RISK-TAKING BEHAVIOR AS A FUNCTION OF PERCEPTUAL AUGMENTATION AND REDUCTION

Smith D. Coffey

Appalachian State University

August 9, 1974

Paul A Fox
Assoc. Professor of Psychology

P S Mann Ph.D.
Asst. Professor of Psychology

Frank R. Tennant Jr
Asst. Professor of Psychology

Walter T. Snyder
Chairman, Dept. of Psychology

B. J. Strickland
Dean, Graduate School

Contents

Acknowledgements

I recognize the following people for their contributions in preparing this manuscript:

Dr. Paul Fox who chaired my thesis committee and provided impetus for my research.

Dr. Frank Terrant served on my thesis committee and provided support and guidance throughout the project.

Dr. Robert S. Maris who served on my thesis committee and directed the building of the lighting console.

Peter S. Bishop who shared with me the financial costs and wiring responsibilities of the lighting console.

Eric Reichard who assisted me in the building of the kinesthetic perception apparatus.

Jean Lineberger who assisted in the typing of the manuscript.

Paul P. and Helen Coffey who provided their son with the freedom and opportunity to grow through education.

Carolyn L. Coffey who assisted in typing her husband's manuscript and financially supported his academic endeavors. She provided the love and emotional support through numerous rewrites.

Dr. Richard Levin who motivated me toward clinical psychology and helped me gain enough self-confidence to attend graduate school.

ABSTRACT

The risk-taking performance of reducers and augmenters of kinesthetic perception was examined under both low and high risk conditions. Twenty subjects were grouped as reducers and augmenters according to scores on a kinesthetic perception test and then tested on risk taking by use of a lighting panel designed to present both low and high risk conditions. Significant differences were found between the risk conditions and a groups-by-risk interaction was also significant. Certain non-significant trends were also reported with respect to risk-taking behavior. Findings support the hypothesis that reducers and augmenters perform differently in low and high risk conditions.

RISK-TAKING BEHAVIOR AS A FUNCTION OF PERCEPTUAL AUGMENTATION AND REDUCTION

Smith D. Coffey

Appalachian State University

Risk can be defined as expectancy of loss as compared to expectancy of greater gain. Every day individuals take some kind of risk. It may be hurrying through a caution signal at a traffic light, or sitting atop a Saturn V rocket preparing to leap into space. Rhetorical questions arise. What is there about an individual that determines how much risk he is willing to take? Are there certain factors that distinguish between those who take risk and others who do not?

Risk-taking behavior has been the subject of much psychological research (Carney, 1971; Fischer, 1971; Huberman, 1969; Schachter, 1959; Slovic, 1966; Swineford, 1941; and Tajfel, 1964). Willingness to take risk has been found to be functionally related to a wide variety of sociological attributes; socio-economic status, introversion-extroversion, and family background, (Carney, 1971; Jamieson, 1969; Kass, 1964; Rim, 1964; and Slovic, 1966) and psychological attributes; perception, independence, and decision-making process, (Carney, 1971; Huberman, 1959; Fischer, 1971; Kogan and Wallach, 1964; and Swineford, 1941) of the subject himself. For example, Schachter (1959) showed that risk

taking and other "dependency-linked behaviors" were related to ordinal position of birth. Subjects who risked a higher probability of loss, with expectancy of greater gains, were more independent. Later-born subjects were higher risk takers than first born.

Risk Taking

Kogan and Wallach (1964) found risk-taking behavior to be related to independence, and that independence was influenced by social factors. An extensive study was conducted of the relationships of many personality variables which influence the decision-making process. A direct functional relationship between independence and risk-taking behavior was found in females, as measured by an independence-yielding scale adapted from Baron(1953) and Crutchfield (1955). The relationship was not found with male subjects. Previous studies (Swineford, 1941; Slovic, 1966; Kass, 1964; Kogan and Wallach, 1964) found that males would be more likely to accept higher risks than females in a variety of situations indicative of willingness to risk. Coffey and Bishop (1973) and Tajfel, et. al. (1964), however, obtained no sex differences related to risk-taking behavior.

Family size (Jamieson, 1969) has also been found to be related to decision-making behavior. No significant differences were obtained between the sexes of the twelve-year-old subjects. Only little influence was attributed to ordinal position. Children from small families (less

than 4 siblings) accepted less risk than those from large families (more than 3 siblings). Females took only slightly (not statistically significant) more risk than males in each of six conditions dealing with ordinal position and family size. Fischer (1971) found that the oldest child of a family reported a significantly greater number of personal examples of high risk activities such as mountain climbing and skydiving than did other family members. It was also found (Eysenck, 1958; Rim, 1968; Carney, 1971) that extroverts tend to take greater risk, and that high risk takers tend to have higher extroversion scores than introversion scores on the Eysenck short questionnaire (Eysenck, 1958).

Reduction and Augmentation

Petrie, Collins, and Soloman, (1960) have shown that certain individuals appear to consistently reduce the intensity of their perceptions, while other individuals tend to consistently augment the intensity of perception. Augmentation and reduction have been estimated by measuring the change in kinesthetically perceived size after stimulation. Those individuals who consistently reduce after stimulation have been found to be more extroverted (Petrie, 1967), more tolerant of pain (Pertie, 1960), and less tolerant of sensory deprivation than augmenters (Petrie, 1958). Ryan (1967) clearly supported Petrie's theory of perceptual augmentation and reduction by examining athletes involved in contact sports, minimal contact sports, and non-athletes. Athletes who participated in contact sports were more pain tolerant

than the other groups, and perceptually reduced after stimulation. Non-athletes showed less pain tolerance and perceptually augmented after stimulation. Huberman (1969) related the two areas of research (pain tolerance and risk taking) by showing that high risk takers participated in high risk and contact sports.

The purpose of the present study was to examine the relationship between risk-taking behavior and reduction and augmentation. The research was designed to determine (1) whether a functional relationship between risk taking and kinesthetic perception exists, and (2) if other variables studied in risk-taking research such as birth order, family size, and sex difference, interact with the risk-taking--reduction-augmentation relationship.

Method

Subjects

The subjects were 20 freshmen and sophomore volunteer college students chosen randomly from a total of 37 students receiving class credits for experimental participation. Of the 37 participators, 11 were found to be augmenters, 12 were found to be reducers, and the remaining 14 obtained scores which placed them between reducers and augmenters. Ten reducers and ten augmenters were chosen randomly from their respective groups and were comprised of five males, five females, and four males and six females respectively.

Apparatus

The risk-taking apparatus used in this experiment was

a replica of that used by Jamieson (1969). An illustration of the apparatus can be seen in Appendix A. It consisted of a console with a control panel and display surface facing the subject. Ten numbered switches which operate corresponding lights, either red or green, were mounted in a horizontal array on the display surface of the console. The lights were small incandescent bulbs covered by colored plastic bubbles. The probability of a red or green light being activated was predetermined by ten more switches on the back of the console which could be activated by the experimenter. A white cue light signaled that the panel was ready for use. A plastic bowl was located to the subject's right of the panel and served as a receptacle for poker chips. The poker chips represented token reward in a won/lost format.

The apparatus measuring augmentation and reduction was that described by Petrie (1967). The apparatus is illustrated in Appendix A. It consisted of a wedge-shaped piece of hardwood, 78 cm long, 2.6 cm thick, 10.4 cm at the wide end, tapering to 1.3 cm at the narrow end. To maintain parallel alignment of the fingers, a sliding finger guide was fixed atop the wedge and the measurement and stimulation blocks. These blocks were 15.6 cm in length, and 2.6 cm thick. The measurement block was 3.9 cm in width, and the stimulation block was 6.5 cm in width.

Procedure

The subjects were brought individually into the testing room. The room was equipped with several carrels to provide

a distraction-free setting. The room was lighted with flourescent lights and the temperature was regulated at a comfortable 70° F. Each of the two parts of the procedure took place at a different carrel. The combined segments of the experiment lasted 75 minutes for each subject.

The kinesthetic perception test was given first. A 30 minute rest period preceded the test. During this rest period the subject was instructed not to touch anything with the thumb or index finger of either hand. Also during this time the subject was questioned about age, birth order, family size, older and younger siblings, participation in sports, handedness, and the types of activities they enjoyed. The answers were recorded by the experimenter. The questionnaire can be seen in Appendix B.

The subject was then blindfolded after the rest period. He was instructed to grasp the measurement bar between the thumb and index finger of the dominant hand, and to find the point that felt of equal width on the wedge-shaped comparison bar grasped identically in his other hand. Four measurements were taken to establish a baseline average. After establishing a baseline, the subject was allowed to rest his non-dominant hand while the stimulation block was rubbed at a constant rate for 90 seconds with the dominant hand. He then equated the perceived equivalent width of the original test block on the tapered block. Again four measurements were taken, with the standard block being held as in the baseline measurements. This procedure was repeated for a

second 90-second trial and finally for a 120-second trial. The blindfold was removed after clearing the blocks from the table. A precedural schemata has been illustrated in Appendix C.

The subject was then seated in front of the risk-taking panel while the operator of the panel was seated behind the panel. It was then explained that tokens could be earned during the experiment. The person who had earned the most tokens at the conclusion of the experiment would receive a prize. The subject was then told to watch the cue light. When it came on he was asked to either turn on the next switch in the series, or turn the panel off, signifying his wish to stop.

The "rules of the game" were then explained to the subject. He was told that in condition A (low risk) nine switches were connected to green lights and one switch was connected to a red light, but the red light connection could be to a different switch each time. As the cue light came on the subject was asked to turn on the next numbered switch or the stop switch. If a switch connected to a green light was turned on, the subject was presented one token. But if the red light came on, the subject would lose not only that token but all previously earned tokens on that trial. If the subject chose to stop, he could then keep all tokens earned up to that point in the game. Under condition B (high risk) the subject faced the greater probability of getting a red light in that eight switches were

connected to red lights. The subject lost if only one red light flashed.

All subjects were then shown two graphs. The graphs have been reproduced in Appendix D. One graph (condition A) was a bar graph representing the probability of loss on the Nth switch if the N-1 switch was connected to a green light. The graphs served only as a general reference showing risk rising as a positively accelerating curve from switch one. The second graph (condition B) showed risk rising as the subject encountered two red lights on the panel. Three practice trials were run so the subject met with both success and failure; red lights occurring at switches 3, 8, and 5. The subject was then asked if he understood that the red light(s) could occur at any switch and that the chance of a red light flashing increased with each green light.

Five trials were conducted in each of the two risk conditions. On the first, second, and fifth trial of each condition the red light was pre-set at switch 9. These three trials were the measurement trials. In condition A the red light was set for switch 7 on the third trial, and for switch 3 for the fourth trial. In condition B the red lights were set at switches 9 and 10 for the first, second, and fifth trial. The red lights were set for switches 4 and 6 for the third trial, and for switches 5 and 7 for the fourth trial. The three measurement trials allowed the subject to take the maximum subjective probability of risk.

The two bogus trials were used to convince the subject of the probability that the red light could occur at any switch.

Design

A three-factor (reducer-augmenter, risk, and trials) mixed design was used with repeated measures on two factors, risk and trials (Bruning and Kintz, 1968). All subjects were given the kinesthetic perception test and then the risk-taking test, both conditions A and B. The order of high and low risk conditions was counterbalanced between groups.

Results

To determine whether a functional relationship existed between risk-taking and kinesthetic perception, scores were obtained on a kinesthetic perception task to group the subjects as either reducers or augmenters. These groups were then evaluated on willingness to take risk in both a low and high risk situation, the dependent variable being the number of switches activated in both risk conditions.

Figure 1 represents the mean number of switches turned on by reducers and augmenters in both high and low risk conditions, and on the three measurement trials (1, 2, and 5). On trial one, the reducers activated an average of one more switch than the augmenters in the low risk condition. The difference between the groups decreased under the high risk condition, even though both groups appeared to react more cautiously. On the second trial, the difference in mean number of switches is greater between reducers and

augmenters. Reducers averaged more than one and one half switches than augmenters on low risk, but dropped below the augmenters on high risk. After two bogus trials, the differences between reducers and augmenters were maintained at constant levels on trial 5.

To test the significance of the difference between groups across trials and risk conditions, a three-factor (reducers-augmenters, risk, and trials) analysis of variance was used. The statistical results are presented in Table 1 with the effects of risk significant at the .001 level ($F=28.91$), and groups-by-risk significant at the .05 level ($F=4.94$).

Augmentation and Reduction

The overall performance of reducers and augmenters was not significantly different. The F score for groups was 3.35. Although reducers took generally more risk than augmenters in the low risk condition, they did not maintain this same proportion in the high risk condition.

Risk

There were significant effects on performance between the low and high risk conditions. An F score of 28.91 was obtained. All subjects clearly responded more cautionsly in the high risk condition than in the low risk condition. In the high risk condition the performance of reducers decreased sharply.

Trials

Although the overall effect of trials on risk performance was not significant (F=1.07), scores did vary across trials. It also appears that the number of trials and the sequential position of the bogus trials in some way affect the performance on trial five.

Other Factors

The information gained from the questionnaires was not dealt with in a strict statistical sense, but was examined to indicate certain trends. Table 2 represents the mean number of switches turned on in both low and high risk conditions by different groups of subjects. The scores of males and females were very similar. Females reacted more to the separate conditions in that they scored slightly higher on low risk induction and slightly lower on high risk induction. Considering ordinal position, the middle child tended to take slightly less risk in both conditions than did the only child, youngest child, and oldest child. As expected, participators in contact sports (football, wrestling, basketball, field hockey) tended to take more risk than others. It was surprising to note that those subjects who do not participate in sports took more risk than those participating in minimal contact sports (swimming, golf, tennis). Subjects who assessed themselves as low risk takers actually assumed more risk than those who assessed themselves as high risk takers.

A profile was collected on the combined scores of individuals who scored highest (N=5), and those who scored lowest (N=5) on both risk conditions regardless of trials. High risk takers tend to be comprised of females who are oldest in the family with older brothers. This high risk group also frequently (twice a week) participated in minimal contact sports such as tennis, swimming, and volleyball. Nearly all their activities were involved with others and they spend very little time alone. This group rated themselves as either great risk takers or only as marginal risk takers. All five high scorers were reducers.

The low scoring group consisted of females who are youngest in the family with older brothers, or of oldest males with younger sisters. They infrequently (once a month) participate in sports of any kind. They enjoy social types of events; dances, concerts, small parties, and meeting people. The low risk scorers rated themselves as moderate risk takers. This group was composed of both reducers and augmenters.

Family size was not considered in that all subjects tested came from small families.

Discussion

The approach to risk taking conducted by this study has been to measure a subject's response in both low and high risk conditions, and then look at factors which may have influenced this risk-taking behavior.

A functional relationship was found between risk taking and perceptual augmentation and reduction. Those subjects who perceived the size of the block to be greater after stimulation, also perceived the expectancy of loss to be greater and proceded more cautiously. This supports Petrie's findings that augmenters exaggerate hazardous situations. The converse may also be stated concerning those subjects who reduced the perceived size of the block. It cannot be known whether this characteristic alone affects the risk-taking process. Table 2 presents data suggesting that sex, ordinal position, sports, and self-assessment of risk are correlated with risk taking. Males and females responded to the risk conditions similarly (Coffey and Bishop, 1973; and Tajfel, et. al., 1964) but with the greatest disparity between the risk conditions found in females. This data also contributes to Jamieson's finding on sex differences in risk taking.

The significance of differences in risk taking found between the low and high risk conditions adds to the questions found in previous risk-taking studies. Most previously reported studies (Carney, 1971; Rim, 1964, Slovic, 1966; and Tajfel, 1964) only presented one level of risk induction. With one level of the independent variable, conclusions are limited in that performance could depend upon whether the subject experienced risk induction as low or high in magnitude. It appears that two levels of the defined independent variable are needed in order to determine

the differences in risk conditions. By presenting two levels of risk induction, the perceived risk is allowed to vary with each subject. It should be noted that consistent differences between reducers and augmenters were found only in the low risk condition in this study.

In consideration of the risk-taking process, one can only assume that all subjects perceived the incentive for risk at the same level. Incentive for turning on the switches were tokens which could be accrued, with a prize being awarded to the subject with the most tokens. All subjects appeared involved in the risk game, but only two subjects inquired about the prize.

The number of bogus trials and the position of the bogus trials in the five-trial sequence might also affect risk-taking performance. The graph showing mean scores on trial five show a leveling-off effect in that reducers and augmenters appear parallel. The bogus trials also represent some ambiguity in presentation. The red light does not occur at the same switch on the bogus trials in the low and high risk condition. In the low risk condition the subject encounters the red light at a sequentially higher switch on trial three, and at a sequentially lower switch on trial four, than the same trials in the high risk condition.

The findings of this study indicate that many factors are involved in the risk-taking process. Perception of risk and kinesthetic perception are related to the subject's willingness to risk. Sex differences, birth order, and

family size appear to influence how much risk an individual may take, but it remains unclear as to how these factors influence the actual perception of risk, and the decision-making process which accompanies risk taking. Kogan and Wallach (1964) approach the aspect of risk as a decision-making process in their independence study. Perceived risk and its measurement appears as a foundation for further risk-taking research.

REFERENCES

Baron, F. Some personality correlates of independence of judgement. Journal of Personality, 1953, 21, 287-297.

Bruning, J. L., & Kintz, B. L. Computational Handbook of Statistics. Glenview, Illinois: Scott, Foresman, and Company, 1968.

Carney, R. E. Risk-Taking Behavior. Springfield, Illinois: Charles C. Thomas, Publisher, 1971.

Coffey, S. D., & Bishop, P. S. Low and high risk-taking behavior as influence by sex differences. Unpublished research, 1973.

Crutchfield, R. S. Conformity and character. American Psychologist, 1955, 10, 191-198.

Eysenck, H. J. A short questionnaire for the measurement of two dimensions of personality. Journal of Applied Psychology, 1958, 42, 14-17.

Fischer, C. H. A comparison on four decision making tasks of the performance and personality characteristics of high and cautious risk subjects. Dissertation Abstracts International, 1971, 32, 556-557.

Gelfand, S. The relationship of birth order to pain tolerance. Journal of Clinical Psychology, 1963, 19, 406-.

Huberman, J. A psychological study of participants in high risk sports. Dissertation Abstracts, 1969, 29, 3667-3668.

Jamieson, B. D. The influences of birth order, family size, and sex differences on risk-taking behavior. Journal of Social Psychology, 1969, 8, 1-8.

Kass, N. Risk in decision making as a function of age, sex, and probability preference. Child Development, 1964, 35, 577-582.

Kogan, N. & Wallach, M. A. Risk-Taking: A Study in Cognition and Personality. New York: Holt, Rinehart, & Winston, 1964.

McClelland, D. C. Studies in Motivation. New York: Appleton-Century-Crofts, Inc., 1955.

O'Toole, A. L. Elementary Practical Statistics. New York: The MacMillan Company, 1964.

Petrie, A. Individuality in Pain and Suffering. Chicago: The University of Chicago Press, 1967.

Petrie, A., Collins, W., & Soloman, P. Pain sensitivity, sensory deprivation, and susceptibility to satiation. Science, 1958, 128, 1431-1433.

Petrie, A., Collins, W., & Soloman, P. The tolerance for pain and for sensory deprivation. American Journal of Psychology, 1960, 73, 80-90.

Rim, Y. Personality and group decisions involving risk. Psychological Record, 1964, 14, 37-45.

Ryan, E. D., & Foster, R. Athletic participation and perceptual augmentation and reduction. Journal of Personality and Social Psychology, 1967, 6, 472-476.

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

Slovic, P. Risk-taking in children: age and sex differences. Child Development, 1966, 37, 169-179.

Stevens, R. R. Sex differences and personality correlates of pain experience. Dissertation Abstracts, 1967, 28, 2633.

Swineford, F. Analysis of a personality trait. Journal of Educational Psychology, 1941, 32, 438-444.

Tajfel, H., Richardson, A., & Everstine, L. Individual judgement consistences in conditions of risk-taking. Journal of Personality, 1964, 32, 550-565.

Table 1.

Analysis of Variance

Source	SS	df	ms	F	p
Total	269.87	119	--	--	--
Between subjects	132.87	19	--	--	--
Groups	20.84	1	20.84	3.35	n.s.
$Error_b$	112.03	18	6.22	--	--
Within subjects	137.00	100	--	--	--
Risk	28.04	1	28.04	28.91	.001
Trials	2.62	2	1.31	1.07	n.s.
G X R	4.79	1	4.79	4.94	.05
G X T	1.51	2	.76	.62	n.s.
R X T	2.81	2	1.41	1.64	n.s.
G X R X T	4.86	2	2.43	2.83	n.s.
$Error_1$	17.50	18	.97	--	--
$Error_2$	43.87	36	1.22	--	--
$Error_3$	31.00	36	.86	--	--

Table 2.

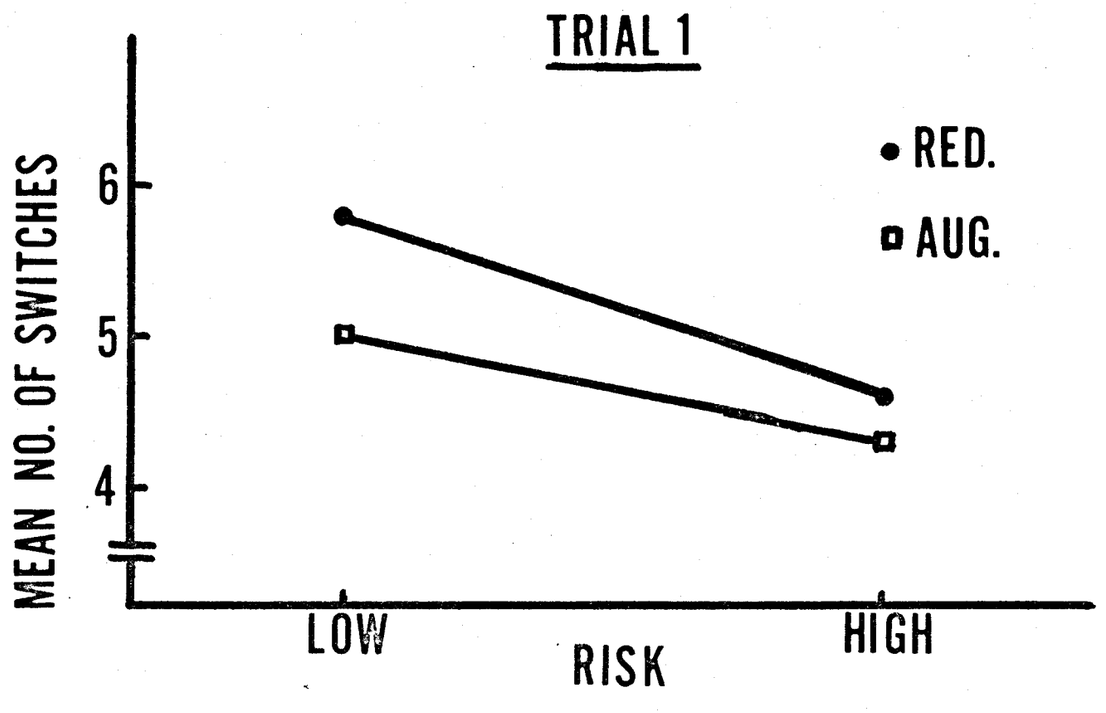
Mean Number of Switches Indicating Low and High Risk Conditions by Subjects Grouped by Sex, Ordinal Position, Sports, and Assessment of Risk

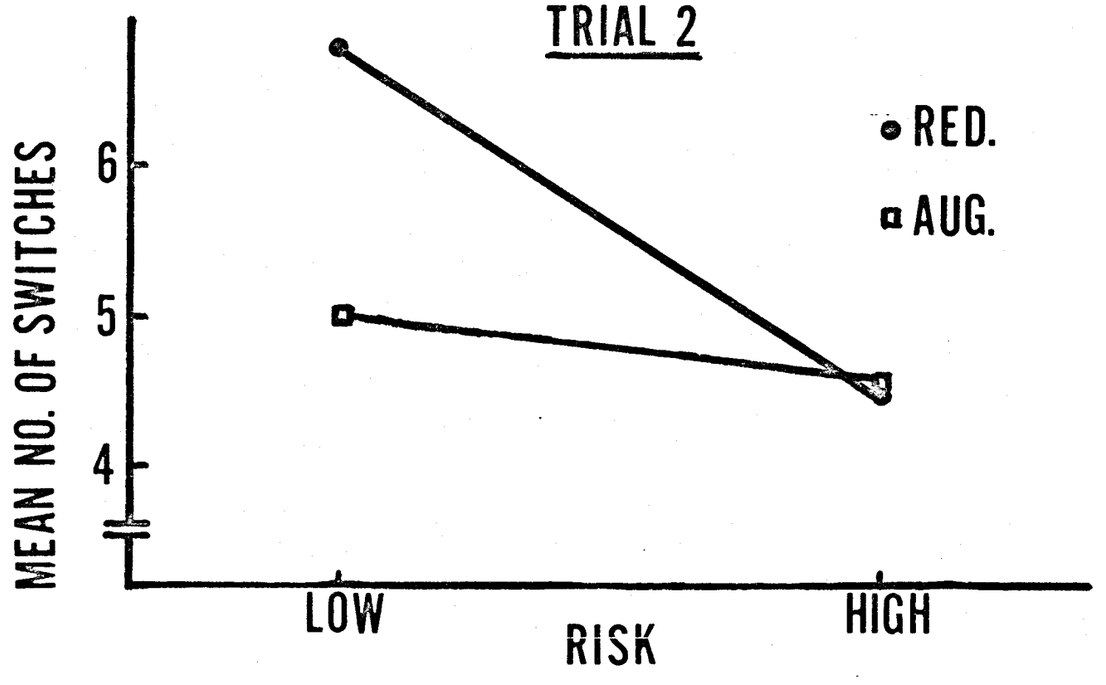
Groups		Low Risk	High Risk
Sex	Males (N=10)	6	4.6
	Females (N=10)	6.4	4.2
Ordinal Position	Only Child (N=4)	6	5.1
	Youngest Child (N=6)	5.5	3.9
	Middle Child (N=3)	5.4	4.3
	Oldest Child (N=7)	6.1	4.6
Sports	Contact (N=8)	6.3	5
	Minimum Contact (N=7)	5.5	3.9
	None (N=5)	6	4.7
Self-Assessment of Risk	Low (N=11)	6.1	5
	High (N=9)	5.8	4
High Risk Takers (N=5)		7.5	5.8
Low Risk Takers (N=5)		4.6	3.1

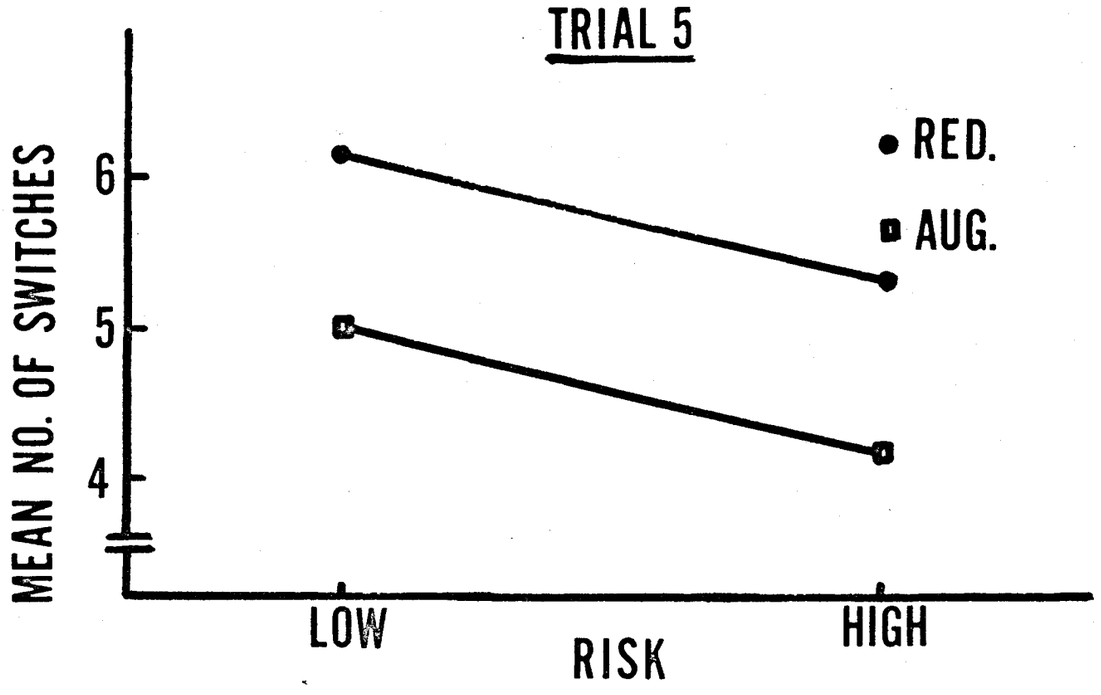
Figure 1.

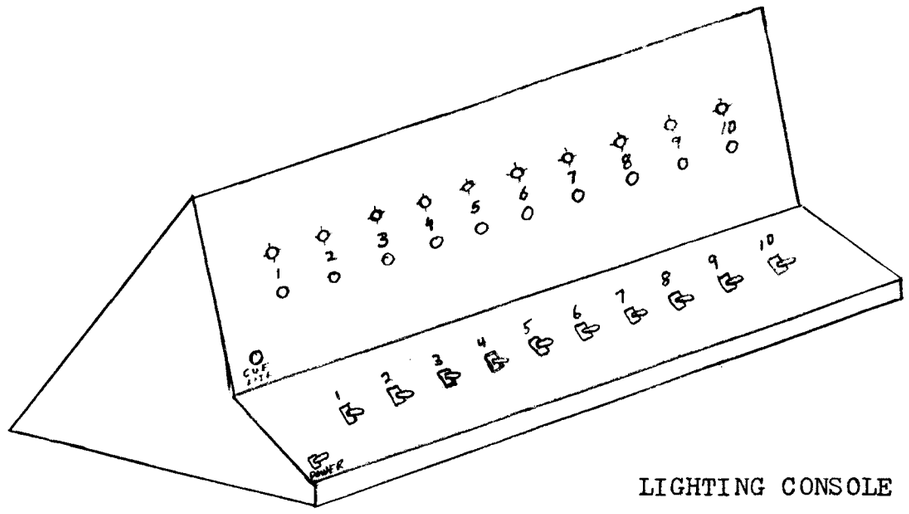
Mean number of switches activated in both low and high risk conditions on three measurement trials by reducers and augmenters.

FIGURE 1

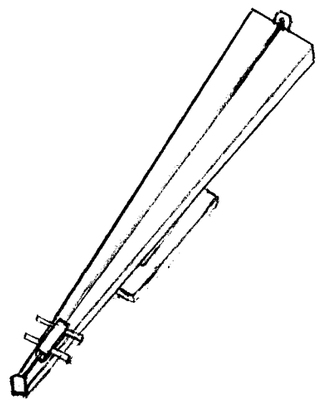




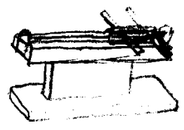


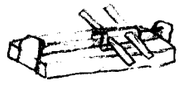


LIGHTING CONSOLE



APPARATUS FOR MEASURING
REDUCTION AND AUGMENTION





Appendix B

Confidential Questionnaire

I. Name?

II. Sex?

III. Age?

IV. Handedness?

V. Father's occupation?

Mother's occupation?

VI. Average family income?

1	2	3	4	5
less than 5,000	5,000 - 10,000	10,000 - 15,000	15,000 - 20,000	Greater than 20,000

VII. Siblings?--total number

Number of older brothers

Number of younger brothers

Number of older sisters

Number of younger sisters

VIII. Participation in sports?

1	2	3	4	5
Never	Very little	Sometimes	Often	Very much

IX. Types of sports?

1.

2.

3.

X. Types of activities? (hobbies, spending of leisure time)

1.

2.

3.

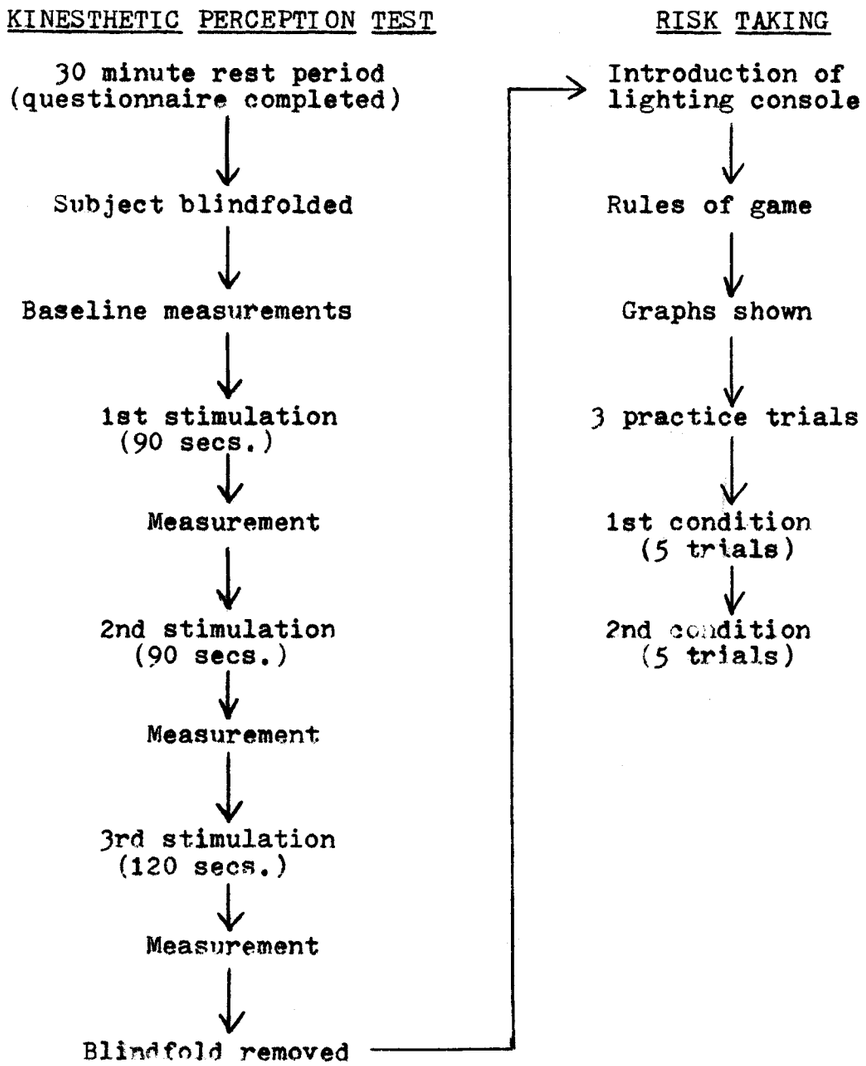
XI. Amount of risk?

1	2	3	4	5
No Risk	A little Risk	Moderate Risk	Much Risk	Great Risk

XII. What experiment will be about?

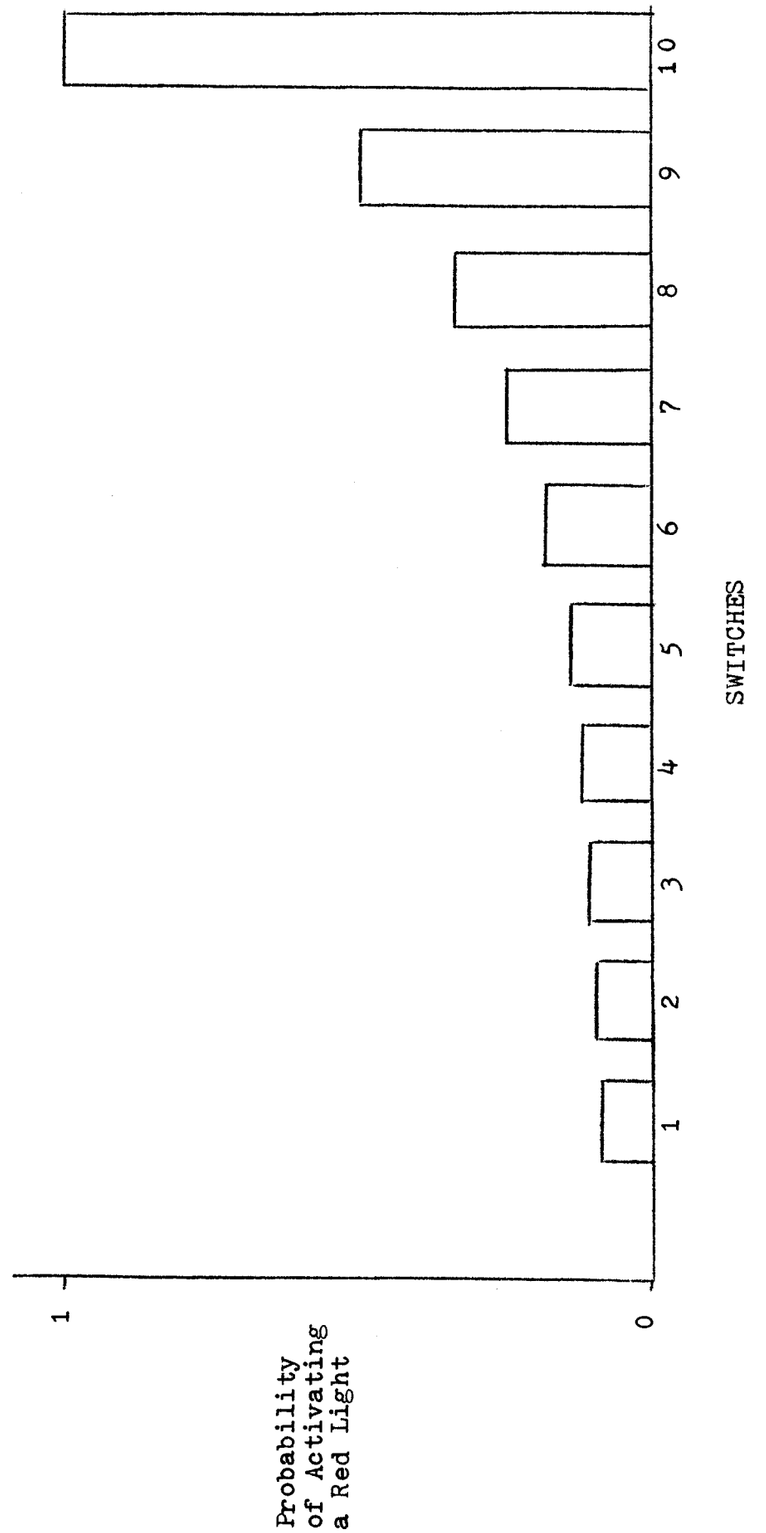
APPENDIX C.

A Procedural Schemata



Appendix D

Bar Graph Representing the Probability of Activating a Red Light on Each Switch if Only One Red Light is Connected



Appendix D

Bar Graph Representing the Probability of Activating a Red Light on Each Switch if Two Red Lights are Connected