PERSONAL CONTROL OF DISCOMFORT GLARE

by

ANIL ANAND

Bachelor of Engineering (Mechanical),
Gauhati University, Gauhati, India, 1977

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Industrial Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1983

Approved by:

Major Professor

To my father, mother and brothers, Ashok and Prem

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Dr. Corwin A. Bennett for his advice, encouragement and guidance which was extremely helpful for this study.

The author also wishes to express his thanks to Mr. S. A. Samaranyake of the Statistics Department at Kansas State University for his help in analyzing the data.

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Light is the form of energy that permits one to see. Both quality and quantity of light must be appropriate for good vision. If the luminance of light is too high for the human eye to adapt to, then the source of light is a glare source. The two undesirable effects of glare are disability and discomfort. They might not occur at the same time. Disability glare reduces the visual efficiency, whereas in discomfort glare, there is no necessary direct interference with vision; but there is annoyance, irritation or distraction. For most interior lighting, the complaint is discomfort rather than disability. If illumination close to the line of sight were increased, then disability effects might occur also.

When the glare produced is directly from the glare source, it is known as direct glare; whereas the glare produced by reflection of a light source is called reflected glare or veiling reflection.

In a typical North American glare experiment, the observer sits with his face in a face rest (to maintain distance and angular size and position values) with the glare source(s) either on or above his line of sight. The subject adjusts a transformer which controls the glare source luminance. He adjusts to a given criterion, such as the "borderline between comfort and discomfort (BCD)". BCD is the response criterion used in most North American discomfort glare research.

This BCD value varies widely from observer to observer. This variation is slightly related to the observer's age, eye color, and other undiscovered factors (Bennett, 1977). Considerable variation exists even within observations by the same observer over a period of time (Bennett, el. al., 1982).

Research related to the application of dis comfort glare to roadway lighting has been done at Kansas State University. Bennett (1977), has determined a relationship between BCD as a function of A, the source angle

in degrees above the line of sight, the background illuminance, L_B (fL), and S, the source size in steradians:

$$BCD = \frac{40(L_B)0.3 \exp(.05A)}{S.06}.$$

Alphin (1961) reported that there was no relation between age and the brightness chosen for BCD. Neither eye color nor the wearing of glasses showed any correlation with the brightness selected for BCD. Bennett (1977) conducted a correlation study between discomfort glare judgments (BCD's) and age, eye color, occupation, sex, population, place of residence, hair color, and wearing of glasses; he found some correlation between BCD and age, eye color, and occupation. Age was negatively correlated with BCD; brown eyed observers, and those with outdoor occupations tolerated higher luminances.

To minimize discomfort from glare, physical control is achieved by providing shielding around the light to avoid direct viewing of the light by the eye. Also, in street lighting, the light source is placed at a high level to be avove the line of sight. Sunglasses are used. In this study another way of getting control of discomfort glare, personal control, is to be studied.

Personal Control

There is a demand from various quarters today for more personal control. For example, students complain that they should have more control over the University's decision process, and persons in poverty complain that they have little control over economic schemes of the government. Though these complaints may have considerable merit, it is not clear what is meant by "personal control". Control has been defined as a belief that one has at one's disposal a response that can influence the aversiveness of an event.

Among psychologists, too, there is a tendency to assume that personal control has a beneficent or stress-reducing effect. They claim that lack of control is a necessary if not sufficient condition for stress (Sells, 1970). Mandler and Watson (1966) have argued for a similar type of relationship. They claim that "Any situation which interrupts, or threatens the interruption of organized response sequences, and which does not offer alternate responses to the organism, will be anxiety producing". According to Mandler, personal control makes it possible for the individual to incorporate a potentially threatening event into a cognitive plan, thus reducing anxiety.

Personal control has been found to be effective in reducing stress when applied to conditions of noise, electric shock and with hospital patients. Research done on personal control has been reviewed in an article "Will it hurt less if I can control it" by Thompson (1981). A similar article by Averill (1979), "Personal control over aversive stimuli and its relationship to stress" reviews research that shows that personal control has a beneficent or stress-reducing effect.

The articles by Thompson (1981) and Averill (1973) review research that relates to four types of control:

1. Behavioral Control
2. Cognitive Control
3. Information Control
4. Retrospective Control

These four types of control show relationships between control and stress. The question is: will the experience be less painful or stressful if the person has the opportunity to control some part of the process?

Behavioral Control. Behavioral control is defined as an available response that can affect the aversiveness of an event, make it less probable

or less intense, or change its duration or timing. One can imagine a switch, a lever, or a button which, when activated, will terminate a loud noise or an electric shock—this is behavioral control.

A variety of control responses have been made available to subjects, including the presence of a button that terminates the noxious event (Geer and Maised, 1972), changes its intensity or duration (Geer, Davison and Gatchel, 1970, or allows the subject to avoid the event altogether (Houston, 1972). Subjects have also been able to reduce or avoid an event by successfully performing a task (Bowers, 1968; Szpiler and Epstein, 1976) and have been given control in a situation by allowing self-administration rather than experimenter administration of the various stimulus (Peruin, 1963; Staub, 1971). Subjects with behavioral control have been found to tolerate more electric shock (Bowers, 1968), more cold pressor pain (Kanfer, 1973), and more loud noise (Glass, 1969). Behavioral control has also led to fewer errors on a task performed while hearing loud noise (Sherrod, 1977).

Langer and Rodin (1976) provided a group of patients in a nursing home with behavioral control over some aspects of its everyday operations. The other group did not have this control. The group with control showed greater participation in activities and was rated as more active and happier.

Haggard (1943) dealt with regulated administration as a mode of control. These subjects were presented with a list of words, one of which was always followed by an electric shock. For half of the subjects, the shock was administered by the experimenter; for the other half, a signal light came on at the appropriate time and subjects administered the shock to themselves. Following this procedure, subjects were told to rest. During the third phase the same procedure was followed as in the first but without the electric shock. During the first phase, the self-administered shocks resulted in

smaller changes in skin conductance than did the experimenter-administered shocks. This is an indication that subjects who had control over the delivery of shock were less stressed. It was found that subjects who administered shock to themselves also tended to be more aware of the experimental conditions than were subjects to whom the shocks were administered by the experimenter. Subjects who received experimenter-administered shocks, however, showed more rapid recovery during therapy. In the third phase, no difference existed between experimenter-administered and self-administered shock groups.

Cognitive Control. While behavioral control involves direct action on the environment, cognitive control refers to the way a potentially harmful event is interpreted. Cognitive control is the belief that one has a cognitive strategy available that can affect the aversiveness of an event. Strategies can be further classified as avoidant and nonavoidant. Avoidant strategies lead one to ignore, deny, disassociate or distract oneself from the event. Nonavoidant strategies focus on the attempt through heightened sensitivity to control physiological or cognitive reactions. Avoidant strategy can be compared to students avoiding the stress of a test by not studying. Nonavoidant is compared to hard work by the student. It has been found that students with avoidant strategies have less pre-test tension but show poorer results than nonavoidant strategy students. Cognitive strategies reduce the effect of a noxious stimulus. They have reduced self-report of pain (Chanes and Barber, 1974), increased tolerance, and threshold for pain, reduced numbers of headaches experienced, and reduced anxiety during a final exam (Houston, 1977). Langer et al, (1975), for example, looked at the effects of stress-reducing strategy on patients who would undergo surgery. Patients given cognitive control reported less

postoperative stress and required fewer pain relievers and sedatives. Janis (1958) examined the coping strategies used by patients awaiting surgery. He found that avoidant-strategy patients experienced less preoperative anxiety but had less favorable postoperative attitudes. Just the opposite pattern was observed in nonavoidant-strategy patients. Visotsky and Hamburg (1961) found that avoidance had positive effects during the initial part of the process of coping with a major traumatic event, but nonavoidant strategies were more useful later on.

Information Control. Information has been conceived as a form of control, and it may at times bring into existence a feeling of control. Information may be a warning signal that precedes a noxious stimulus and therefore gives temporal information about the event. Jones, Bentler and Petry (1966) found that subjects appear to be more motivated to obtain information about the time of occurrence of a noxious stimulus than about its intensity. Epstein (1973) found the effects of different kinds of information on reactions to noxious stimuli (loud noise and electric shock). He found that information regarding the time of occurrence, likelihood and nature of the stimulus could either reduce or enhance reactivity to the impact of the stimulus.

Research reviewed showed that stimuli like electric shock or bursts of loud noise indicate that subjects generally prefer to have information about an impeding harm, but there is no definite relationship between information and stress.

The role of information in reducing stress has become a topic of considerable interest. The information may be in the form of a signal. There are instances in which signaled shock has led to less stress than unsignaled shock. Weiss (1970) gave evidence that this is due to the fact that the

subject learns not only that a warning signal predicts shock but also that the absence of the signal predicts safety. Jones (1966) found that subjects appear to be more motivated to obtain information about the time of occurrence of a noxious stimulus than about its intensity. Staub and Kellett (1972) examined the relative value of two types of knowledge concerning an unending threat like electric shock. Subjects were given information about (a) the objective characteristics of the shock (i.e. the nature of the apparatus and its safety features, amount of electricity, etc.) and/or (b) about the types of sensations subjects would experience when the shock was delivered. It was found that subjects who received both types of information were willing to accept more intense shocks then were subjects who received only one type of information. The no-information subjects, however, did express more worry or anxiety than those who had either or both kinds of knowledge. Cromwell (1977) found that information provided to recent cardiac patients retarded recovery, if it was not accompanied by either diversion or participation. He found that information has positive effects only if people are given a way of handling the arousal engendered by the information, such as by participating in the treatment program.

Retrospective Control. Retrospective control refers to beliefs about the causes of a past event. It is believed that attributions of control with a past event lead to less stress in the future. Several researchers have noted that victims of misfortune often search their past to find some action of their own that could have brought the misfortune upon them.

Chodoff (1964) found that parents of children with leukemia felt responsible for their child's condition. The self-blame of these parents seemed in a sense an adaptive function, reducing anxiety and concern. Bulman (1977) examined the relation between victims' acceptance of

responsibility and coping ability and found that good coping was associated with victims blaming themselves for the accident.

From the previous discussion it is found that different forms of control are beneficial in controlling the effect from several noxious stimuli. The research question is whether any of these form of control have an effect in reducing or adapting discomfort from glare.

PROBLEM

The primary objective of this study is to determine whether six controls — subject starts/stops the stimulus, subject adjusts the stimulus, warning signal prior to the stimulus, external distraction, internal distraction and desensitization have an effect on the subjects' assessments of glare.

The hypothesis is that the six control conditions have an effect in reducing discomfort from glare. For this to be true the subject will adjust to a higher level for "borderline between comfort and discomfort" when compared to the no-control condition.

METHOD

The apparatus is shown in Figure 1. The appratus was a hemisphere of two feet radius. The size of the aperture chosen for the experiment was 3.33cm (.0015 sr). A projector bulb (CTT, 1000 W, 120V) was installed in the back, and the light passed through a filter to the front where the subject was seated. The subject was seated at a distance of two and a half feet from the glare source. The source of light was along the horizontal line of sight. The background luminance was kept constant at one cd/m^2 The subject looked at the glare source. When the experimental instructions were read to the subject, he or she looked at a light of very low luminance fixed near the glare source.

The subject was asked to adjust his or her position in front of the hemisphere with the chin resting on a chin rest. This is shown in Figure 2. The intensity of the glare source could be adjusted by a transformer, placed in front of the subject. The transformer was connected to a voltmeter which gave the readings in volts corresponding to the luminance of the glare source. A timer was also connected with the transformer. When the light switch was on, the timer automatically read the time in hundreths of a second. The transformer was set in its highest position for a maximum luminance of 83252 cd/m^2.

Experimental Conditions

No Control Condition. First the average value of the BCD obtained from pretrial was set. When the glare source was turned on the subject looked at his or her BCD value from the pretrial. The experimenter controlled the light but the subject directed him to adjust for the new BCD setting. The time allowed for each BCD setting was 60 seconds and there were two replications of the same experiment. The no control was a general condition

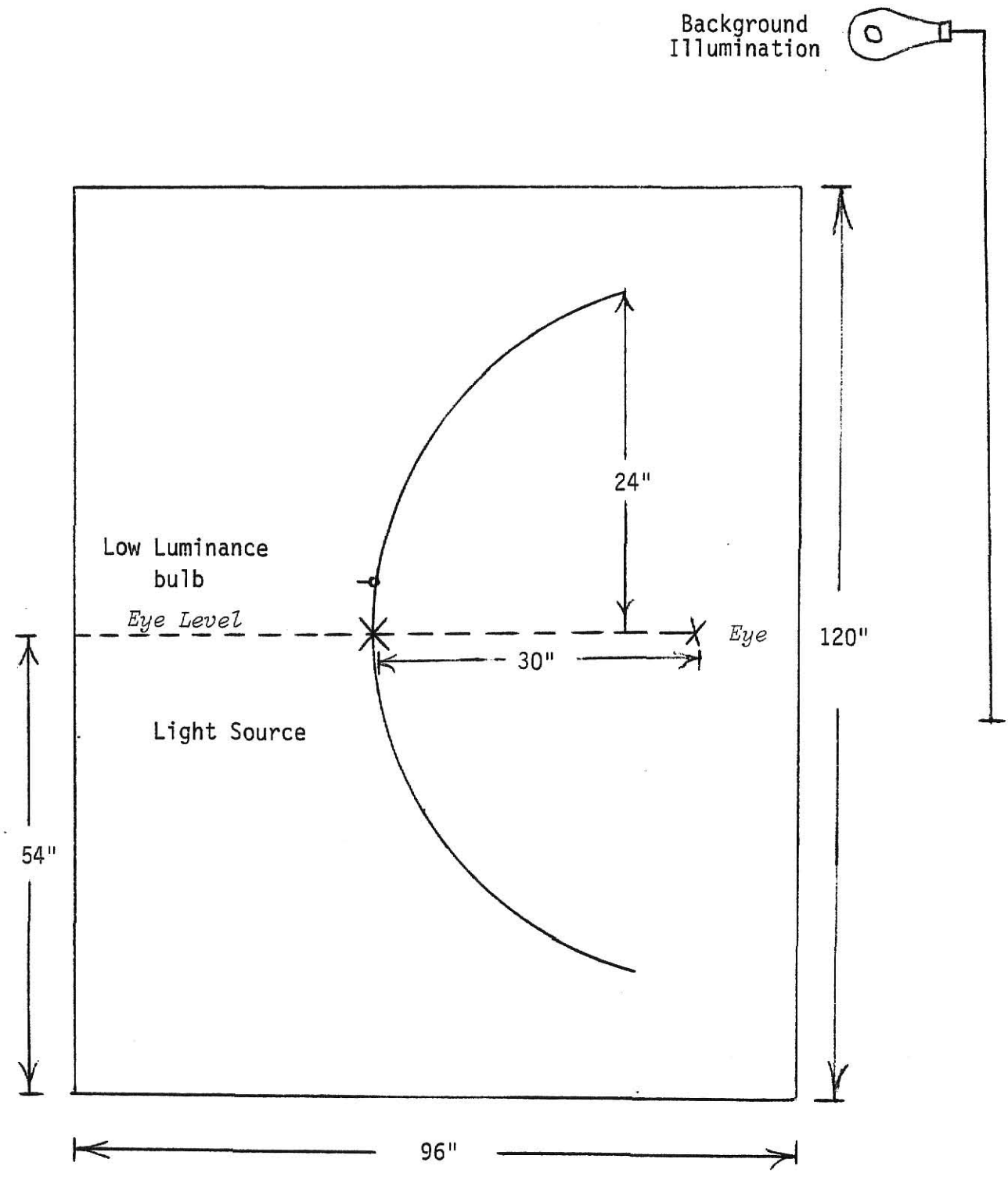

Figure 1. Hemisphere

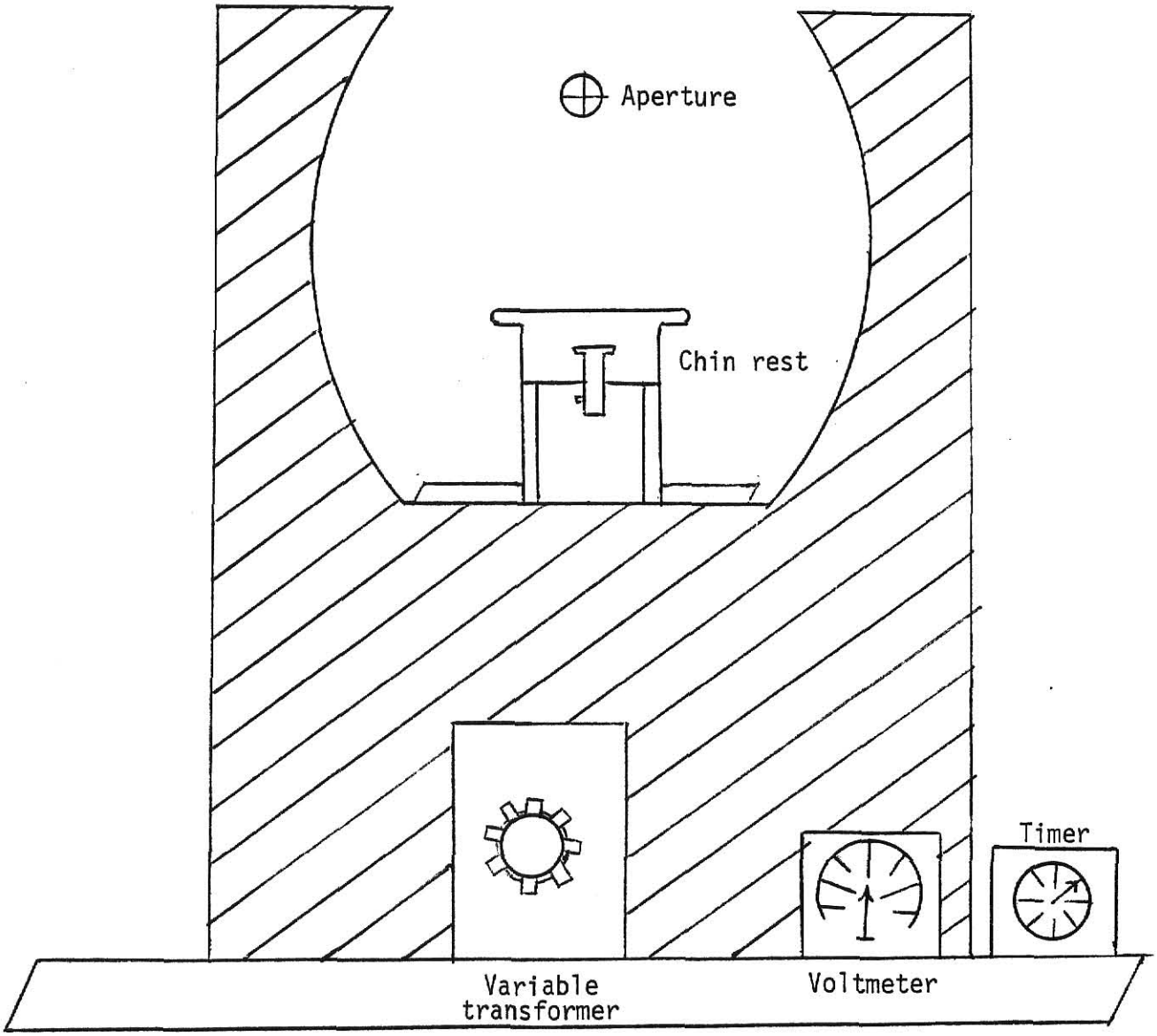

Figure 2. Hemisphere with chin rest, variable transformer, voltmeter and timer.

and the other six conditions were similar to it with only one change in each.

Subject Starts/Stops the Stimulus. The BCD value obtained from the pretrial was adjusted before the start of the experiment. The control was with the experimenter, and the subject directed him to adjust for the new BCD setting. There was no time limit to set the new value and the subject had the freedom to start or to stop the experiment anytime. There were two replications of the experiment, and the average value was found.

Subject Adjusts. The average BCD value obtained from the pretrial was adjusted before the experiment started. This time the subject had to control the light, and the experimenter started and stopped it. The time limit was only 60 seconds for setting each BCD value. There were two replications of the experiment, and the average was obtained. This condition is similar to self-administered shock.

Warning Signal. A warning bell was sounded and then after 15 seconds the light switch was thrown open. The subject witnessed his or her BCD setting from the pretrial. The experimenter had the control and the subject directed him to adjust for a new BCD setting. The time limit was 60 seconds, and there were two replications of the experiment. This is compared to the information type of control as the subject got the information that the glare would be witnessed briefly after the warning was given.

External Distraction. A tape recorded discussion between two women was played. The women discussed the birth of a baby and its first year of life. The talk was thought to be interesting and could distract the attention of the subject.

The subject heard the discussion for two minutes and was asked to pay

attention to it. After two minutes the subject was shown the BCD. The recorded talk was played while the new setting was made. As before, there were two replications of this condition.

This experiment is one of avoidant strategy in cognitive control. The subject may avoid the glare source by listening to the talk and getting distracted.

Internal Distraction. The subject was asked to imagine that he or she had won a million dollars and was asked what he or she wanted to do with so much money. The subject was asked to imagine for two minutes; and while he or she was in thought, the BCD value obtained in the pretrial was shown. The subject directed the experimenter to adjust for the new BCD setting. The time limit was 60 seconds for each setting. The test had two replications, and the average value was found.

The test is compared to the avoidant strategy of cognitive control.

Desensitization. Here the subject was asked to relax as much as possible by relaxing different parts of the body. When the subject showed all signs of being relaxed, the BCD value obtained in the pretrial was shown. The subject was asked to look at the glare source for some time until he or she was adjusted and relaxed with the light. The switch was then turned off. In the second phase the same glare was shown again, but this time the subject had to direct the experimenter to adjust for the new BCD setting. The time limit was 60 seconds for each setting, and there were two replications of the test.

This test is compared to the non-avoidant strategy of cognitive control.

Instructions

When the subject came into the experiment room, he or she was asked to sit comfortably and adjust his or her position in the chin rest. Tape recorded instructions were provided:

"We are pleased that you have consented to participate in the experiment. There is a concept called borderline between comfort and discomfort or BCD. First, take the control and increase the intensity of light to a high level. Look at the light! Most people would say that the light is uncomfortably glaring. Now take the control and turn the light down until it is at a low level. Look at the light! Most people would say that this light is comfortable, i.e. not glaring. Now, somewhere between these two extremes should be a point of change, a threshold, where the light is at the borderline between comfort and discomfort. This is what we call BCD. This point should be such that the light is not annoying or uncomfortable to you, BUT, if it were higher, it would be uncomfortable.

Take your own time to find the BCD point. It may take a little longer at first to decide whether the light is uncomfortable or not. Adjust the light up and down until you find the BCD point. DO NOT set the light at the borderline between tolerable and intolerable — that is a higher level. Similarly, do not use the pleasantness—comfortable, criterion—this is a lower level. BCD is between these two criteria.

We will initially set the light to zero; you will adjust the light upward through small steps to 'pleasant' and to the 'borderline between pleasantness and comfort'. Continue adjusting upward through 'comfortable' to the 'borderline between comfort and discomfort'. Even though we show higher criteria, namely 'uncomfortable but tolerable' and 'borderline between tolerable and intolerable', we want you to stop at BCD and not go beyond.

We want you to be aware that the light could be set to those higher criteria.

So take the control and adjust the light upwards through the steps to BCD. Take the time to adjust the light to the criteria you are adjusting for. Feel free to adjust the light upward and downward to search for a particular level. You may even go back to a lower level if you wish, set it, and go upward through the steps. The object is to set the light where you feel these criteria are. Immediately following this you are to adjust to the BCD criterion. This test will be repeated twice.

There should be no discomfort or risk to you in the procedure. However, if you would rather not participate, feel free to leave. Naturally I would prefer that you complete the experiment so that I can gather all the required data."

No Control Condition

"Now we are to adjust only to the 'borderline between comfort and discomfort'. I will adjust to the BCD setting from your pretrial value. I will have the control and you must direct me to move upward or downward for the new BCD setting. You will be given only 60 seconds time for each BCD setting, and the test will be repeated."

Control Conditions

Subject starts/stops the experiment. "We are to adjust to only the BCD criteria. I will first adjust the light to your BCD value obtained from the pretrial. I will have the control with me but you will direct me to move upward or downward for your new setting—even if you think the previous setting is still O.K. However, you will not be allowed to have the control. The test will be repeated twice, and you may start or stop at any time you wish."

Subject adjusts but experimenter starts/stops. "We are to adjust to only the BCD criterion. I will first adjust the light to your BCD value obtained from the pretrial. You will now have the control, and you will adjust upward or downward for your new setting—even if you think the previous setting is still O.K. You will be given only 60 seconds time for each BCD setting, and the test will be repeated twice."

Warning signal. "Wait to hear the warning bell; and then after a brief time, you will witness the BCD value you had adjusted in the pretrial. You must direct me to adjust the light upward or downward — even if you think the previous BCD setting is still O.K. You will be given only 60 seconds for each BCD setting, and the test will be repeated."

External distraction. "Listen to the recording and pay attention to it. While listening to the recording you will see the BCD value you had adjusted in the pretrial. Look at the light and direct me to move upward or downward for your new setting — even if you think the previous BCD setting is still O.K. You will be given only 60 seconds for each BCD setting, and the test will be repeated."

Internal distraction. "Start imagining that you have won a million dollars and what you want to do with that. One is sure to fulfill all his or her desires with that money. While you are imagining you will see the BCD value you had adjusted in your pretrial. Look at the light and direct me to move upward or downward — even if you think the previous BCD setting is still O.K. The experiment will be repeated twice, and you will have 60 seconds for each BCD setting."

Desensitization. "Now I want you to relax. Shift your position in the chair and with the face rest as much as possible to get comfortable. Pay attention to your back and shoulders—they may seem a little tense. Relax them. Finally, pay attention to your arms and hands. If they are tense, relax them. Overall I'd like you to be relaxed as much as possible. Now look at the BCD value you had obtained from the pretrail—take your own time and feel relaxed with the light. While looking at the light, direct me to adjust the BCD value upward or downward — even if you think the previous BCD setting is still O. K. You will be given only 60 seconds time for each BCD setting, and the test will be repeated."

After the initial instructions were given, each subject adjusted twice to the following conditions—pleasant, borderline between pleasant and comfort, comfortable and borderline between comfort and discomfort. This was done so that each subject could get the feel of different criteria of glare. Immediately following this, the subject adjusted twice to the BCD criterion. The average of these two BCD values was the pretrial value.

All subjects set BCD values under seven different conditions — no control, subject starts/stops, subject adjusts, warning signal, external distraction, internal distraction, and desensitization. These seven conditions were randomized for each of the subjects. The instructions required for each condition were first read and then explained before the start of the experiment. Under each condition BCD value were set twice and the average value obtained.

Subjects and Recruitment Procedure

The subjects were picked from Industrial Management classes in the Industrial Engineering Department. The subjects were offered extra credit in the course if they participated in the experiment. In all, 40 students took part in the experiment, and the average time for each experiment was 60 minutes. The subjects varied in age between 19 and 34 years with a mean of 21.75 years. Out of this 31 subjects were male and nine female. Twelve of them wore glasses.

RESULTS

Table 1 gives the means for the experimental conditions in cd/m^2 and the probabilities that the control conditions are different from the non-control by t-test for the seven conditions.

Table 2 gives the analysis of variance for model, person and treatments. The model has 40 subjects and seven treatments. "Person" is the number of subjects, which was forty.

Table 3 in Appendix A gives the value of luminance (cd/m^2) for different voltages.

Figure 3 in Appendix A gives the graph for conversion from volts to luminance (cd/m^2).

TABLE 1

The means in cd/m^2 and the probabilities by t-test for seven conditions.

Treatment	Means (cd/m^2)	Probability (t-test)
No control	5995	.
Subject starts/stops	7257	0.0246
Subject adjusts	6325	0.6232
Warning signal	6650	0.4802
External distraction	4860	0.0300
Internal distraction	6425	0.5556
Desensitization	6822	0.1481

TABLE 2

The Analysis of Variance for model, person and treatments.

Source	DF	SS	MS	F Value	PR>f	R-sq
Model	45	113338.617	2518.63	121.89	.0001	.959
Error	234	4835.34	20.6638	Std.dev.		
Corrected Total	279	118173.96			4.545	

Source	DF	Type I SS	F Value	PR>f
Person	39	112863.1035	140.05	.0001
Treatment	6	475.5138	3.84	.0011

On comparing together the six control conditions with the no-control condition, it is found that the means for all the six control conditions should be at least 6600 cd/m^2 to be statistically different from the no-control condition. The means of the six control conditions together at the five percent level is found to be 6600 cd/m^2. Hence it is concluded that the mean effect of the six control conditions is statistically different from the no-control condition.

DISCUSSION

Personal control has an effect on discomfort glare.

While comparing the significance levels of the six control conditions with the no-control condition, it is found that the condition when the subject starts/stops is statistically different from the no-control condition; and this condition has a positive effect in controlling discomfort from glare. Also the condition of external distraction is statistically different from the no-control condition, but this condition has a negative effect in controlling discomfort from glare. The control conditions of subject adjusts, warning signal, internal distraction and desensitization are statistically the same as the no-control condition and hence have no effect in controlling discomfort glare. The condition when the subject starts/stops the experiment has a control of 4.1 percent over the no-control condition. This is because when the subject starts the experiment, he or she is prepared for the discomfort glare. Also in this condition the subject has more time to adjust to that glare since there is enough time for setting the BCD value.

BCD is a mild noxious stimulus. The chances of getting more control would have been better had a higher criterion of glare like the borderline between tolerable and intolerable been used. By introducing such higher glare criteria, further research could be done and probably positive results would be obtained.

While at this time there seems to be little practical application for this experiment, perhaps research in the future will show ways to reduce glare for drivers. There is a need for further research in the method in which the subject starts/stops the experiment. This will help to evaluate practical applications.

CONCLUSION

The condition when the subject starts/stops the experiment has a positive effect in controlling discomfort from glare, while the condition in which there is external distraction has a negative effect in controlling discomfort from glare. The conditions of the subject adjusting, warning signal, internal distraction, and desensitization have no significant effect in controlling discomfort glare.

REFERENCES

Anantha, B. N. Fry's dynamic disk roadway lighting simulator, Master's report, Industrial Engineering Department, Kansas State University, 1982

Averill, J. R. Personal Control over aversive stimuli and its relationship to stress, Psychological Bulletin, 1973, 80, 286-303.

Averill, J. R. and Rosenn M. Vigilant and nonvigilant coping strategies and psychophysiological stress reactions during the anticipation of electric shock, Journal of Personality and Social Psychology, 1972, 23, 128-141.

Bennett, C. A. Discomfort Glare: Parametric study of angularly small sources, Kansas Engineering Experiment Station Special Report No. 117, Summer, 1976.

Bennett, C. A. Discomfort Glare: Stability of individual's sensitivity, Kansas Engineering Experiment Station Special Report No. 126, Spring, 1976.

Bennett, C. A. Discomfort Glare: Roadways (I): Four experiments on multiple sources, Kansas Engineering Experiment Station Special Report, No. 129, Summer, 1979.

Bennett, C. A. Discomfort Glare: An unbiased assessment using a fixed glare source, Kansas Engineering Experiment Station Special Report No. 140, Fall, 1980.

Bennett, C. A. Ramarao et. al., Discomfort Glare: A multiple-criteria approach to anchor judgments.

Bowers, K. Pain, anxiety, and perceived control. (1968) as cited by Thompson (1981).

Bulman, R. J. Attributed of blame and coping in the "real world". (1977) as cited by Thompson (1981).

Chaves, J. R. and Barber, T. X. Cognitive Strategies. (1974) as cited by Thompson (1981).

Chodoff, P. Stress defences and coping behavior. (1964) as cited by Thompson (1981).

Cromwell, R. L. Acute myocardial infarction. (1977) as cited by Thompson (1981).

Epstein, S. Expectancy and Magnitude of reaction to a noxious UCS. (1973) as cited by Averill (1973).

Geer, J. H., Davison, G. C. and Gatchel, R. J. Reduction of stress in humans through nonveridical perceived control of aversive stimulation. (1970) as cited by Thompson (1981).

Geer, J. H. and Maisel, E. Evaluating the effects of the prediction control confound. (1972) as cited by Thompson (1981).

Glass, D. C. Psychic costs of adaptation to an environmental stressor. (1969) as cited by Thompson (1981).

Haggard, E. A. Experimental studies in affective processes. (1943) as cited by Averill (1973).

Houston, B. K. Dispositional anxiety and the effectiveness of cognitive strategies. (1977) as cited by Thompson (1981).

Houston, B. K. Control over stress, locus of control, and response to stress. (1972) as cited by Thompson (1981).

Janis, J. L. Psychological stress. (1958) as cited by Thompson (1981).

Jones, A., Bentler, P. M. & Petry, G. The reduction of uncertainty concerning future pain (1966) as cited by Averill (1973).

Kanfer, J. H. Self-control and the tolerance of noxious stimulus. (1973) as cited by Thompson (1981).

Langer, E. J. and Robin, J. The effects of choice and enhanced personal responsibility for the aged. (1976) as cited by Thompson (1981)

Lulla, A. G. Range effects in discomfort glare, Master's Thesis, Industrial Engineering Department, Kansas State University, 1978.

Mandler, G. and Watson, D. L. Anxiety and the interruption of behavior. (1966) as cited by Averill (1973).

Pervin, L. A. The need to predict and control under conditions of threat. (1963) as cited by Thompson (1981).

Sells, S. B. On the nature of stress. (1970) as cited by Averill (1973).

Staub, E. and Kellett, D. S. Increasing pain tolerance by information about aversive stimuli. (1972) as cited by Averill (1973).

Szpiler, F. A. and Epstein, S. Availability of an avoidance response as related to automomic arousal. (1976) as cited by Thompson (1981).

Thompson, S. C. Will it hurt less if I can control it? A complex answer to a simple question, Psychological Bulletin, 1981, 90, 89-101.

Visotsky, H. M., Hamburg, D. A. Coping behavior under extreme stress. (1961) as cited by Thompson (1981).

Weiss, J. M. Somatic effects of predictable and unpredictable Shock. (1970) as cited by Averill (1973).

APPENDIX A

TABLE 3

Voltmeter vs. Spotmeter Reading

Aperture Size: 3.33 cm

VOLTMETER READING (VOLTS)	SPOTMETER READING (fL)	LUMINANCE (cd/m^2)
1	0	0
2	0	0
10	2	6.85
15	7	23.98
20	18	61.70
25	47	161
30	72	246.7
35	242	829
40	400	1370
45	720	2466.7
50	1110	3802.9
55	1710	5858.5
60	2330	7982.6
65	3300	11305.8
70	4200	14389
75	5800	19870.8

VOLTMETER READING (VOLTS)	SPOTMETER READING (fL)	LUMINANCE (cd/m^2)
80	7200	24667
85	9000	30834
90	11700	40084
95	13000	44538
100	15200	52075
105	18400	63038.4
110	21200	71631
115	24300	83251.8

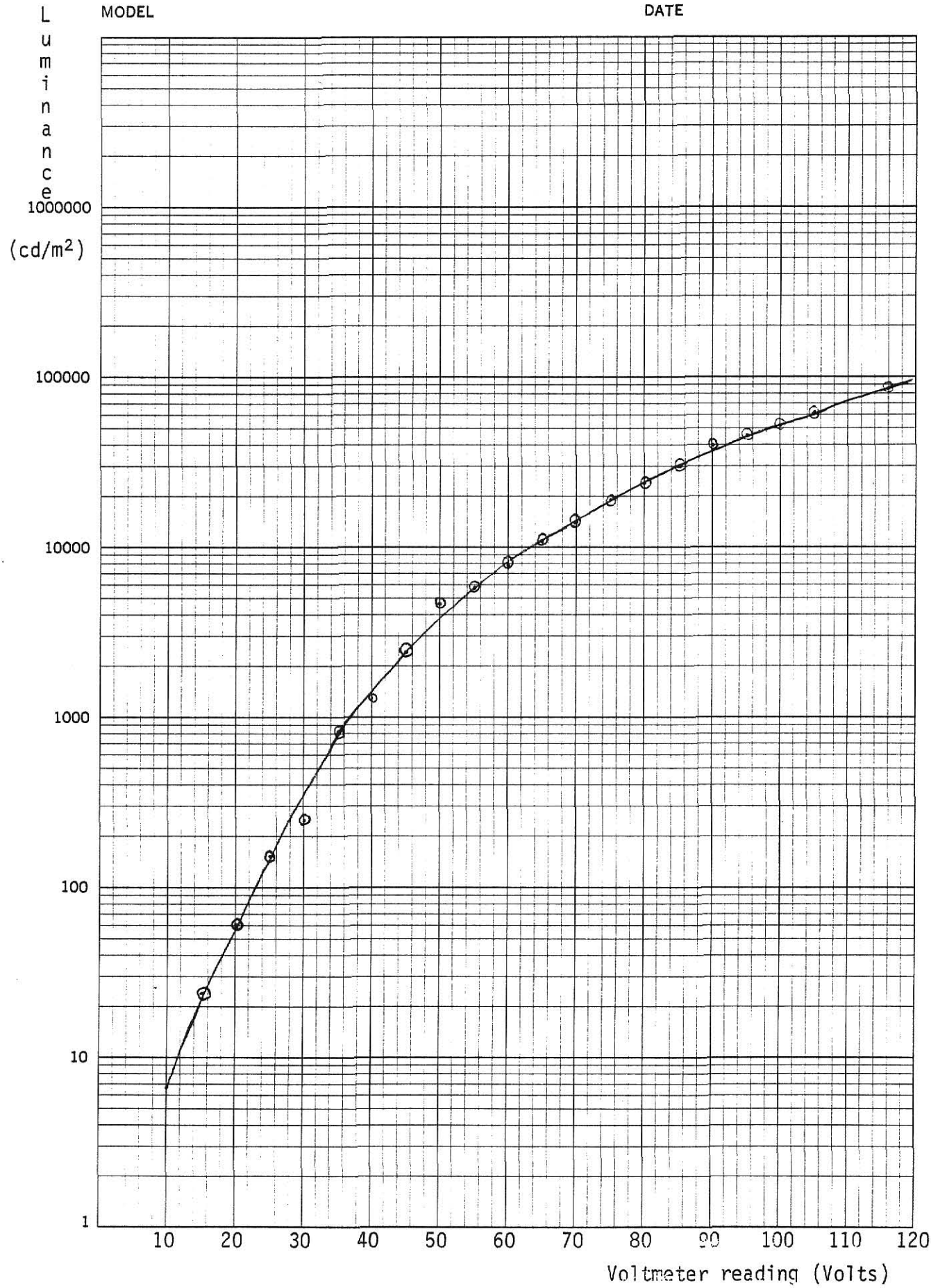

Figure 3. Plot of Volts vs. Luminance (cd/m²)

APPENDIX B

ANALYSIS OF VARIANCE

ANALYSIS OF VARIANCE

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
PERSON	40	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
TRT	7	1 2 3 4 5 6 7

NUMBER OF OBSERVATIONS IN DATA SET = 280

ANALYSIS OF VARIANCE

GENERAL LINEAR MODELS PROCEDURE

LEAST SQUARES MEANS

TRT	Y LSMEAN	STD ERR LSMEAN	PROB > |T| HO:LSMEAN=0	PROB > |T| HO: LSMEAN(I)=LSMEAN(J) I/J	1	2	3	4	5	6	7
1	55.9500000	0.7187465	0.0001	1	.	0.0246	0.6232	0.4802	0.0300	0.5556	0.1481
2	58.2500000	0.7187465	0.0001	2	0.0246	.	0.0779	0.1211	0.0001	0.0958	0.4178
3	56.4500000	0.7187465	0.0001	3	0.6232	0.0779	.	0.8298	0.0080	0.9217	0.3384
4	56.6687500	0.7187465	0.0001	4	0.4802	0.1211	0.8298	.	0.0042	0.9071	0.4576
5	53.7312500	0.7187465	0.0001	5	0.0300	0.0001	0.0080	0.0042	.	0.0060	0.0003
6	56.5500000	0.7187465	0.0001	6	0.5556	0.0958	0.9217	0.9071	0.0060	.	0.3902
7	57.4250000	0.7187465	0.0001	7	0.1481	0.4178	0.3384	0.4576	0.0003	0.3902	.

NOTE: TO ENSURE OVERALL PROTECTION LEVEL, ONLY PROBABILITIES ASSOCIATED WITH PRE-PLANNED COMPARISONS SHOULD BE USED.

ANALYSIS OF VARIANCE

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: Y

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	45	113338.61741071	2518.63594246	121.89	0.0001	0.959083	8.0553
ERROR	234	4835.34330357	20.66386027		STD DEV		Y MEAN
CORRECTED TOTAL	279	118173.96071429			4.54575189		56.43214286

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
PERSON	39	112863.10357143	140.05	0.0001	39	112863.10357143	140.05	0.0001
TRT	6	475.51383929	3.84	0.0011	6	475.51383929	3.84	0.0011

APPENDIX C

RAW DATA

LIST OF DATA

OBS	TRT1	TRT2	TRT3	TRT4	TRT5	TRT6	TRT7	PERSON	Y	TRT
1	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	37.00	1
2	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	36.00	2
3	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	37.00	3
4	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	35.50	4
5	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	38.00	5
6	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	33.75	6
7	37.0	36.0	37.00	35.50	38.00	33.75	39.75	1	39.75	7
8	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	93.00	1
9	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	95.00	2
10	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	98.50	3
11	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	94.50	4
12	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	93.00	5
13	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	96.00	6
14	93.0	95.0	98.50	94.50	93.00	96.00	100.00	2	100.00	7
15	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	71.50	1
16	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	72.50	2
17	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	68.75	3
18	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	64.50	4
19	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	68.00	5
20	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	71.50	6
21	71.5	72.5	68.75	64.50	68.00	71.50	73.00	3	73.00	7
22	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	51.00	1
23	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	57.00	2
24	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	52.00	3
25	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	53.50	4
26	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	51.00	5
27	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	52.00	6
28	51.0	57.0	52.00	53.50	51.00	52.00	53.75	4	53.75	7
29	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	44.50	1
30	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	40.00	2
31	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	40.00	3
32	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	37.25	4
33	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	40.00	5
34	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	43.50	6
35	44.5	40.0	40.00	37.25	40.00	43.50	40.50	5	40.50	7
36	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	55.50	1
37	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	54.00	2
38	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	56.00	3
39	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	57.00	4
40	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	48.50	5
41	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	49.00	6
42	55.5	54.0	56.00	57.00	48.50	49.00	57.50	6	57.50	7
43	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	37.50	1
44	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	35.00	2
45	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	43.00	3
46	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	36.00	4
47	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	36.00	5
48	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	36.75	6
49	37.5	35.0	43.00	36.00	36.00	36.75	34.50	7	34.50	7
50	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	49.50	1
51	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	44.50	2
52	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	44.00	3
53	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	43.50	4
54	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	42.25	5
55	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	48.50	6
56	49.5	44.5	44.00	43.50	42.25	48.50	48.50	8	48.50	7

LIST OF DATA

OBS	TRT1	TRT2	TRT3	TRT4	TRT5	TRT6	TRT7	PERSON	Y	TRT
57	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	49.50	1
58	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	51.50	2
59	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	54.00	3
60	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	49.00	4
61	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	49.00	5
62	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	57.00	6
63	49.5	51.50	54.00	49.00	49.00	57.00	50.00	9	50.00	7
64	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	77.00	1
65	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	81.00	2
66	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	84.00	3
67	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	74.00	4
68	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	53.50	5
69	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	67.50	6
70	77.0	81.00	84.00	74.00	53.50	67.50	67.00	10	67.00	7
71	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	71.50	1
72	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	71.00	2
73	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	53.50	3
74	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	72.50	4
75	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	63.00	5
76	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	55.00	6
77	71.5	71.00	53.50	72.50	63.00	55.00	56.50	11	56.50	7
78	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	116.00	1
79	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	117.00	2
80	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	115.00	3
81	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	115.50	4
82	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	115.50	5
83	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	115.50	6
84	116.0	117.00	115.00	115.50	115.50	115.50	115.50	12	115.50	7
85	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	49.00	1
86	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	52.75	2
87	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	49.25	3
88	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	44.50	4
89	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	55.25	5
90	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	58.25	6
91	49.0	52.75	49.25	44.50	55.25	58.25	51.25	13	51.25	7
92	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	37.00	1
93	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	36.25	2
94	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	35.00	3
95	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	38.25	4
96	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	37.00	5
97	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	42.00	6
98	37.0	36.25	35.00	38.25	37.00	42.00	39.00	14	39.00	7
99	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	71.00	1
100	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	69.00	2
101	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	66.00	3
102	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	74.00	4
103	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	64.00	5
104	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	61.00	6
105	71.0	69.00	66.00	74.00	64.00	61.00	83.50	15	83.50	7
106	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	44.50	1
107	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	43.00	2
108	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	45.50	3
109	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	42.50	4
110	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	44.50	5
111	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	42.50	6
112	44.5	43.00	45.50	42.50	44.50	42.50	42.50	16	42.50	7

LIST OF DATA

OBS	TRT1	TRT2	TRT3	TRT4	TRT5	TRT6	TRT7	PERSON	Y	TRT
113	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	84.50	1
114	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	84.50	2
115	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	95.00	3
116	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	83.00	4
117	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	81.00	5
118	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	102.50	6
119	84.50	84.50	95.00	83.00	81.00	102.50	82.50	17	82.50	7
120	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	48.75	1
121	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	50.75	2
122	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	53.25	3
123	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	49.75	4
124	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	50.50	5
125	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	46.50	6
126	48.75	50.75	53.25	49.75	50.50	46.50	52.00	18	52.00	7
127	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	53.75	1
128	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	56.00	2
129	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	54.00	3
130	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	56.25	4
131	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	56.75	5
132	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	53.00	6
133	53.75	56.00	54.00	56.25	56.75	53.00	59.75	19	59.75	7
134	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	41.50	1
135	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	42.00	2
136	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	41.75	3
137	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	41.00	4
138	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	43.00	5
139	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	40.75	6
140	41.50	42.00	41.75	41.00	43.00	40.75	40.00	20	40.00	7
141	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	67.00	1
142	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	69.00	2
143	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	51.75	3
144	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	62.00	4
145	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	51.50	5
146	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	57.00	6
147	67.00	69.00	51.75	62.00	51.50	57.00	69.00	21	69.00	7
148	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	96.50	1
149	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	102.00	2
150	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	92.00	3
151	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	82.00	4
152	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	81.50	5
153	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	85.50	6
154	96.50	102.00	92.00	82.00	81.50	85.50	110.50	22	110.50	7
155	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	29.75	1
156	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	34.25	2
157	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	35.50	3
158	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	34.50	4
159	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	30.00	5
160	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	30.50	6
161	29.75	34.25	35.50	34.50	30.00	30.50	34.50	23	34.50	7
162	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	72.50	1
163	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	82.00	2
164	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	78.50	3
165	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	84.00	4
166	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	61.50	5
167	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	63.00	6
168	72.50	82.00	78.50	84.00	61.50	63.00	70.00	24	70.00	7

LIST OF DATA

OBS	TRT1	TRT2	TRT3	TRT4	TRT5	TRT6	TRT7	PERSON	Y	TRT
169	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	80.50	1
170	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	86.50	2
171	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	85.50	3
172	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	83.50	4
173	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	79.00	5
174	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	85.50	6
175	80.5	86.50	85.5	83.50	79.00	85.5	88.75	25	88.75	7
176	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	35.50	1
177	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	37.50	2
178	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	33.50	3
179	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	34.75	4
180	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	32.00	5
181	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	34.50	6
182	35.5	37.50	33.5	34.75	32.00	34.5	36.25	26	36.25	7
183	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	38.50	1
184	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	45.25	2
185	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	35.50	3
186	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	42.50	4
187	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	40.25	5
188	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	41.00	6
189	38.5	45.25	35.5	42.50	40.25	41.0	40.50	27	40.50	7
190	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	39.50	1
191	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	38.50	2
192	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	33.50	3
193	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	43.25	4
194	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	29.00	5
195	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	46.50	6
196	39.5	38.50	33.5	43.25	29.00	46.5	35.50	28	35.50	7
197	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	40.50	1
198	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	45.50	2
199	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	43.00	3
200	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	44.25	4
201	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	42.00	5
202	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	46.50	6
203	40.5	45.50	43.0	44.25	42.00	46.5	44.00	29	44.00	7
204	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	64.00	1
205	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	81.50	2
206	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	74.00	3
207	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	81.50	4
208	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	74.50	5
209	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	75.00	6
210	64.0	81.50	74.0	81.50	74.50	75.0	69.00	30	69.00	7
211	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	39.00	1
212	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	44.50	2
213	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	50.00	3
214	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	51.00	4
215	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	49.50	5
216	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	50.50	6
217	39.0	44.50	50.0	51.00	49.50	50.5	45.50	31	45.50	7
218	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	81.50	1
219	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	86.75	2
220	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	80.00	3
221	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	79.00	4
222	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	81.50	5
223	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	87.00	6
224	81.5	86.75	80.0	79.00	81.50	87.0	84.50	32	84.50	7

LIST OF DATA

OBS	TRT1	TRT2	TRT3	TRT4	TRT5	TRT6	TRT7	PERSON	Y	TRT
225	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	50.00	1
226	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	52.00	2
227	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	57.00	3
228	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	49.50	4
229	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	54.00	5
230	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	53.00	6
231	50.00	52.00	57.00	49.50	54.00	53.0	50.0	33	50.00	7
232	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	71.00	1
233	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	72.25	2
234	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	71.50	3
235	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	76.00	4
236	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	63.50	5
237	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	71.00	6
238	71.00	72.25	71.50	76.00	63.50	71.0	75.5	34	75.50	7
239	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	45.00	1
240	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	48.00	2
241	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	45.25	3
242	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	46.50	4
243	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	43.25	5
244	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	42.50	6
245	45.00	48.00	45.25	46.50	43.25	42.5	46.5	35	46.50	7
246	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	40.00	1
247	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	43.00	2
248	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	44.00	3
249	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	46.50	4
250	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	36.25	5
251	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	44.50	6
252	40.00	43.00	44.00	46.50	36.25	44.5	35.5	36	35.50	7
253	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	46.25	1
254	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	50.00	2
255	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	46.50	3
256	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	52.00	4
257	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	48.00	5
258	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	52.50	6
259	46.25	50.00	46.50	52.00	48.00	52.5	54.5	37	54.50	7
260	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	17.00	1
261	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	21.50	2
262	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	18.00	3
263	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	17.25	4
264	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	19.00	5
265	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	18.00	6
266	17.00	21.50	18.00	17.25	19.00	18.0	19.0	38	19.00	7
267	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	45.00	1
268	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	46.25	2
269	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	45.50	3
270	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	38.75	4
271	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	47.25	5
272	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	45.50	6
273	45.00	46.25	45.50	38.75	47.25	45.5	51.5	39	51.50	7
274	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	55.50	1
275	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	55.00	2
276	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	52.00	3
277	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	56.00	4
278	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	56.00	5
279	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	60.00	6
280	55.50	55.00	52.00	56.00	56.00	60.0	49.5	40	49.50	7

PERSONAL CONTROL OF DISCOMFORT GLARE

by

ANIL ANAND

Bachelor of Engineering (Mechanical),
Gauhati University, Gauhati, India, 1977

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Industrial Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1983

ABSTRACT

An experiment was conducted wherein 40 subjects made discomfort glare settings for seven different conditions — no control, subject starts/stops, subject adjust, warning signa, external distraction, internal distraction and desensitization. This was done to find whether personal control had an effect in reducing discomfort from glare. Each of the six control conditions were compared to the no control condition. It was found that the condition where the subject starts/stops the experiment had a significant effect in controlling discomfort from glare. The condition of external control had a negative effect in controlling discomfort from glare. For the conditions of subject adjusts, warning signal, internal distractions and desensitization the effect was also positive but was not statistically significant to be considered positive in controlling glare.