The effects of shock punishment associations on the apparent distance of coloured stimuli.

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THE EFFECTS OF SHOCK PUNISHMENT ASSOCIATIONS
ON THE APPARENT DISTANCE
OF COLOURED STIMULI

by
MARY BONNER

B.A. University of Windsor, 1965

A Thesis
Submitted to the Faculty of Graduate Studies
to the Department of Psychology in
Partial Fulfillment of the Requirements
for the Degree of Master of Arts at
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Windsor, Ontario, Canada
1966
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ABSTRACT

This study was an attempt to test the Solley-Murphy hypothesis in an avoidance/no-avoidance paradigm. This hypothesis states that if a perceived stimulus closely precedes some punishing stimulus event and escape or avoidance of the punishing stimulus is possible, then that perceived stimulus will become emphasized in the perceptual field. If no escape or avoidance is possible, then that perceived stimulus will be de-emphasized in the perceptual field. Simple visual stimuli, coloured disks of blue and green, were used as the associated stimuli to accompany shock punishment. The green colour was associated with shock that could be avoided and the blue was associated with shock that could not be avoided.

Three groups of 10 male Ss each participated in the experiment. The experimental group received a training phase of 50 trials of coloured stimuli associated with the shock. The first control group received no training phase at all. The second control group also received a training phase with 50 colour presentations but no shock. In the test phase the Ss of all three groups were asked to judge the apparent distance of the above stimuli as they were moved nearer and farther between two stationary grey standards. Because all the stimulus positions of one colour had to be given first, followed by all the stimulus positions of the other, each of the three groups was divided into two subgroups according to the order of presentation.
The results obtained showed that there were significant differences between the blue and green colours in the experimental group but not in the control groups. However, the change in the experimental group was not a function of the avoidable and non-avoidable shock conditions, as predicted in the Solley-Murphy hypothesis. Instead, there was a significant order effect; that is, whatever colour was presented first was de-emphasized and so appeared consistently farther, and whatever colour was presented second was emphasized and so appeared consistently nearer.
This study grew out of an interest in the reasons why different people perceive the same objects in decidedly different ways. What is it in our personality, in our past experience, and in our present outlook, that makes us accentuate certain objects and barely notice others? Since such questions are not what M. A. theses are made of, the topic had to be vastly reduced in size. The resulting piece of research became an attempt to demonstrate that two colours, which normally appear equidistant, will be seen to differ by people who have had them associated with different conditions.

I would like to express my deep appreciation to Dr. A. A. Smith without whose guidance and lively interest this thesis could not have been completed. I am also grateful for the helpful criticisms and comments of my readers, Dr. J. A. Malone and Dr. E. McNamara, the "brave" participation of my subjects, and the no less brave forbearance of John, my husband, throughout the various moods of this study.
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CHAPTER I

INTRODUCTION

A hundred years of research in physiological optics and perception laid down a firm foundation for the understanding of the senses by which we view our environment. During this time emphasis was placed upon the physical properties of the environment or the universal laws of perceptual responses. All this threw little light on the nature of perceptual distortion and individual differences. It did not elucidate the problem of what conditions the individual to focus on specific aspects of his world to the temporary exclusion of others. In other words, perception was studied as though it were divorced from the total personality of the perceiver and thus it was difficult to explain how a particular individual viewed his environment.

This picture of the perceptual scene, described by Gardner Murphy (1954) in his Introduction to Witkin's Personality through Perception, has undergone considerable change in the last few years. With the "New Look" psychologists and their studies into perceptual defense, there was greater emphasis on the influence of previous associations on perception. Due to the difficulty of studying veridical perceptions in the laboratory, non-veridical or misperceptions were more commonly studied with the hope that they would throw light on veridical perception. There was also difficulty (especially with adult Ss) in producing reward-associated
conditions of comparable intensity to punishment-associated conditions, the latter being more easily accomplished by stimuli such as shock. Thus, a large portion of the literature has dealt with punishment associations on behaviour.

Although the influence of punishment associations on perception is generally accepted now, there is a scarcity of experimental information about the processes by which their influence develops and operates. So far, the experiments in this area have not yielded consistent results.

Allusions have been made to a person's emphasis upon the punished or threatening aspects of a perceptual world. Tolman (1932, p. 344) reported a study by Bretnall and Hall in which Ss learned to move a stylus along a board and punch one of every pair of holes scattered on its surface. They found that the group of Ss who were required to learn to punch the punishment-giving holes and to avoid the non-punishment-giving ones did so more rapidly than groups who were required to punch the non-punished holes and avoid the punished ones.

However, there have been recent studies demonstrating that under certain conditions punished events are underemphasized or perceptually "repressed". In one such study, Dulany (1957) employed avoidance learning procedures to change the comparative recognizability of four geometrical figures presented simultaneously below the threshold of awareness. Using the perceptual defense-vigilance model he had 16 Ss undergo defense training and another 16 Ss undergo vigilance training. During defense training, if the S selected the
critical figure he was shocked. If he selected one of the other three figures he avoided the shock. During vigilance training, selection of the critical figure was instrumental to shock avoidance while selection of any of the other three figures incurred the shock. Fourteen of the Ss in the defense-group found the critical figure less recognizable after this training. Thirteen of the 16 Ss in the vigilance-group found the critical figure more recognizable than before training. In both cases learning proceeded without awareness.

In view of the conflicting evidence the general question facing the experimenter is: "What are the conditions of learning which lead to perceptual emphasis and what are the conditions of learning which lead to perceptual de-emphasis?" (Solley and Murphy, 1960, p.105). The term "perceptual defense", generally associated with this area, was not used in this study. Solley and Murphy (1960, p.106) point out that the term is misleading because "both emphasis and de-emphasis are defenses - hyperacuity can be as defensive as is hypoacuity". Moreover, there was good reason to abandon a term which so far has only led to increasing amounts of controversy.

According to Dulany (1957), much of the confusion is due to the use of linguistic stimuli whose significance to the S is a matter of dispute because the history of the S's commerce with the stimuli is unknown. In other words, the factor of familiarity was not sufficiently accounted for in these studies. Familiarity can be experimentally studied as "learning". Therefore, in typical studies of perceptual
defense, such as that of Walters et al. (1964), taboo words had not been "learned" as well as other words and therefore required greater thresholds for recognition. Seen in learning terms, most of the experiments in perceptual defense consisted of a test phase only with the preceding training phase unknown.

As pointed out previously, the primary need at this point is to specify the conditions under which punishment will tend to accentuate and strengthen an associated perceptual response and the conditions under which associated punishment will tend to disrupt or weaken a perceptual response. As a small step toward meeting this need further, the present study was similar to the work of Dulany (1957) in that it attempted to produce experimentally the learning of perceptual defense or what Solley and Murphy (1960) have termed perceptual emphasis and de-emphasis.

A number of steps have already been made toward a greater specification of the conditions of perceptual learning. Most of these perceptual learning experiments have employed electric shock as the punishment or noxious stimulus and the review of the literature will be restricted to the studies using this variable with human Ss. One of these studies, that of Dulany (1957) has already been described. Another study was done by Ayllon and Somner (1956). They had 30 female Ss associate an electric shock of 50 volts with certain faces, the outlines of which they traced with their index finger. Two of these faces were profiles with an identical contour line, the third was a set-breaking full face. A periodic reinforcement of electric
shock was used to associate punishment with a given profile. During the post-training series, S was blindfolded and asked to identify an ambiguous contour line. The Ss who rated shock as moderately or very unpleasant tended to report the punished face. Those who rated the shock as slightly unpleasant tended to report the non-punished alternative face.

These findings seem to contradict the results obtained by Smith and Hockberg (1954). Here the Ss associated electric shock with two of four faces, all of which were solid rather than in outline, and arranged in such a way that one face could be perceived as figure and the other as ground. In the first experiment with 20 Ss, a significant difference favoring the non-shocked figures was obtained. In the second experiment with 10 Ss, and a change of set, wherein the Ss were asked to identify both of the faces rather than choose one, both faces could be perceived equally well.

Pustell (1957) used the same materials and paradigm as Dulany (1957) except that he presented the "unbearable shock" (determined by self-judgments) 0.2 seconds after the stimulus was given. He also used a reinforcement schedule similar to classical rather than instrumental conditioning. Under conditions of low illumination and short stimulus exposure S made the same series of perceptual judgments before and after training. There was no uniform effect but there was a striking sex difference, with the males tending towards perceptual vigilance and the females towards defense.
Pustell's interpretation of this was that moderately strong anxiety can function as a signal which heightens perception, resulting in vigilance, while the presumably intenser anxiety of the females can function as an unpleasant drive which is reduced by perceptual defense.

Another interpretation of these results arises from the fact that Pustell's male Ss reported that they tried to escape from the shock whereas the female Ss reported that they more or less passively submitted. Solley and Murphy (1960) interpret this in the following way. A percept preceding punishment will come to be a warning sign that pain will follow. If the person can escape the punishment by recognizing the percept he will become alert to the occurrence of the percept. If there is no escape possible the person will tend to "repress" or de-emphasize the punishment associated perception. From the foregoing Solley and Murphy have formulated a general experimental condition for perceptual learning. If a perceived stimulus closely precedes a punishing event and some form or degree of escape from the event is possible, then the perceived stimulus will become dominant over a nonpunished, neutral stimulus; if no escape is possible, then the punishment associated stimulus will become less dominant in the perceptual field.

The above formulation was supported by Reece (1954). He administered strong shock to 70 Ss while they learned a list of paired nonsense syllables. Pronunciation of the response syllable was followed by cessation of shock in the
escape shock group. The no-escape shock group endured the shock for the entire duration of the syllable's exposure on the memory drum. Recognition thresholds of the same syllables were determined on the tachistoscope prior to and after the learning. It was found that the escape shock group showed significantly lower thresholds after learning than the no-escape shock group.

The effects of the previously stated escape, no-escape conditions seem further supported by Bruner and Postman (1947) who considered tension release to be a positive reinforcer. They had adult Ss estimate the size of a metal disk by adjusting a spot of light on a milk-glass screen until it appeared the same size as the disk. Following this phase, they had one group of Ss pass the disk in and out of a metal grid which was electrically charged. The other half of the Ss did nothing during this phase. Following this training phase, size estimations of the disk were taken again. The control Ss showed no change but the experimental Ss now over-estimated the size of the disk. Passing the disk in and out of the charged grid was so difficult that the Ss could not avoid being shocked; however, they could escape by moving the disk rapidly in and out of the grid. However, Bruner and Postman proposed that it was not this shock condition but rather its aftermath, or the period of tension release, which resulted in the overestimation by the experimental Ss. But Solley and Murphy (1960) pointed out that interpretation of these results is difficult because the experimental Ss had more experience with the disk than the control Ss.
McNamara and Long (1958) also tackled the problem of escape and no-escape conditions using the tactual plaques of Ayllon and Sommer (1956). The plaques were tactual profiles of faces which were associated with electric shock administered to the hand not used in tracing the plaque. In Experiment I and III, the shock was temporarily contiguous with the traced profile and in Experiment II, it was given three seconds afterward. In some conditions, the Ss were allowed to escape from shock and in others, they were not. Immediately following the training phase the Ss were blindfolded and traced an "ambiguous" line (which was the identical contour for both the shocked and non-shocked profile), reporting which profile was being traced. Results showed that there was more reporting of the shocked profiles in the escape conditions than in the no-escape conditions. The conclusion was that escape is more likely to lead to emphasis of the shocked profiles than is no-escape.

In view of the above studies, a further refinement of the previous general experimental condition can be stated as follows: If there is no neutral stimulus and all stimuli are associated with punishment, then those stimuli which are associated with punishment that can be escaped will become dominant in the perceptual field over those stimuli which are associated with punishment that cannot be escaped. These punishment conditions can also be studied using an avoidance/non-avoidance paradigm rather than the escape versus no-escape model. As Solley and Murphy (1960) point out, escape training has disadvantages.
in that it sensitizes the organism to make fast motor movements and so disrupts the discrimination process.

The avoidance/non-avoidance paradigm has been employed by Katahn et al. (1965) using a simple auditory stimulus associated with the shock punishment. In its relative simplicity it has an advantage over some of the studies already mentioned which used complicated visual stimuli.

The Ss in this study were 30 female students. For the avoidance group, a 2000 cycle tone was paired with shock (the strongest that could be endured) while the Ss performed on a learning task. The task apparatus consisted of a matrix of buttons. The tone was the signal for the S to press some combination of two buttons on the matrix. When the S discovered the correct combinations she received three or four shock free trials by pressing the same buttons in response to the tone signal. When the shock began again, S was to search for some other combination of buttons through which she could avoid shock for another three or four trials.

The S continued in this way until a total of 60 shocks was received.

In this study, there were two types of non-avoidance groups. In the first group, Ss performed on a learning task with shock following every response for 60 trials. In the other group, the learning task was not used. The Ss in this group received 60 presentations of the tone followed immediately by shock. Two types of control groups were also used. In one group, Ss received 60 presentations of the tone, no shock, and did not perform on the learning task.
This group was included for increased familiarity with tone. The other control group received 30 trials of shock alone, 60 tone presentations and another 30 shocks. The learning task was not used. This group was included to control for the effect of shock on tone thresholds when shock is not paired in a meaningful or conditioning relationship with tone.

Previous to, and immediately after the various treatments, thresholds for the tone were determined using the mean of 10 ascending Method of Limits trials. The avoidance group exhibited decreased thresholds for the tone following the experimental treatment compared with their own pre-treatment thresholds. Both of the no-avoidance groups exhibited higher thresholds while controls showed little change. While the mean difference between the avoidance and non-avoidance conditions was relatively small, Ss were highly consistent in the direction of change. Katahan et al. concluded that apparently a sensitization effect or "emphasis" occurred as a result of the avoidance treatment, while some form of desensitization or "de-emphasis" had resulted from the non-avoidance treatment.

Purpose of the Study

The present study was a similar attempt to test the Solley-Murphy condition or hypothesis with an avoidance/non-avoidance paradigm. It was concerned with testing this hypothesis in a depth perception situation. The particular stimuli chosen were two disks, green and blue, which had been used in a previous study of the effects of
hue and saturation on distance judgments (Stelmack, 1965).

The idea for the study grew out of enquiries made in the former study regarding the colour preferences of the Ss. After the experiment, the Ss were asked to indicate which colours they liked best. It had been thought that there might be some relationship between liking and disliking a colour and judging its apparent distance. Results of the enquiries had indicated a low negative rank order correlation between colour preferences and the "hearer" appearing targets.

However, these previous enquiries were similar to studies in perceptual defense when little could be said about the conditions by which the perceptual differences came about. The present study was an attempt to produce experimentally conditions that would change perceptual responses to colours. To do this, it was necessary to find stimuli that originally evoked similar responses so that any subsequent changes could be attributed to the experimental manipulation. Because the P.S.E.s for the blue and the green disks did not differ significantly in Stelmack's study (1965), under similar illumination conditions, they provided ideal stimuli for the present research.

The particular perceptual change to be studied was the change in the "nearness" or "farness" of these colours. Blue was associated with a non-avoidance shock condition and green was associated with an avoidance shock condition. According to the Solley-Murphy hypothesis, it was predicted that the green colour, which had served as a signal for the
avoidance of shock, would become more dominant in the perceptual field and so appear nearer, while the blue, which had been associated with a non-avoidance shock, would become less dominant and so appear farther away. In Solley and Murphy's terms, if the colour appeared nearer it was "emphasized", and if it appeared farther away it was "de-emphasized". This hypothesis can be stated diagrammatically by the following:

Avoidance → Emphasis → Sharp Outline → Brighter → Nearer → More Saturated

No-Avoidance → De-emphasis → Blurred Outline → Dimmer → Farther → Less Saturated

Beginning at the left of the above diagram, the "avoidance" and "non-avoidance" represent the experimental conditions and the "emphasis" and "de-emphasis" the hypothesized reaction. Operationally, "emphasis" is defined as that reaction in which the colour appears sharper in outline, brighter and more saturated. "De-emphasis" is defined as that reaction in which the colour appears blurred in outline, dimmer and less saturated.

Research in colour perception, such as the study of Stelmack (1965), has shown that these latter qualities result in a judgment of the coloured object as "nearer"; the former qualities result in a judgment of the coloured object as "farther".
CHAPTER II

METHOD

Subjects.

The subjects in this study were 30 male students between the ages of 18 and 25 at the University of Windsor. Males were chosen because it was felt that they were generally less experienced with colours and thus individual differences would be reduced. Prior to the experiment, the Ss were tested and screened for normal visual acuity and stereopsis with the Bausch and Lomb orthorator.

Apparatus.

Limitations in adapting the available equipment necessitated the use of two separate pieces of apparatus, one for training phase and one for the test phase. The test phase was run on the apparatus described in detail by Stelmack (1965). Essentially it was a rectangular wooden box, 4 ft. (vertical) by 8 ft. (horizontal), with the horizontal axis supported 3 ft. from the floor. A 20 in. by 10 in. opening was cut in the front to provide for a reduction screen. This was opened and closed by a pulley-operated shutter. Through this was seen the inner surface of the back end which was pierced by 3 holes, 1 in. in diameter, ¼ in. apart from centre to centre along a horizontal line. Through these holes were passed long dowels tipped with the coloured stimuli, ½ in. circles of Munsell paper.
The two outer dowels were fixed and carried neutral grey reference stimuli of Munsell value 6. The inner, moveable dowel carried the coloured test stimuli, a blue target of Munsell notation 10B 10/6 and a green target of Munsell notation 5 G 10/6. The coloured and grey stimuli were thus matched for brightness and the two coloured stimuli were matched for both brightness and saturation.

The inner surface of the back of the box was covered with black velvet to provide a non-reflecting background. The walls and foreground were painted a flat white. The illumination within the apparatus was supplied by 100 watt clear incandescent bulbs (G.E. 100A/1CL) which gave a close approximation to Illuminant A. Similar lamps were mounted externally in front and behind the reduction screen. The S sat behind a viewing screen which was placed before the apparatus so that the distance from the eye position to the stimuli was 1 1/2 ft. This viewing screen was fitted with a viewing hood with special Corning colour-temperaturealtering filters which gave the effect of viewing under Illuminant C for which the Munsell scale are calibrated. Schematic diagrams of the physical arrangements are presented in Figures 1 & 2.

The stimulus targets themselves were two of the ones used by Stelmack (1965). They were cut from Munsell paper and cemented to metal disks, 1 in. in diameter, coupled to a thin metal rod projecting 1/8 in. from the wooden dowel. Calibrated slots in the centre moveable dowel permitted accurate positioning at 1/8 in. intervals in front of and
Fig. 1. Schematic diagram of apparatus, side view.

1. Stimulus target 2. interior lamps 3. exterior lamps 4. shutter
Fig. 2. Schematic diagram of apparatus, top view.

1. Stimulus targets  2. interior lamps  3. exterior lamps  4. shutter
behind the fixed standard targets. These standard targets defined a reference plane at right angles to the line of sight and 18 in. in front of the back surface. Two standard targets were used instead of one to control for ocular dominance.

The power supply to the lamps was switched through a Hunter timer (model 111C) for control of exposure time. The interior lamps illuminating the stimulus targets provided a three second exposure and the exterior lamps lighting the exterior area for the inter-trial period a five second illumination.

The other apparatus used for the training phase was a modified Gerbrands tachistoscope. Here the standard stimulus holders were replaced by thin steel plates, faced on the inner viewing surface by black velvet and pierced with a \( \frac{1}{2} \) in. diameter circular aperture in the centre of each plate. The stimuli were cut from the same Munsell papers as those used in the depth apparatus and were held over the apertures by small magnets. The diameter of \( \frac{1}{2} \) in. effected an approximate retinal image of the disks used in the depth apparatus.

The standard fluorescent lamps of the tachistoscope were replaced by 100 watt clear incandescent bulbs controlled by a Hunter timer. Corning colour-temperature altering filters, similar to those in the depth apparatus were placed in front of the viewing apertures. The timer also controlled a small battery operated shock device which produced
shock at the moment the coloured stimulus disappeared. In front of the S there was a small press switch. The shock electrodes were coupled to the shock generator through the button and an associated switching network in such a way that on certain trials S could avoid receiving the shock by pressing and holding the button; on other trials, shock was felt whether or not the button was pressed.

Procedure.

The experimental procedure consisted of two phases. The first phase was the treatment phase using the tachistoscope. The S received 25 presentations of each of the coloured stimuli, green and blue, given in random order. By means of the switching apparatus, green was always followed by shock which could be avoided by the S pressing and holding the button in front of him. Blue was always followed by shock which could not be avoided whether the S pushed the button or not.

Due to the limitations of the shock apparatus, the intensity of the shock could not be calibrated. Therefore, during the experiment it was varied over a small range previously found to be anxiety-producing for five male "judges" among the graduate students.

The procedure in the treatment phase for the experimental group was as follows: The S was seated in front of the tachistoscope and the two shock electrodes were attached to his fingers. The following instructions were given:
Please make yourself comfortable. This part of the experiment will involve some administration of shock. The shock is not set up to produce any real pain. You should also know that there is absolutely no danger involved. The shock apparatus is not connected to any power supply but is run by two batteries. The shock will be given to you through these metal clasps which I'm putting on your fingers.

The experiment will run as follows: In between trials you will see a grey disk. With each trial this grey disk will change to either a green or a blue disk. At the end of three seconds the colour will go off and you will be given a shock. You will be able to avoid some of these shocks by pressing the button in front of you and holding it down. It will be up to you to find out when you will be able to do this. As each colour comes on would you also name it.

The second or test phase followed immediately after the treatment phase. The S was brought into another room and seated in front of the depth perception apparatus. The instructions were then given as follows:

Please sit up as close as you can to the eyepiece. When the curtain is lifted you will see three disks on a horizontal plane. The two outside disks are at the same distance from you. Your task is to judge within a few seconds whether the disk in the centre is nearer or farther from you than the disks on the outside. You must say "nearer" or "farther" even if you think they are equal.

The stimuli were then presented according to the Method of Constant Stimuli. This method was used by Stelmack (1965) and has been shown to be generally superior to both the Method of Limits and the Method of Adjustments (Siegel, 1962). In this case, the method consisted of 50 presentations of one colour followed by 50 presentations of the other. For each colour, there were ten presentations at each of five stimulus positions: 9", 9.5", 10", 10.5" and 11", with 10" representing the equal position. All the positions of one colour were presented first, followed by all the positions of the other because the limitations of
the apparatus did not permit a mixed presentation. Thus, in order to eliminate a practice effect, one half of the subjects in each treatment group received blue first and the other half received green first. Thus, there were two subgroups, Order I (blue first) and Order 2, (green first) in each of the treatment groups.

Each setting was exposed for three seconds in which time the S was able to reply either "nearer" or "farther". This forced choice was felt to be appropriate because it has been found that the measurement of points of subjective equality (P.S.E.'s) is more precise without an "equal" category. In other words, it is easier for Ss to decide on a judgment whenever the response dimensions are reduced (Siegel, 1965). The number of settings was also reduced from seven to five upon a suggestion from Stelmack (1965) who found seven unnecessary for discrimination.

While the settings were being made the stimuli were hidden from view by the shutter in the front of the apparatus. During this time the exterior lights (Figure 1) were on to maintain daylight illumination. When the setting was ready, the exterior lights went off as the interior lights came on and the illuminated target was exposed to the S.

In addition to the experimental group, there were two control groups. The first control group, (Control I),

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1 As in a study by Mount (1956), conditions were intended to approximate normal viewing conditions so that any results could generalize more easily to practical problems.
received the test phase on the depth apparatus only. The second control group, (Control II), received the test phase preceded by a treatment phase which was the same as that of the experimental group except that no shock was administered. The instructions for this group were:

This part of the experiment will run as follows: In between trials you will see a grey disk. With each trial this grey disk will change to either a green or a blue disk. All you have to do is watch the coloured disks as they come on and name the colours.

This Control II group was included to control for the effects of having observed the colours previously at close range before the test phase.

Control by means of these two groups described above was decided upon as an alternative to the design used in pilot studies in which the experimental Ss acted as their own controls. This was done by means of a test phase on the depth perception apparatus before and after the treatment phase. Ten Ss were run according to this procedure and although their results did indicate some change it was found to be insignificant. This was tentatively attributed to the fact that the training and test phases were given in two different rooms, using two different pieces of apparatus. It seemed probable that the Ss were more inclined to associate the two similar test phases rather than a dissimilar treatment phase and its subsequent test phase.

Another modification of the pilot study design was a foregoing of the evaluations of the shock by the Ss after the experiment was over. For this evaluation, three choices were given: Moderate, moderately strong and strong, but it
was found that the Ss' evaluations did not show sufficient variation to warrant further enquiry.
The points of subjective equality (P.S.E.s), for both green and blue colours were calculated for each S on the basis of his "nearer" and "farther" judgments. The P.S.E.s were the points at which the S judged the comparison stimuli to be nearer than the standard stimuli fifty per cent of the time. In other words, this was the same as determining the points at which the S judged the comparison target equal to the standard targets. These points were determined by the following procedure. The per cent "nearer" responses for each of the five stimulus positions was tabulated and then converted to Z scores. Using the method of average Z scores as outlined in Woodworth and Schlosberg (1954, p. 205), the P.S.E.s were then determined.

The method of average Z scores was felt to be an adequate technique because in the previous study by Stelmack (1965) the differences obtained by using this technique and the more cumbersome and refined Least Squares Method were negligible. Besides, the per cent "nearer" judgments given for each stimulus position were not of the required homogeneity for an appropriate use of this method. There were too many cases in which there were 100 per cent "nearer" or "farther" judgments. These responses were omitted from the calculations because they represent "infinity" which is not a determinate value. The sample computation for one
target is presented in Appendix A. This appendix also shows the graphical computation of the P.S.E.s.

Table 1 presents the mean P.S.E.'s for each of the three treatment groups Experimental, Control I and Control II and their subgroups Order 1 and Order 2.

Table I

Mean P.S.E.'s for blue and green in the three treatment groups and two order subgroups.

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Control Group I</th>
<th>Control Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Green</td>
<td>Blue</td>
<td>Green</td>
</tr>
<tr>
<td>Order 1</td>
<td>10.46</td>
<td>9.62</td>
<td>10.06</td>
</tr>
<tr>
<td>Order 2</td>
<td>10.09</td>
<td>10.68</td>
<td>10.19</td>
</tr>
</tbody>
</table>

The mean P.S.E's which appear in Table I are plotted graphically in Figure 3. The numbers along the ordinate represent the settings along which the dowel was moved. Below the 10" position the disks were physically farther; above this position the disks were physically nearer. The points indicate the P.S.E's at which the disks appeared to be equal. Thus, the higher the P.S.E's rise above the 10" position, the farther away the disks appeared because they had to be pushed physically nearer to appear equal. Conversely, the lower the P.S.E's fall below the 10" position, the nearer the coloured disks appeared because they were physically farther when they were judged equal.

The differences between the P.S.E's for the various
Figure 3. Mean P.S.E.s for blue and green in the three Treatment groups and two Order subgroups.
groups were analyzed to assess which differences were significant. The analysis of the variance for the judged nearness of blue and green, according to the three treatment groups and two order subgroups, is presented in Table 2. Raw data are presented in Appendix B.

Table 2

Analysis of Variance for judged nearness of two Colours by three Treatment groups and two Order subgroups.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>F ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order (O)</td>
<td>.57</td>
<td>1</td>
<td>.57</td>
<td></td>
</tr>
<tr>
<td>Treatment (T)</td>
<td>.71</td>
<td>2</td>
<td>.36</td>
<td></td>
</tr>
<tr>
<td>O x T</td>
<td>.17</td>
<td>2</td>
<td>.09</td>
<td>.45</td>
</tr>
<tr>
<td>Within</td>
<td>4.82</td>
<td>24</td>
<td>.20</td>
<td></td>
</tr>
<tr>
<td>Within subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour (G)</td>
<td>.02</td>
<td>1</td>
<td>.02</td>
<td>1</td>
</tr>
<tr>
<td>O x C</td>
<td>.67</td>
<td>1</td>
<td>.67</td>
<td>33.5 *</td>
</tr>
<tr>
<td>T x C</td>
<td>.02</td>
<td>2</td>
<td>.01</td>
<td>2</td>
</tr>
<tr>
<td>O x T x C</td>
<td>1.73</td>
<td>2</td>
<td>.87</td>
<td>43.5 **</td>
</tr>
<tr>
<td>Within</td>
<td>.42</td>
<td>24</td>
<td>.02</td>
<td></td>
</tr>
</tbody>
</table>

* $F_{.05} (1, 24) = 7.82$
** $F_{.01} (2, 24) = 5.61$

In this table, the Order (O) represents the two order subgroup: one in which all of the blue stimuli were presented first and the other in which all of the green stimuli were presented first. Treatment (T) represents the three
treatment groups: the experimental group, the Control I group and the Control II group. Colour (C) refers to the blue and green colours.

Examination of the table illustrates the following. The assessment of the effects of the treatments on the colours is indicated in the "within subjects" section by T x C. Following across, it can be seen that the obtained F ration, 2, is not significant which means that there were no significant differences in the effects of the treatments on the perceptual judgments of the blue and green colours. However, following across from O x C and O x T x C the obtained ratios are highly significant, indicating that there are differences resulting from the order of presentation. Inspection of Figure 3 indicates these differences, resulting from the interaction of the order of presentation, in the first treatment or experimental group. This interaction effect was statistically evaluated by an analysis of variance on the simple interaction effects of Order and Colour for the three Treatment groups. This analysis is presented in Table 3.
Table 3

Analysis of Variance on the simple interaction effects OC, Order and Colour for the three treatment groups.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df.</th>
<th>Mean Squares</th>
<th>F ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC for $T_1$</td>
<td>2.55</td>
<td>1</td>
<td>2.55</td>
<td>23.18 *</td>
</tr>
<tr>
<td>OC for $T_2$</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>OC for $T_3$</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* $F_{.99} (1,24) = 7.82$

The results of this analysis indicate that there was a highly significant Order effect on Colour in the experimental group but no such effect in the other two Control groups. In other words, the experimental group who had the green and blue colours associated with the avoidable and non-avoidable shock did differ in their perception of these colours in the test phase. However, the perceptual change, the apparent nearness or emphasis of one colour, and the apparent farness or de-emphasis of the other, did not occur according to the particular associated shock condition. Instead, whichever colour was presented first in the test phase appeared farther or was de-emphasized, and whichever colour was presented second appeared nearer or was emphasized.
CHAPTER IV

DISCUSSION

The foregoing results indicate that the punishment associations did affect the perceived distance of the coloured stimuli. However, as pointed out in the previous chapter, the differences did not occur as a function of the particular associated shock condition, avoidance or non-avoidance. The nearness and farness, or the emphasis and de-emphasis of the colours, was determined by the order of presentation rather than the differing shock conditions.

However, since there was no order effect in either of the control groups it was inferred that it was the associated shock conditions that caused this order effect to appear. It seemed that both colours had acquired the same type of unpleasant association because the Ss in Order 1 (blue first) perceived the blue as being farther away and the Ss in Order 2 (green first) perceived the green as being farther away. In other words, whichever colour was presented first was de-emphasized. However, this de-emphasizing effect was immediate and shortlived so that by the time the second colour was presented a different effect was observed. The Ss now perceived the second colour as being significantly nearer. Thus, whichever colour, was presented second was emphasized.

However, this emphasis was not the same in both Order subgroups. In the Order 2 group (green first), the second
colour, blue, appeared to be emphasized in comparison with the green in the same group. However, in comparison with the two control groups, there was no significant difference. According to Ittelson and Kilpatrick (1952), repeated practice in a situation of perceptual distortion can correct for the illusion effect. It appeared that in the Order 2 group repeated practice corrected the induced perceptual change. However, in the Order 1 (blue first) group the second colour, green, was not only emphasized in comparison to the blue, but was also significantly emphasized in comparison to the second colour in the control groups. Here repeated practice seemed to result in a compensatory rather than a correction effect.

From the above it can be seen that the perceptual changes did not occur according to the Solley-Murphy hypothesis, that is, as a function of avoidable or non-avoidable shock conditions. In addition to the possibility of the confounding effects of a test procedure in which all the stimulus positions of one colour were presented first, followed by all the positions of the other, several other reasons can be offered for the fact that the Solley-Murphy hypothesis was not upheld. One is that the shock itself was not strong enough. Previous studies generally used a more severe shock. In Dulany's study (1957), the shock was set for each S at a level which he judged to be "just this side of beyond endurance". In Nyllon and Sonner's study (1956), some Ss reported the shock as very unpleasant. Pustell's shock (1957) was described as "unbearable", Reece's shock (1954) was turned
"strong" and in the study by Katahn et al. (1965), the shock was described as "the strongest that could be endured". By contrast, in the present study, all Ss reported the shock as "moderate" to "moderately strong" when it was varied over a range extending to its fullest capacity.

More consistent results might have been obtained if the treatment phase had been carried out with less awareness, on the part of the Ss, of the association of a particular shock condition with a particular colour. Solley and Murphy (1960, p.283) point out that it appears that maximal "autistic" perception is obtained if the reinforcement or punishment stimuli are barely in awareness. They suggest that when this occurs the perceptual materials are being linked with "primary process" mechanisms, whereas when the stimuli are well into awareness, then, secondary processes are more active. Therefore, awareness of being rewarded or punished prevents a conscious association between perceptual material and reinforcement stimuli, arousing resistance to perceptual alteration. None of the previous studies did take this factor into consideration. Dulany (1957) pointed out that in both the defense and vigilance groups learning proceeded subliminally and therefore without awareness. Pustell (1957) also had his Ss make their judgments under conditions of low illumination and stimulus exposure time below the Ss' conscious threshold. In the study by Katahn et al. (1965), Ss performed a learning task in which they had to press correct combinations of buttons in order to actually avoid the avoidable shock. The associated stimulus, tone, was given as they performed on this task. Thus, their attention, being largely absorbed in the task, was never
fully on the tone-shock association. In contrast to these studies, the present study required no learning of combinations but merely the pressing of one button to avoid the shock. As a result, there was specific focusing of the S's attention on the colour-shock associations which might have aroused resistance to perceptual alteration as previously described.

Through necessity, two different rooms and two pieces of apparatus were used for the training and test phases. This procedure resulted in a "break" in the tension for the S, since in moving from one room to the other some contact with other people, not involved in the experiment, was frequently unavoidable. A greater association between these two phases may have resulted if both had been given without interruption on the same apparatus.
CHAPTER V

SUMMARY

This study was an attempt to test the Solley-Murphy hypothesis of the emphasis and de-emphasis of stimuli, previously associated with certain punishment conditions. Basically this hypothesis states that if a perceived stimulus closely precedes some punishing stimulus event, and escape or avoidance of the stimulus is possible, then that perceived stimulus will become dominant in the perceptual field; if no escape or avoidance is possible, then that perceived stimulus will become less dominant in the perceptual field. These effects are labelled perceptual "emphasis" and "de-emphasis" by Solley and Murphy.

The procedure consisted of two phases. During the first phase, using a tachistoscope, the experimental group associated the colour blue with shock that could not be avoided and the colour green with shock that could be avoided. In the second or test phase, using a depth perception apparatus, the experimental Ss judged the distance of these same colours as they were moved nearer and farther between fixed targets along certain pre-determined stimulus positions. The psychophysical method employed was the Method of Constant Stimuli.

A first control group was given the test phase only. A second control group was also given the tachistoscope
phase first, the same as the experimental group, except that no shock was given to effect colour associations.

In the experiment there were three groups of 10 male Ss each, forming the experimental group and two control groups as described above. In the test phase the limitations of the depth perception apparatus made it necessary to present all the stimulus positions of one colour first followed by all the stimulus positions of the other. In order to control for an order effect each of the three groups was divided into two subgroups, the first receiving all the blue first and the second the green.

The P.E.E.s obtained from the test phase showed that there were significant differences between the blue and green in the experimental group but not in the control groups. However, this change in the nearness and farness of the colours did not occur according to the type of associated shock condition, avoidable or non-avoidable. Instead, whichever colour was presented first appeared farther, and so was de-emphasized, and whichever colour was presented second appeared nearer, and so was emphasized. This order effect in the experimental group was significant at the .01 level of confidence. No such order effect was observed in either of the control groups.
APPENDIX A

SAMPLE COMPUTATION OF THE P.S.E.

A sample computation of the P.S.E.s for blue and green for one subject in the experimental group, subgroup, Order 1.

<table>
<thead>
<tr>
<th>Stimulus Positions</th>
<th>Per cent nearer responses</th>
<th>Z scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.5</td>
<td>10</td>
<td>1.28</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>-.53</td>
</tr>
<tr>
<td>10.5</td>
<td>50</td>
<td>0.52</td>
</tr>
<tr>
<td>11</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>9.5</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>40</td>
<td>-.25</td>
</tr>
<tr>
<td>10.5</td>
<td>80</td>
<td>.84</td>
</tr>
<tr>
<td>11</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

The points from the above table were then plotted graphically; -.90 and +.26 were joined to plot the blue colour judgments and -.08 and +.48 were joined to plot the green colour judgments. The stimulus positions at which the lines crossed the Z=0 line, 10.55 and 9.65, were then considered as the P.S.E.s for the respective colours. This graphical computation of the P.S.E.s is found below.

Graphic computation of the P.S.E.s for blue and green for one S in the experimental group, subgroup Order 1. (Reduced in size from graphs used in actual computation)
**APPENDIX B**

Table of raw data - P.S.E.'s of both colours for each of 30 Ss in each of the three treatment groups and two order subgroups.

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Control I</th>
<th>Control II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blue</td>
<td>Green</td>
<td>Blue</td>
</tr>
<tr>
<td>10.55</td>
<td>9.65</td>
<td>10.25</td>
<td>10.00</td>
</tr>
<tr>
<td>Order 1</td>
<td>10.90</td>
<td>10.15</td>
<td>10.05</td>
</tr>
<tr>
<td>(Blue First)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td>9.00</td>
<td>9.80</td>
<td>10.15</td>
</tr>
<tr>
<td>10.35</td>
<td>9.75</td>
<td>10.35</td>
<td>10.25</td>
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<tr>
<td>10.15</td>
<td>10.90</td>
<td>10.25</td>
<td>10.00</td>
</tr>
<tr>
<td>9.60</td>
<td>10.00</td>
<td>10.00</td>
<td>10.10</td>
</tr>
<tr>
<td>Order 2</td>
<td>10.45</td>
<td>10.75</td>
<td>9.95</td>
</tr>
<tr>
<td>(Green First)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.90</td>
<td>10.75</td>
<td>10.35</td>
<td>10.40</td>
</tr>
<tr>
<td>10.35</td>
<td>11.00</td>
<td>10.40</td>
<td>10.30</td>
</tr>
</tbody>
</table>
ABSTRACT


VITA AUCToris

1943  Born in Riga, Latvia, to Kasimir and Karina Zostins.

1949-65 Educated at Blessed Sacrament Elementary School and Ursuline College, Chatham; St. Francis Xavier University, Antigonish, N.S. and University of Windsor, Ontario.

1965  Graduated with Honours B.A. in Psychology, University of Windsor, Ontario. Registered as full-time graduate student at the University of Windsor.