1979; and Weiner and Peter, 1973). Carroll and Payne (1976; 1977) investigated the parole decision process within the American criminal justice system. Their studies showed that causal attributions influence the parole decision. For example, if the cause of a crime is judged to be stable, internal and/or intentional (e.g., hardened criminal), the criminal is less likely to be paroled. On the other hand, if the cause of the crime is judged to be more external (e.g., provoked by new economic conditions) then there is a greater probability for parole to be granted.

A post-hoc analysis of the data permits examination of the question of causal attriution. In the present study, both participants have been assigned the submissive role of "subject" and may attribute both their own and their coworker's behavior to external factors (e.g., instructions). At the same time, the participants may have attributed the experimenter's behavior to internal factors (e.g., his own intentions).

The distances A-INV (Alone-close experimenter) and C-OTH (Crowded-close coworker) are similar. Both distances are assumed to be less than PID. In both cases, at the time of the estimation, there is only one person who is closer to the subject than PID.

Subjects overestimated slightly more when estimating the distance to the experimenter (A-INV), than when estimating the distance to the coworker (C-OTH). The mean EE for the intentional invader (A-INV) was +17.81% ($\pm$4.80), while for the instructed invader (C-OTH) it was +11.56% ($\pm$5.20). A-INV (Alone-close experimenter) was overestimated significantly more than C-OTH (Crowded-close coworker) [$F(1, 1071) = 8.03$, $p < .01$]. Even though the differences are small, the results do suggest that when uncomfortably close proximity is due to external variables (e.g., instructions) the attempt to compensate will be less, than when it is due to internal variables (e.g., personal intentions).

Density-Intensity Theory has not been supported, although there are some explanations that a defendant of Density-Intensity Theory might propose. Interpersonal distance may not have been a prominent stimulus. Even if the experimenter had just walked on his own accord, to a distance less than 53 cm (21 inches) to the participant, the interpersonal distance is not necessarily the participant's prominent stimulus. While this may be true, there is no other prominent stimulus that is intuitively apparent, and Density-Intensity Theory gives no specifications on how to identify a prominent stimulus.

The marginally significant results relevant to attribution have some bearing on the interpretation of Hypothesis 2 (Crowding). The predictions of Density-Intensity Theory are restricted to situations where the increasing the number of people involves people similar along a prominent dimension. Thus, strictly speaking, Density-Intensity Theory is not applicable (experimenter and coworker's intentions are judged differently). If this argument is made, then Density-Intensity Theory has very limited scope.

Humanness

The prediction of Hypothesis 3 (humanness) was that estimations of distances to inanimate targets would be less erroneous than estimations to human targets. The results for Close targets support Hypothesis 3. The results for Far targets were in the opposite direction. Hypothesis 3 is therefore supported for distances less than PID but not for distances beyond PID.

For close targets, subjects overestimated the distance to a human target more than the distance to an inanimate target. The data pertinent to the humanness hypothesis (in reference to close targets) comes from the comparison between the EE means for the C-OTH (Crowded-close coworker) and A-LECT (Alone-close object) targets. The EE for the distance to the Close Human (C-OTH) was +11.7% (or 4.5 cm). The estimation of the distance to the close object (A-LECT) should not be influenced in any significant way by outside factors. Thus, the estimation was expected to be fairly accurate, which it was. The EE for A-LECT was -5.47% (or 2.6 cm). In support of Hypothesis 3, a participant's accuracy in perceiving a distance was affected when the target was human and closer than PID, but not when the target was inanimate and closer than PID.

This hypothesis was not confirmed for distances beyond PID. The results show that the distance to an inanimate target was significantly more underestimated than the distance to a human target (see also Table 6 and Figure 3). To obtain some explanation for these conflicting results, some visual perception theories were reviewed. An intervening variable that was not accounted for in the design of the study was general perceptual adjustment. Helson's (1947, 1964) Adaptation-Level Theory is one of several theories of perception that postulate the functioning of perception not to be static, but mutable.

Adaptation-Level Theory. Helson (1947,1964) proposed that a perceiver adapts to a changing environment. Each perceiver evolves a reference or adaptation level against which comparable stimuli are judged. An adaptation level results from the pooled effects (interactions) of three classes of stimuli: (a) focal stimuli, (b) background stimuli and (c) residual stimuli. Perception is determined by the pooled effect of the stimulus set.

Focal stimuli are those which are central to the perceiver's attention. Background stimuli form the context in which the focal stimuli are perceived. Residual stimuli are not present, but have been experienced by the perceiver. The residual stimuli constitute a perceptual norm.

A background stimulus may be used by a perceiver as a standard stimulus against which a focal stimulus is compared. In this instance, it is called an anchor stimulus. If, in a series of stimuli, one stimulus is emphasized, then it will be dominant. The dominant stimulus is the anchor stimulus. The relevance of the anchor stimulus depends on its similarity or nearness along one or more dimensions to the focal stimuli. Any characteristic of the anchor stimulus that accentuates a characteristic of the focal stimuli will tend to increase the power of the anchor stimulus in the pooling process. This in turn modifies the norms for judging the focal stimuli (Avant and Helson, 1973).

Adaptation-Level Theory postulates that perception is not determined by absolute physical properties, but rather by the relationship between stimuli. Changes in perception can be evoked by modifying the accompanying background stimuli, or may result from different prior experiences.

Bevan, Maier and Helson (1963) demonstrated the effect of background stimuli in asking subjects to estimate the number of beans in a jar. When subjects judged the beans and the jar as one organic unit, the size of the jar was part of the array of focal stimuli. In this condition, the larger the jar, the higher was the estimate of the number of beans in the jar. This effect was minimized when the subjects were instructed to judge the jar only as a container and thus unrelated to the number of beans in the jar. The more the background stimuli are perceived to be related to the focal stimuli, the more modification of the background stimuli will evoke changes in the perception of the focal stimuli.

Avant and Bevan (1971) describe an exploratory study of Adaptation-Level Theory on the dimension of distance. The close-far dimension involved a game of tossing bean bags at a target. Each subject pitched a bean bag for ten pre-test trials and then, without forewarning, pitched for two test trials. There were three groups of subjects. Each group had the same target distance (609.6 cm) for the two test trials. However, each group had a different target distance for the ten pre-test trials. These distances were either 304.8, 609.6, or 914.4 cm (i.e. 10, 20, or 30 feet).

In the test trials, if the target was a greater distance away than the anchor stimulus, the distance was undershot (underestimated) in comparison to the subjects whose test target was the same as the anchor stimulus. If the test target was closer than the anchor stimulus, the subject (in comparison to the control subjects) overshot (overestimated) the distance.

Adaptation-Level Theory may be applicable to the estimation of absolute distances. In the present study, it is assumed that the distance between humans will be a dominant stimulus, particularly when the distance is distinctly different from the perceptual norm (i.e., PID). When the interpersonal distance is equal to PID, there is no disequilibrium (Argyle and Dean, 1965) and thus, it would not be a prominent stimulus (anchor stimulus). Any shift from the perceptual norm may also affect the estimation of distances to inanimate objects. The relevance of interpersonal distance as an anchor stimulus depends on its nearness or similarity to the other distances being estimated. The more similar in distance the anchor stimulus (distance to experimenter) is to the focal stimulus (present target distance) the more the anchor stimulus will affect the estimation of the target distance.

The argument above can explain the results which did not support Hypothesis 3 (humanness - Far). The results were as follows. The mean of the absolute distances to a Far human target was 233.1 cm and the EE was -12.0% or 28.0 cm. The mean of the absolute distances to a Far semi-human target (a manikin) was 279.4 cm and the EE was -15.6% (or 43.6 cm). The mean of the absolute distances to a Far inanimate target (candelabrum) was 269.3 cm and the EE was

-18.8% (or 50.6 cm). Both the manikin and the candelabrum distances were underestimated more than was the Far human target distance. The candelabrum distance was closer to the Far human target distance than was the manikin distance. The candelabrum distance was underestimated more than the manikin distance. Thus, the distance that was most similar to the anchor stimulus (distance to experimenter) was the distance to the candelabrum and it was underestimated more than the distance to the manikin.

In turn, the same argument can explain the results that supported Hypothesis 3 (humanness, Close targets), in that the estimations of the distance to the inanimate target was the most accurate of all the estimations. If the interpersonal distance (to A-EXP) was the anchor stimulus, then the estimation of distance to the close inanimate object (A-LECT) should have a greater EE as the degree of similarity between the two distances (A-EXP and A-LECT) increases. Because of the large difference in distance between A-LECT and A-EXP, the effect of the anchor stimulus would be slight. Thus, the estimation of the distance to A-LECT should be close to being accurate. The EE was -5.47%.

<u>Interaction Effects</u>

The results pertinent to Hypothesis 3 as discussed above are reaffirmed in the interaction effect between target proximity and humanness. See also Table 6 and Figure 3. The EE means used in this interaction comparison was A-EXP (-9.98), A-INV (+17.81), A-CAN (-20.39) AND A-LECT (-5.47). There is an interaction effect because the difference for the human targets between Far and Close distances (-9.98 - 17.81 = 27.79) is greater than the difference for inanimate targets (20.39 - 5.47 = 14.92). While an interaction effect was predicted by Hypothesis 3, the effect was predicted to be greater. Specifically, the difference for the inanimate targets between the Far and Close distances should have been much less (i.e., both were predicted to be accurate). Adaptation-Level Theory gives a tenable explanation to these unpredicted results without detracting from the general applicability of Affiliative-Conflict Theory.

The marginally significant difference in the interaction effect between humanness and crowdedness is more difficult to interpret. Because this study included no close inanimate targets in the crowded condition, only EEs for Far distances were used for the comparison (A-EXP, A-CAN, C-EXP AND C-CAN). However, in reference to this comparison, what might be occurring is that crowdedness may have had the effect of slightly diminishing the anchoring effect of the

Far Human target. A reason for this could be that the distance to the Far Human was not the only reference distance that had some of the subject's attention, when in the Crowded condition. Possibly, this other reference distance was the distance to the close coworker (C-OTH). At the time of the estimation of the distance to the candelabrum (C-CAN), the experimenter was inappropriately far, while the coworker was inappropriately close.

In summary, the interpretation of the results pertinent to hypotheses concerning humanness is not clear. A possibly tenable statement is that the distance to an inanimate object that is closer than PID will not likely be overestimated when there is no similar comparison distance to a human. However, if a human is closer than PID, it is extremely likely that the distance to this human will be overestimated. It may be that while the compensating effect will cognitively move the invading human closer to the vicitim's PID, there is the absence of discomfort when only an inanimate object is closer than PID, and thus, compensation is not applied.

Returning to the discussion on target proximity, for the moment, it is again proposed that Argyle and Dean's (1965) Affiliative-Conflict Theory is supported. In this study, the inaccuracy of the estimations of all the interpersonal distances (A-EXP, C-EXP, A-INV, C-INV AND C-OTH) implied compensation for the absolute distance not equaling PID. It is proposed that this compensatory effect does not occur with the inanimate objects per se. The inaccuracy in the estimation of distances to inanimate objects is directly affected by the estimation of the interpersonal distances and in particular, the effect is dependent on how similar the distance to the inanimate object is to the interpersonal distance.

Research Proposals

The present study has demonstrated that the compensatory effects predicted by Argyle and Dean's (1965) Affiliative-Conflict Theory also apply to perceptual-cognitive behaviors. Specifically, we predict that a participant who is estimating an interpersonal distance will underestimate the distance if the other person (i.e., the target) is farther than PID. On the other hand, if the other person is closer than PID, then the distance will be overestimated. Some questions have become more defined. Three of these questions concern: (a) a possible linear relationship between the absolute distance and the compensation effect, (b) Adaption-Level Theory's explanation of the effect on inanimate targets and (c) the effect of causal attribution on a crowdedness effect.

The first question of future interest is whether there is a linear relationship is between absolute distance and compensation. Within a certain range of distances, there should be a steadily increasing compensatory effect as the difference between PID and the absolute distance increases (in both directions). The design of the experiment could be very simple. Each subject would estimate only one distance ranging from 30 to 500 cm. If compensation for discrepancy between PID and absolute distance is the only determining factor in estimation error then the results should show a linear relationship. See Table 7 for the predicted results, based on Adaptation-Level Theory.

It seems likely that the increase in compensation is limited to a specifiable range of distances (perhaps between 30 to 500 cm). Once the discrepancy between the distance to be estimated and PID is quite noticeable, compensatory effects may cease, or even reverse.

Assuming that the above general prediction (linear relationship) is essentially supported, then subsequent research could reduce the number of test distances (e.g., 50, 100, 180, 300 and 400 cm). If the predictions are supported, then Affiliative-Conflict Theory would be further supported.

Table 7: Predicted Estimated Error for Interpersonal Distances.

Distance (cm)	Estimated Error (%)
30	(+ 25% or + 10%)
45	+ 20
75	+ 18
100	+ 10
125	+ 8
150	0
180	0
210	0
260	- 10
320	- 15
400	- 20
500	(- 25% or - 10%)

Note: It is unclear at what distance estimation accuracy will begin to return.

Another proposal for further research examines factors which might affect the estimation of distances to inanimate targets. Based on Adaptation-Level Theory, it is predicted that estimation would be most affected when the distances to the inanimate target and the human are similar. This relationship should be more pronounced when the distance to the human is more prominent (e.g., when it is not equal to PID). The converse is not true. That is, it is predicted that estimation to a human target will not be affected by changes in distance to an inanimate target. The determining factor is the difference between the distance to the human and PID. A research design that would further investigate this, would be a 4 x 4 between-subject factors design with 2 within-subject variables, where the between-subject factors would be distances to human and inanimate targets. The within-subject variables would be the estimation of the distance to one human target and to one inanimate target. The human target would be at one of the following distances: 50, 100, 180 and 300 cm. The inanimate target would likewise be at one of those distances. If the distance to the human target is an anchor stimulus (particularly if at a distance not equal to PID), then as predicted by Helson's (1964) Adaptation-Level Theory, it would affect estimations to similar distances. In turn, the more similar the distance to the inanimate target is to the anchor stimulus then the greater the Estimated Error (EE) for the inanimate targets.

Regardless of where the inanimate target is placed, the estimation errors of interpersonal distances should be as follows: (a) 50 cm should be overestimated, (b) 100 cm should also be overestimated, (c) 180 cm should be close to being accurate and (d) 300 cm should be underestimated. Also, the interpersonal distance of 50 cm should be overestimated more than the interpersonal distance of 100 cm. See Table 8 for the predicted results.

Another direction for research would be to examine crowdedness and attribution. Assuming it is confirmed that when interpersonal distance is greater than PID subjects will underestimate, and when the interpersonal distance is less than PID subjects will overestimate, then the difference between the relationship of Self to Coworker and the relationship of Self to Experimenter would be a measure of attribution of the cause of the interpersonal distance. It is predicted that greater compensation would occur when the targets are "experimenters" than when they are "coworkers". Also, compensation would be greater when the number of "experimenters" rather than the number of "coworkers" is increased.

Table 8: Predicted EE for Human and Inanimate Targets.

Human		Inanimate	
distance	estimation error (%)	distance	estimation error (%)
50	+20	50	+20 + 0 = +20
	same	100	+20 - 10 = +10
	same	180	0 + 0 = 0
	same	300	0 + 0 = 0
100	+10	50	+10 + 10 = +20
	same	100	+10 + 0 = +10
	same	180	+10 - 5 = + 5
	same	300	0 + 0 = 0
180	0	50	0 + 0 = 0
	same	100	0 + 10 = +10
	same	180	0 + 0 = 0
	same	300	0 - 5 = - 5
300	-10	50	0 + 0 = 0
	same	100	0 + 0 = 0
	same	180	-10 + 5 = - 5
	same	300	-10 + 0 = -10

In the proposed design, the subject would be in close proximity to either two or three other people. The number of "Coworkers" and "Experimenters" would each vary independently from zero to three. The test distance (between 45 and 53 cm) would be less than PID. The "Self" (subject) would estimate only two distances, and would be in one of the following seven conditions involving: a) 1 Experimenter (E) and 1 Coworker (C), b) 2 E, c) 2 C, d) 2 E & 1 C, e) 2 C & 1 E, f) 3 E and g) 3 C. This design would at the same time further test Freedman's (1975) Density-Intensity Theory.

Summary

The present study supports and extends Affiliative-Conflict Theory. Compensatory behavior was very apparent in a non-intimacy behavior, distance perception. Subjects clearly overestimated the distances to people who were uncomfortably close and underestimated the distances to people who were uncomfortably far. The unpredicted results that estimation errors were higher for far inanimate targets than the estimation errors for far human targets were not explainable by Affiliative-Conflict Theory. Adaptation-Level Theory offers a possible explanation for this effect.

References

Altman, I., & Vinsel, A. Personal space: An analysis of E. T. Hall's proxemics framework. In I. Altman & J. F. Wohlwill (Eds.), Human Behavior and Environment (Vol. 2). New York: Plenum Press, 1977.

Argyle, I., & Dean, J. Eye contact, distance and affiliation. Sociometry, 1965, 28, 289-304.

Avant, L. L., & Bevan, W. Adaptation level and visual space perception. In M. H. Appley (Ed.), Adaptation-Level Theory. New York: Academic Press, 1971.

Avant, L. L., & Helson, H. Theories of perception. In B. B. Wolman (Ed.), Handbook of General Psychology. Englewood Cliffs: Prentice-Hall, 1973

Baird, J. W. The influence of accommodation and convergengnce upon perception of depth. American Journal of Psychology, 1903, 14, 150-200.

Barefoot, J. C., Hoople, H., & McClay, D. Avoidance of an act which would violate personal space. Psychonomic Science, 1972, 28, 205-206.

Baum, A., & Greenberg, C. I. Waiting for a crowd: The behavioral and perceptual effects of anticipated crowding. Journal of Personality and Social Psychology, 1975, 32, 671-679.

Baum, A., & Koman, S. K. Differential response to anticipated crowding: Psychological effects of social and spatial density. Journal of Personality and Social Psychology, 1976, 34, 526-536.

Baum, A., Riess, M., & O'Hara, J. Architectual variants of reactions to spatial invasion. Environment and Behavior, 1974, 6, 91-100.

Baum, A., & Valins, S. Architecture and Social Behavior: Psychological Studies in Social Denisty. Hillsdale: Lawrence Erlbaum Assocites, 1977.

Becker, F. D., & Mayo, C. Delineating personal distance and territoriality. Environment and Behavior, 1971, 3, 375-381.

Beloff, H., & Coupar, S. Some transactional perceptions of African faces. British Journal of Social and Clinical Psychology, 1968, 7, 169-175.

Beloff, J., & Beloff, H. The influence of valence on distance judgements of human faces. Journal of Abnormal and Social Psychology, 1961, 62, 720-722.

Bevan, W., Maier, R. A., & Helson, H. The influence of context upon the estimation of number. American Journal of Psychology, 1963, 76, 464-469.

Brunswick, E. Representative design and probabilistic theory in fuctional psychology. Psychological Review, 1955, 62, 193-217.

Cadwallader, M. T. Methodological examinatiopn of cognitive distance. In W. F. E. Preiser, (Ed.), Environmental Design Research (Vol. 2). Stroudsburg: Dowden, Hutchinson and Ross Inc., 1973, 193-199.

Carroll, J. S. & Payne, J. W. The psychology of the parole decision process: A joint application of attribution theory and information processing psychology. In J. S. Carroll & J. W. Payne (Eds.) Cognition and Social Behavior. Hillsdale: Lawrence Erlbaum Associates, 1976.

Carroll, J. S. and Payne, J. W. Judgements about crime and the criminal: A model and a method for investigating parole decision. In B. D. Sales (Ed.), Prospectives in Law and Psychology: Vol 1, The Criminal Justice System. New York: Plenum, 1977.

Cohen, S. Environmental load and the allocation of attention. In A. Baum & S. Valins (Eds.), *Advances in Environmental Psychology*. Hillsdale: Lawrence Erlbaum Associates, 1978.

Coutts, L. M., & Ledden, M. Nonverbal compensatory reactions to changes in interpersonal proximity. *Journal of Social Psychology*, 1977, *102*, 283-290.

Dannenmaier, W. D., & Thumin, Authority status as a factor in perceptual distortion of size. *Journal of Social Psychology*, 1964, *63*, 361-365.

Dinges, N. G., & Oetting, E. R. Interaction distance anxiety in the counseling dyad. *Journal of Counseling Psychology*, 1972, *19*, 146-149.

Efran, M. G., & Cheyne, J. A. Affective concomitants of the invasion of shared space: Behavioral, physiological and verbal indications. *Journal of Personality and Social Psychology*, 1974, *29*, 219-226.

Epstein, Y. M., & Karlin, R. A. Effects of acute experimental crowding. *Journal of Applied Social Psychology*, 1975, *5*, 34-53.

Ford, J. G., & Hoebeke, S. Distant interpersonal spacing and psychological distance. *Psychological Reports*, 1980, *46*, 1299-1303.

Ford, J. G., Knight, M., & Cramer, R. The phenomenological experience of interpersonal spacing. *Sociometry*, 1977, *40*, 387-396.

Freedman, J.L. *Crowding and Human Behavior*. San Francisco: Freeman, 1975.

Gifford, R. The experience of personal space: Perception of interpersonal distance. *Journal of Nonverbal Behavior*, 1983, *7*, 170-178.

Gogel, W. C. Scalar perceptions with binocular cues of distances. *American Journal of Psychology*, 1972, *85*, 477-497.

Haase, R. F. Relationship of sex and instructional set to the regulation of interpersonal interaction distance in a counseling analogue. *Journal of Counseling Psychology*, 1970, *17*, 233-236.

Haase, R. F., & Pepper, D. T., Jr. Nonverbal components of emphatic communication. *Journal of Counseling Psychology*, 1972, *19*, 417-424.

Hall, E. T. A system for the notation of proxemic behavior. *American Anthropologist*, 1963, *65*, 1003-1026.

Hall, E. T. The Hidden Dimension. Garden City: Doubleday, 1966.

Hayduk, L. A. The permeability of personal space. Canadian Journal of Behavioral Science, 1981, 13, 274-287.

Heider, F. The Psychology of Interpersonal Relations. New York: Wiley, 1958.

Helson, H. Adaption level as frame of reference for prediction of psychophysical data. American Journal of Psychology, 1947, 60, 1-29.

Helson, H. Adaptation-Level Theory: An Experimental and Systematic Approach to Behavior. New York: Harper, 1964.

Hensley, W. E., & Angoli, M. Message valence, familiarity, sex and personality effects on perceptual distortion of hieght. Journal of Psychology, 1980, 104, 149-156.

Hester, G. A. Effects of active movement on body-part estimates. Perceptual and Motor Skills, 1970, 30, 607-613.

Howard, R. B., Chase, S. D. & Rothman, M. An analysis of four measures of cognitive maps. In W. F. E. Preiser, (Ed.), Environmental Design Research (Vol. 1). Stroudsburg: Dowden, Hutchinson and Ross Inc., 1973, 254-264.

Ittelson, W. H. The Ames Demonstrations in Perception. Princeton: Princeton University Press, 1952.

Johnson, C. F., & Dabbs, J. M., Jr. Self-disclosure in dyads as a function of distance and the subject-experimenter relationship. Sociometry, 1976, 39, 257-263.

Kendon, A. Some functions of gaze direction in social interaction. ACTA Psycholoica, 1967, 26, 22-63.

Knowles, E. S. Boundaaries around social space: Dyadic responses to an invader. Environment and Behavior, 1972, 4, 437-445.

Koff, E., & Kiekhofer, M. Body-part size estimation in children. Perceptual and Motor Skills, 1978, 47, 1047-1050.

Koulack, D., & Tuthill, J. A. Hieght perception: a function of social distance. Canadian Journal of Behavioural Science, 1972, 4, 50-53.

Luft, J. On nonverbal interaction. Journal of Psychology, 1966, 63, 261-268.

Mathews, K. E., & Canon, L. K. Environmental noise level as a determinant of helping behavior. Journal of Personality and Social Psychology, 1975, 35, 571-577.

McDowell, K. V. Violations of personal space. Canadian Journal of Behavioral Science, 1972, 4, 210-217.

Middlemist, R. D., Knowles, E. S., & Matter, C. F. Personal space invasions in the lavatory: Suggestive evidence for arousal. Journal of Personality and Social Psychology, 1976, 33, 541-546.

Milgram, S. The experience of living in cities. Science, 1970, 167, 1461-1468.

Nisbitt, P. D., & Steven, G. Personal space and stimulus intensity at a Southern California Amusement Park. Sociometry, 1974, 37, 105-115.

Patterson, M. L. Compensation in nonverbal immediacy behaviors: A review. Sociometry, 1973, 36, 237-252.

Patterson, M. L. Interpersonal distance, affect, and equilibrium theory. Journal of Social Psychology, 1977, 101, 205-214.

Peplau, L. A., Russel, D. & Heim, M. The experience of loneliness. In I. H. Frieze, D. Bar-Tal & J. S. Carroll (Eds.). *New Approaches to Social Problems: Applications of Attribution Theory*. San Francisco: Jossey-Boss, 1979.

Saegert, S. High density environments: Their personal and social consequences. In A. Baum & Y. Epstein (Eds.), *Human Responses to Crowding*. Hillsdale: Lawrence Erlbaum Associates, 1978.

Schachter, S. *The Psychology of Affiliation*. Stanford: Standford University Press, 1959.

Shontz, E. C., & McNish, R. D. The human body as stimulus object: Estimates of distances between body landmarks. *Journal of Experimental Psychology*, 1972, *95*, 20-24.

Sommer, R. Small group ecology. *Psychological Bulletin*, 1967, *67*, 145-152.

Sundstrom, E. An experimental study of crowding: Effects of room size, intrusion and goal blocking on nonverbal behavior, self-disclosure and self-reported stress. *Journal of Personality and Social Psychology*, 1975, ~~35~~ 32, 645-654.

Sundstrom, E., & Altman, I. Interpersonal relationships and personal space: Research review and theortical model. Human Ecology, 1976, 4, 47-67.

Valins, S., & Baum, A. Residential group size, social interaction, and crowding. Environmental and Behavior, 1973, 5, 421-439.

Weiner, B. & Peter, N. A cognitive-development analysis of achievement and moral judgements. Developmental Psychology, 1973, 9, 290-309

Wilson, P. R. Perceptual distortion of hieght as a function of ascribed academic status. Journal of Social Psychology, 1968, 74, 103-110.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1971.

Worchel, S., & Teddlie, C. The experience of crowding: A two-factor theory. Journal of Personality and Social Psychology, 1976, 34, 30-40.

Worchel, S., & Yohai, S. M. L. The role of attribution in the experience of crowding. Journal of Experimental Social Psychology, 1979, 15, 91-104.

VITA

Surname: GALLAGHER   Given Names: TIMOTHY MICHAEL BOEHLER

Place of Birth: EDMONTON,   CANADA

Date of Birth: October 8,   1951

Educational Institutions Attended:

MCGILL UNIVERSITY, MONTREAL	1975 to 1979
UNIVERSITY OF VICTORIA, B.C.	1979 to 1985

Degrees Awarded:

B.A. (HONORS)	1979	MCGILL UNIVERSITY, MONTREAL

PARTIAL COPYRIGHT LICENSE

I hereby grant the right to lend my thesis (the title of which is shown below) to users of the University of Victoria Library, and to make single copies only for such users or in response to a request from the Library of any other university, or similar institution, on its behalf or for one of its users. I further agree that permission for extensive copying of this thesis for scholarly may be granted by me or a member of the University designated by me. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Title of Thesis

DISTANCE ESTIMATION AS A FACTOR OF THE PROXIMITY AND HUMANNESS OF THE TARGET

Author [redacted]

TIMOTHY MICHAEL BOEHLER GALLAGHER

March 14, 1985