Temporal Stimulus Generalization in Humans

A thesis submitted in partial fulfilment of the requirements for the degree

of

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at the

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by

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The University of Waikato

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Abstract

Two experiments investigated temporal generalization in humans using a computer based task which presented red dots with a range of lines at different angles and durations. After training with a standard S+ stimulus duration, generalization testing commenced with an asymmetrical series of presentations of lines of varying angles and durations.

Experiment 1 had four conditions, with a standard S+ duration being the presentation of a red dot for a fixed duration. Two of the conditions had the addition of the line tilt. In Experiment 1, 11 participants produced a peak shift effect in all four conditions.

Experiment 2 was the same as Experiment 1 except that there were two conditions. Condition 2 was the same as Condition 1 except that the participants were given a verbal instruction to think of the line tilt as if hands on a clock. All 9 participants produced a peak shift effect in both conditions.

In Experiment 2, the effect of categorising the stimuli and in turn changing the stimuli from a continuous dimension to discrete stimuli (one in which could be labelled) and the verbal instruction of to think of the line tilt as if hands on a clock did not have an effect on the peak shift as predicted.

The results for both experiments were in accordance with predictions of adaptation level theory.

Acknowledgements

I wish to thank my supervisors Dr Lewis Bizo and Dr James McEwan who have been extremely patient with me and understanding – thanks James for your sense of humour. I am grateful to all my friends and family who have supported me through this journey and I especially want to thank my daughter Jacqueline who was the inspiration behind wanting to study psychology and how to help our children grow strong, resilient and as healthy as can be.

Ethical Considerations:

Formal approval for this research was granted by the Research Committee of the Psychology Department of the University of Waikato. Consent was given to work with humans 2012:27 and each participant gave written consent.

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Introduction

In the study of learning two key concepts are discrimination, telling things apart and generalization, treating different things the same. More particularly generalization is when presented with a new stimulus similar to the original stimulus, the same responses occur.

A way to measure generalization or perceived similarity is to do a generalization test. In a typical generalization test a stimulus is presented and associated with a particular response. For example when presented with a circle the hen is trained to peck on the left key. When presented with an elipse a peck on the left key would indicate generalization from the circle to the elipse.

Generalization can occur across a range of different stimuli including the frequency of sounds, intensity of light and duration, typically the duration on which a stimulus is presented. Temporal generalization is studied by first reinforcing responding after the presentation of a target stimulus duration (S+) and not reinforcing after shorter or longer stimulus durations. Temporal generalization testing is done by presenting a range of durations whose length varies symmetrically around the S+ and having the participant report whether the stimulus is the S+ or not.

Results from such a study are typically presented using a so called generalization gradient. Such a gradient has the stimulus presentation duration plotted against the number of times the participant reported that the S- stimulus was the S+. The number of S+ responses declines symmetrically with the increase in difference between the magnitude of S+ and S-. The degree to which the participant can tell the difference between the S+ and S- is reflected in the steepness of the generalization gradient and is a way of measuring stimulus control.

On some occasions we see the peak not at the expected value, centred on the S+, but is displaced to a larger or smaller value (peak shift). This displacement is typically produced by training in which responding is reinforced in the presence of or after the presentation of the stimuli (S+) and is not reinforced in the presence of or after the other stimuli (S-). Subsequent generalization testing would produce a generalization gradient with a peak displaced from the S+ stimulus to another stimulus in a direction further from the S- than from the S+ (Hanson, 1959) as shown in Figure 1 by Bizo and McMahon (2007) below.

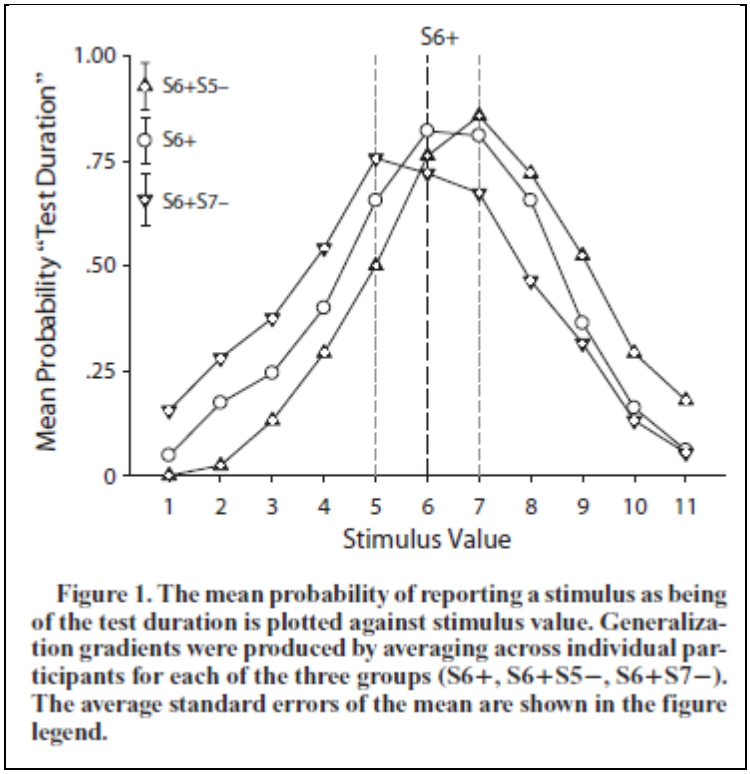


Figure 1. The mean probability of reporting a stimulus as being of the test duration is plotted against stimulus value. Generalization gradients were produced by averaging across individual participants for each of the three groups (S6+, S6+S5−, S6+S7−). The average standard errors of the mean are shown in the figure legend.

Figure 1. Reproduced from Bizo and McMahon (2007).

There have been a number of accounts of this peak shift phenomenon. Spence's theory of inhibitory and excitatory gradients is one popular explanation (Spence, 1937). Rewarding participants in the presence of the S+ produces an excitatory gradient forming around the S+ wheres ignoring S- during training produces an inhibitory gradient around the S- (Spetch and

Cheng, 1998). Spence argues that the summation of the gradients produces a peak shift effect. Spence's (1937) gradient summation theory explains the discrimination learning where the interaction between (S+) and (S-) results in an excitatory gradient forming around the S+ and an inhibitory gradient forming around the S- (Spech & Cheng, 1998). The peak shift is presumed to result from the summation of the gradients and ends up with a higher excitatory value (Spetch & Cheng, 1998). Spence's gradient interaction model predicts a negative relationship between the amount of separation between the S+ and S- and the amount of peak obtained (Thomas et al, 1991). Spence's theory has not been as successful at accounting for the data produced by humans and also fails to consider the possible effect of the S- stimuli presented during testing (Bizo & McMahon, 2007).

A theory more relevant to humans is Thomas (1993) adaptation level account based on an alternative relational account. It is believed that people develop an average to the presented stimuli during discrimination training and learn about the relationships between those values (Spetch & Cheng, 1998).

Thomas (1993) explains the range effects are due to Helsons (1964) adaptation level theory whereby subjects develop a frame of reference (adaptation level) being an average of all stimuli experienced. The stimuli are then encoded in relation to the adaptation level. The range of stimuli then has an effect on where the peak of responding is found. This adaptation level theory was originally developed to explain the "central tendency effect" (a peak shift towards the centre of an asymmetrical generalization test series, following training with a single stimulus and tested with more values to one side of the training value) (Thomas et al, 1991).

Thomas (1993) explains the adaptation level theory calculation as the arithmetic mean of the stimuli that a subject has experienced and is displayed in Equation 1:

$$\text{AL} = Y(t) = \sum_{i=1}^{\mathrm{t}} \mathrm{w}(i) f[X(i)].$$

Tomie and Thomas (1974) tested 4 groups of 20 with an experiment on colour perception. The first experiment on two of the groups was with a training stimulus of 505*nm* (green) and then tested for generalization in one of three ranges: asymmetrical green (505–545), asymmetrical blue (465-505) or symmetrical blue/green (485-525). In experiment 2 were given a shorter interval between trials and in the instructions half were given the colour name blue in one half and green in the other half.

The results produced no shift for the asymmetrical blue group and it is assumed because the AL could not shift from the green TS (505) towards the blue test values (465-505). The asymmetrical green group produced a shift to 520 and the symmetrical group shifted to only 510.

Thomas, Svinicki and Vogt (1973) tested the AL theory on 3 experiments and were interested in whether a subject may categorise stimuli with relation to the AL responding in one way to stimuli above the AL and another way to stimuli below the AL.

Both possibilities fail to explain the peak shift effect as found by Bizo and McMahon (2007). In human studies findings have been inconsistent and peak shift has often been attributed to range effects due to the range of stimuli used in testing (Spetch and Cheng, 1998).

A further explanation from Spetch and Cheng, (1998) suggest that subjects learn to develop a frame of reference based on the average of the stimuli experienced during training. The rule learned during training produces peak responding to novel stimuli and explained in adaptation level theory as learnt as X units above or below the S+. During generalisation testing the range of stimuli presented is novel and there is no feedback so the adaptation level should shift. Spetch and Cheng (1998) failed to produce peak shift and found that the generalization gradients were shaped like a step function and their results support the hypothesis that the birds are encoding stimuli categorically as short, medium or long. They trained pigeons on a go/no go procedure to

discriminate between 2.52 and 5.67s signals. Then they were tested with a range of durations from 0.5 to 28.67s and their responses appeared to be categorised as short medium or long.

There has been research done and a range of theoretical explanations put forward to explain peak shift. However, it is not clear how valid any of these explanations truly are. In this project we seek to clearly replicate the peak shift effect and examine empirically the possible explanations. To do this we will endeavour to move the sample stimulus from continuous to discrete by the addition of a line to the presented sample. If necessary enhancing this effect by providing participants with a rule to encourage them to encode the lines as discrete stimuli. It is hoped that these empirical findings will bring more clarity to the array of theoretical explanations presently on offer.

Experiment 1

Method

Participants. There were 26 participants including first year psychology students at the University of Waikato and other volunteers. Participants ages ranged from 18 to 65 and there was 15 females and 11 males. .

Apparatus. Experimental events were controlled and recorded via a personal computer. Instructions were displayed on a 15 inch colour monitor.

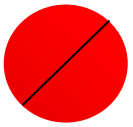
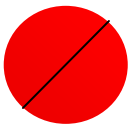
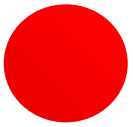
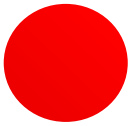
Procedure

Introduction. The participants were instructed to be seated in front of the computer monitor and given an ethics consent form to sign, a demographic questionnaire and an information sheet as attached in Appendix 2. The information sheet was placed beside them and the following verbal instructions given "*This is an experiment on time duration. A red dot will appear on the screen in front of you. Try to remember this red dot as you will have to distinguish it from a number of other red dots presented to you. The experimenter will be seated in the room during the entire experiment. Participants were asked to respond only after the presentation of the target stimulus and were asked not to respond after presentation of the non target stimulus. Any questions?*" Further instructions were also presented on the screen and these appear in the Appendix 3, these instructions appeared on the screen until such time as the participant pressed the space bar.

The initial phase of all four conditions involved intra-dimensional discrimination training. The training was essentially the same across all four conditions with the same target stimulus duration of S+ of 0.732 seconds except the non-target stimulus duration and line tilt variable changed in the conditions as in the Table 1 below. Each condition was separated by a short

break. The experimenter was in the room throughout the experiment, seated behind and out of view of participants.

Table 1: Conditions

	S+	S-	DOT
CONDITION 1	S5 (0.732)s	S6 (0.916)s	Line Tilt 
CONDITION 2	S5 (0.732)s	S4 (0.586)s	Line Tilt 
CONDITION 3	S5 (0.732)s	S6 (0.916)s	No Line Tilt 
CONDITION 4	S5 (0.732)s	S4 (0.586)s	No Line Tilt 

At the start of the training phase the instructions were given on the screen '*the training phase is about to begin - press the space bar to begin'*. The target stimulus,a red dot of 15 mm in diameter, appeared on the middle of the screen for the experimentally arranged duration. Then further instructions appeared on the screen '*Press the 'Z' key after the target stimulus*.' A red dot was then presented on the screen for an experimentally arranged duration and then further instructions appear '*Press the 'Z' key if that was the target stimulus*.' If they pressed the 'Z' key and were correct, (that it was the target), then they received feedback of '*Correct! That was the target*.' If they pressed the 'Z' key and it was not the target, they received feedback "*Correct! That wasn't the Target!*'. If they pushed the 'Z' key and it was not the target they received feedback '*Incorrect that wasn't the target'* and if they did not push the key and it was the target they receive feedback '*Incorrect! That was the*

Target". The next trial started automatically and the S+ and S- were each presented 12 times in a random order across the training trials. If the participant made more than two errors during the last 10 training trails, they received an additional 10 training trials. If they made more than two errors in these additional training trials, they still continued to the testing phase but their data was not included in the analyses. Irrespective of the performance all participants went on to complete all four conditions.

After the training trials, the Test phase began. The words "*test phase*" were positioned at the top of the screen throughout the test phase. Participants were instructed to press the 'Z' key following each presentation of the target duration during the test phase. In the testing session there were 54 trials consisting of 6 blocks, each block consisted of 9 different stimulus durations, including the training stimulus, that were randomly presented without replacement.

Table 2: **Stimulus Durations** were as follows:

S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**
0.30 seconds	0.375 seconds	0.469 seconds	0.586 seconds	0.732 seconds	0.916 seconds	1.144 seconds	1.431 seconds	1.788 seconds

EXPERIMENT 1

Results

Figure 2. Shows the mean response frequencies obtained from the Experiment 1, Condition 1 (line) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) during the testing for all participants (less the excluded participants). The data shows there is a shift in responding away from the S+ and from the S-. The highest response rate occurred at the S5 value.

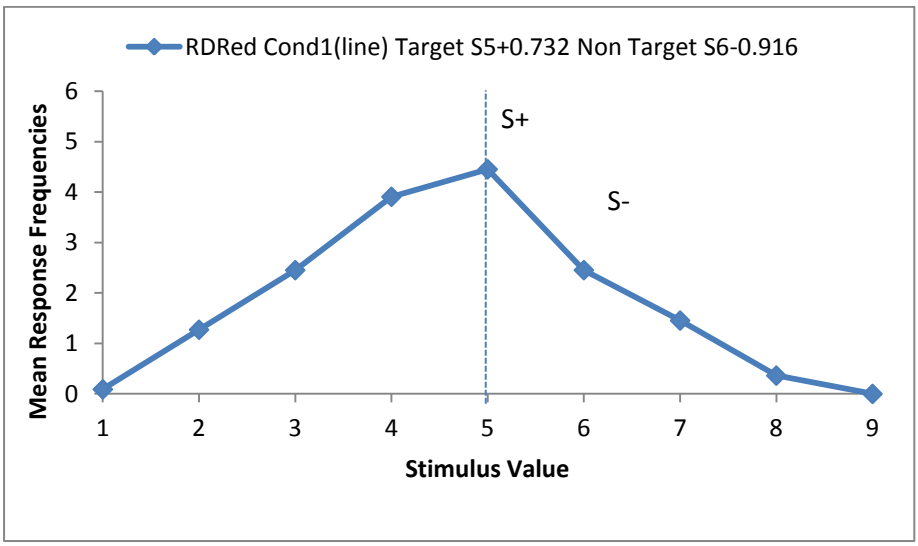


Figure 2. Shows the mean response frequencies plotted against stimulus value of responses obtained from the Experiment 1, Condition 1 (line) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) during the testing for all participants.

Figure 3.

Shows the mean response frequencies obtained from the Experiment 1, Condition 1 (line) Target S5+ (0.732 seconds) and Non Target S4- (0.586 seconds) during the testing for all participants (less the excluded participants). The data shows there is a shift in responding away from the S+ and the S-. The highest response rate occurred at the S5 value.

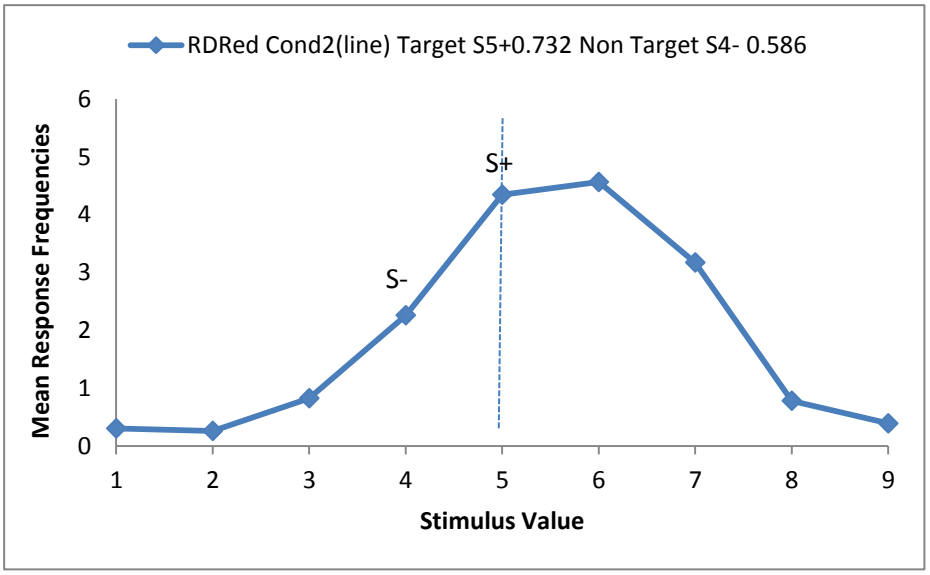


Figure 3. Shows the mean response frequencies plotted against the stimulus value of responses obtained from the Experiment 1, Condition 2 (line) Target S5+ (0.732 seconds) and Non Target S4- (0.586 seconds) during the testing for all participants (less the excluded participants).

Figure 4. Shows the mean response frequencies obtained from the Experiment 1, Condition 1 (line) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) and Experiment 1 Condition 3 (dot no line) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) during the testing for all participants (less the excluded participants). The data shows there is a shift in responding away from the S+ and the S-. The highest response rate occurred at the S5 value.

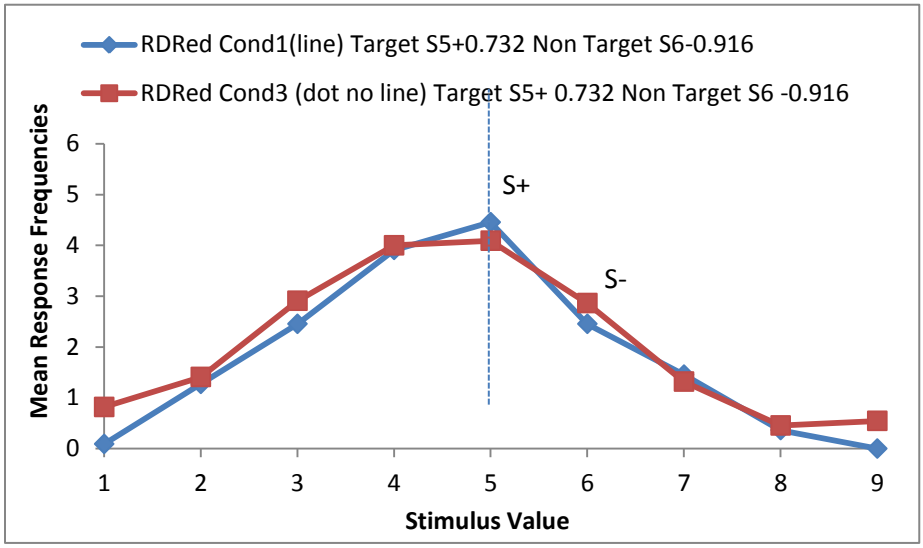


Figure 4. Shows the mean response frequencies plotted against stimulus value of responses obtained from the Experiment 1, Condition 1 (line) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) and Experiment 1 Condition 3 (dot no line) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) during the testing for all participants (less the excluded participants).

Figure 5. Shows the mean response frequencies obtained from the Experiment 1, Condition 2 (line) Target S+ (0.732 seconds) and Non Target S4- (0.586 seconds) and Experiment 1 Condition 4 (line) Target S+ (0.732 seconds) and Non Target S4- (0.586 seconds)during the testing for all participants (less the excluded participants). The data shows there is a shift in responding away from the S+ and the S-. The highest response rate was placed at the S6 (0.986 seconds). .

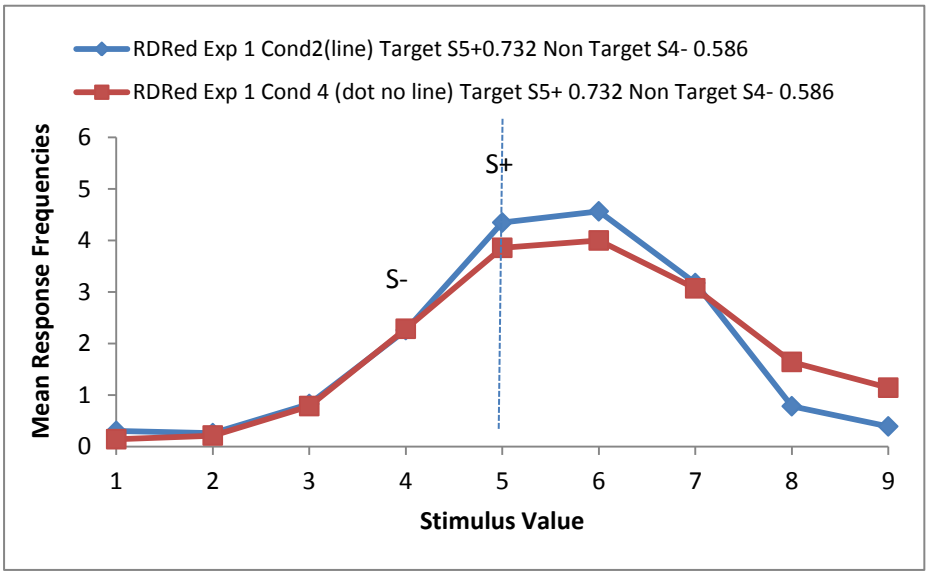


Figure 5. Shows the mean response frequencies plotted against stimulus value of responses obtained from Experiment 1 Condition 2 (line) Target S+ (0.732 seconds) and Non Target S4- (0.586 seconds) and Experiment 1 Condition 4 (line) Target S+ (0.732 seconds) and Non Target S4- (0.586 seconds)during the testing for all participants (less the excluded participants).

Figure 6. Shows a graph of frequency distribution with the number of responses made to each stimuli as an average response across the participants. Condition 1 was slightly lower than the other three conditions.

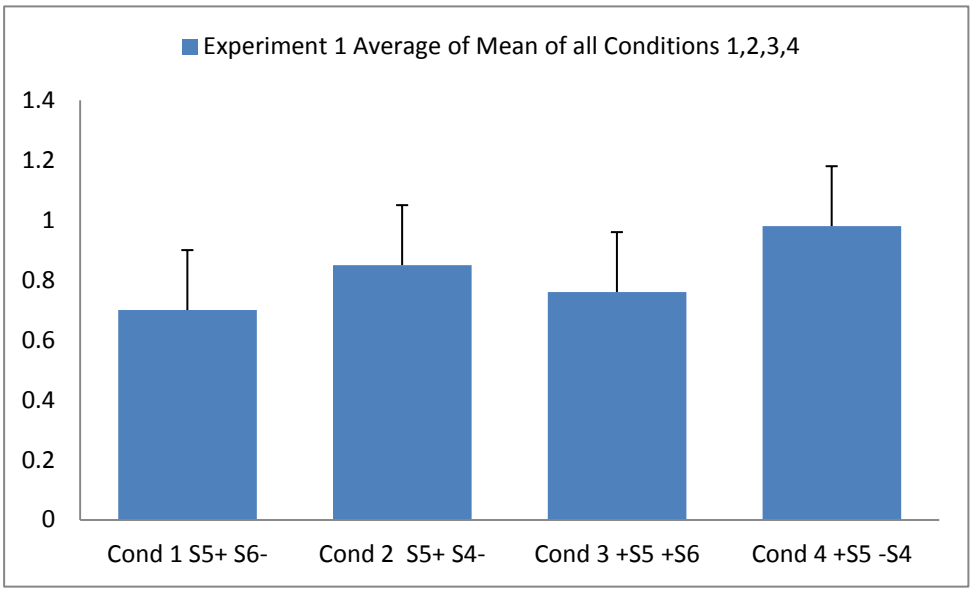


Figure 6 - Shows the Average of the Mean of all Conditions in Experiment 1 and is a table of frequency distribution with the number of responses made to each stimuli as an average response across the participants.

Figure 7. Shows the average of the standard deviations obtained from the four conditions in Experiment 1. Condition A and Condition B were lower than Condition C and D.

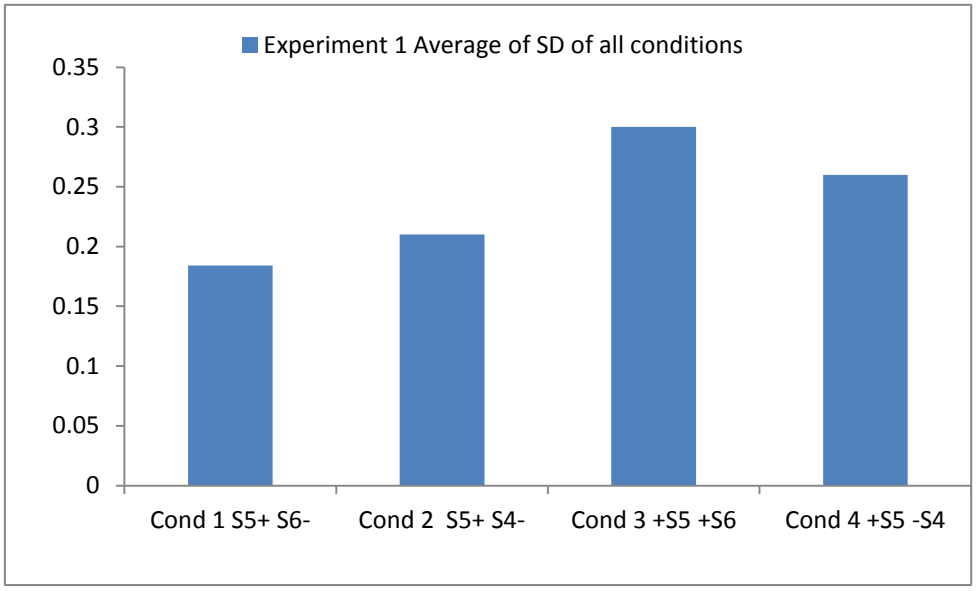


Figure 7. Shows the average of the standard deviations obtained from the four conditions in Experiment 1.

EXPERIMENT 1

Discussion

Results for Condition 1 and 2 show peak shift as seen in previous research in this area. For example research by Bizo & McMahon (2007) and shown in the Figure 1 above.

Thomas (1974) suggested that addition of a line should produce a result that would prevent a peak shift effect or central tendency effect. Results for Conditions 3 and 4 show that the addition of a line tilt failed to remove the peak shift as expected from Thomas (1974). This absence of effect is very clear when Condition 3 and 4 with the labelling are compared with Condition 1 and 2 without the labelling.

Failure to eliminate peak shift by using the lines maybe because participants did not verbally encode the line angles and as a result the stimuli failed to become discrete in the manner predicted by Thomas. To overcome this lack of verbal encoding perhaps participants should be explicitly instructed to attend to the line angles as a clockface as suggested by Thomas (1974).

Experiment 2

Introduction

In Experiment 1 we observed the peak shift and a failure to remove peak shift with the addition of a line tilt and now would like to investigate if we can remove the peak shift as suggested by other authors by adding instructions as well as the line tilt.

Thomas (1974) takes into account the effect of the range of S- during testing and accounts for the human ability to adapt. Thomas (1974) suggests that after training the stimuli are converted into an arithmetic mean (AL) and a response rule is formed. During generalization testing the AL would be the mean of all the stimulus values experienced during both training and testing. This creates a relational approach to responding and is continually adjusted to an adaptation level.

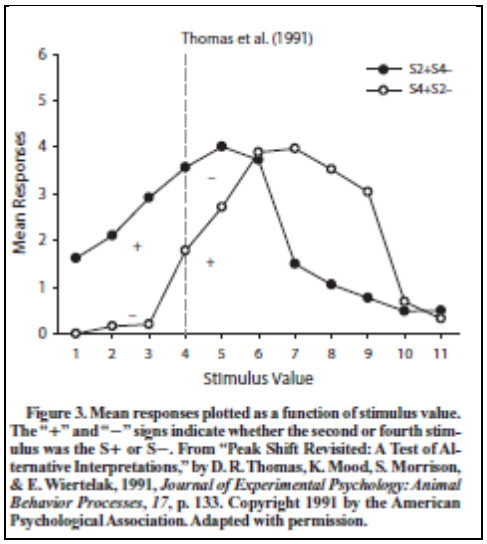


Figure 3. Mean responses plotted as a function of stimulus value. The "+" and "−" signs indicate whether the second or fourth stimulus was the S+ or S−. From "Peak Shift Revisited: A Test of Alternative Interpretations," by D. R. Thomas, K. Mood, S. Morrison, & E. Wiertelak, 1991, *Journal of Experimental Psychology: Animal Behavior Processes, 17*, p. 133. Copyright 1991 by the American Psychological Association. Adapted with permission.

Figure 8. Reproduced from Bizo & McMahon (2007)

Bizo and MacMahon (2007) argue for the use of discrete stimuli through rule giving as suggested by Thomas (1974).

Russell and Kirkpatrick (2007) conducted two experiments and their results indicated scalar temporal generalization and in particular evidence of categorical encoding. Experiment 1 produced a peak shift and shorter intervals were identified as easier to discriminate due to higher values and sharper functions and this was attributed to the scalar property of timing. Experiment 2 indicated that categorical coding may have occurred and results were consistent with scalar generalization. The three tasks were Small/Large, Small/Medium and S/M/L and the generalization gradient produced by S/M/L was attributed to the scalar process. Also evidence of learning was attributed to the space of the intervals and more consistent with the scale generalization account. The reason that the SL/M group did not perform as well may be due to categorical encoding due to a natural tendency to want to categorise values together.

Experiment 2 was identical to Experiment 1 but had the addition of a verbal label included in order to observe if the categorization of stimuli would have an effect on the peak shift and central tendency effect.

Experiment 2

Method

Participants. There were 20 participants including first year psychology students at the University of Waikato and a small number of other volunteers. Participants ages ranged from 18 to 65 and there was 9 females and 11 males.

Apparatus. The apparatus was the same as that used in Experiment 1.

Experiment 2

Procedure

The procedure for Experiment 2 Condition 1 (No Rule Condition) was identical to that of Experiment 1 Condition 1. The procedure for Experiment 2 Condition 2 (Rule Condition) was the same as Experiment 1 Condition 1 except that the instructions were altered. The verbal and written instructions were altered to include 'it is useful to remember the target stimulus by the lines that are shown as if they are similar to a clock face' as shown in Appendix 4. First participants were randomly assigned to either the "Rule" Condition or the "No Rule" Condition. At the completion of the first condition all participants went on to complete the remaining condition. 11 Participants were excluded using the same criteria as Experiment 1.

Experiment 2

Results

Figure 9. Shows the mean response frequencies obtained from Experiment 2, Condition 1 (no verbal instruction of lines) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) during the testing for all participants (less the excluded participants). The data shows there is a shift in responding away from the S+ and S- . The highest responding was placed at the S4 value.

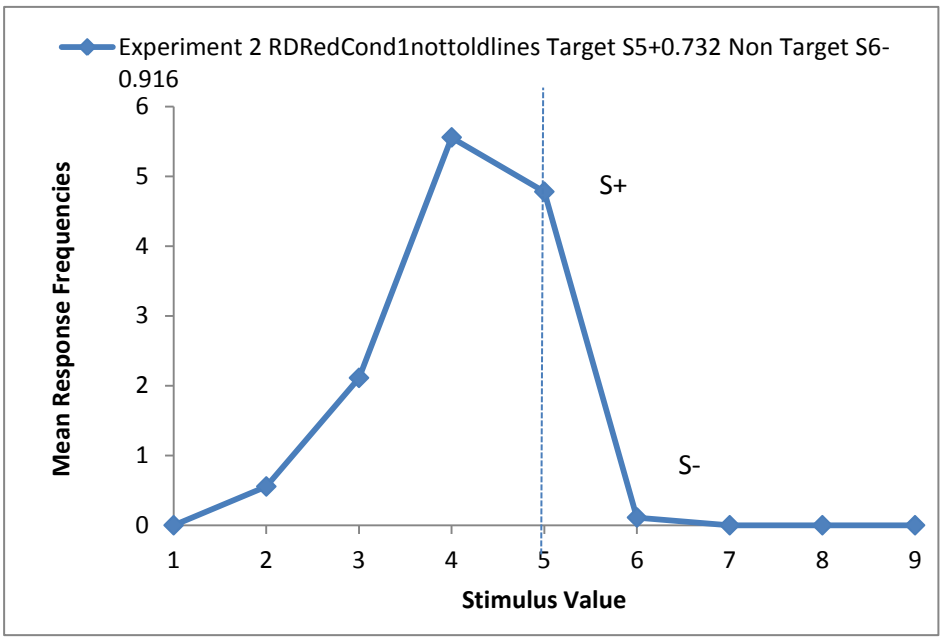


Figure 9 . Shows the mean response frequencies obtained from Experiment 2, Condition 1 (no verbal instruction of lines) Target S5+ (0.732 seconds) and Non Target S6- (0.916 seconds) during the testing for all participants (less the excluded participants)

Figure 10 . Shows the mean response frequencies obtained from Experiment 2, Condition 2 (verbal instruction of line) Target S5+ (0.732 seconds) and Non Target (0.916 seconds) during the testing for all participants (less the excluded participants). The data shows there is a shift in responding away from the S+ and S-. The highest response rate occurred at the S4 value.

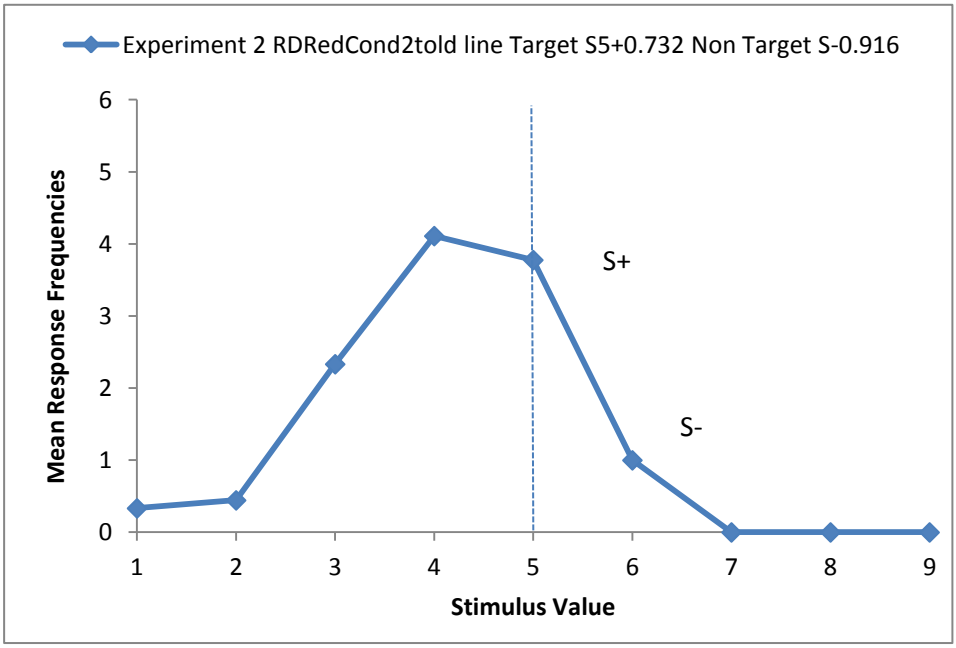


Figure 10 . Shows the mean response frequencies obtained from Experiment 2, Condition 2 (verbal instruction of line) Target S5+ (0.732 seconds) and Non Target (0.916 seconds) during the testing for all participants (less the excluded participants).

Figure 11. Shows the mean of Experiment 2 Condition 1 (no verbal instruction of lines) and Condition 2 (verbal instruction of lines).

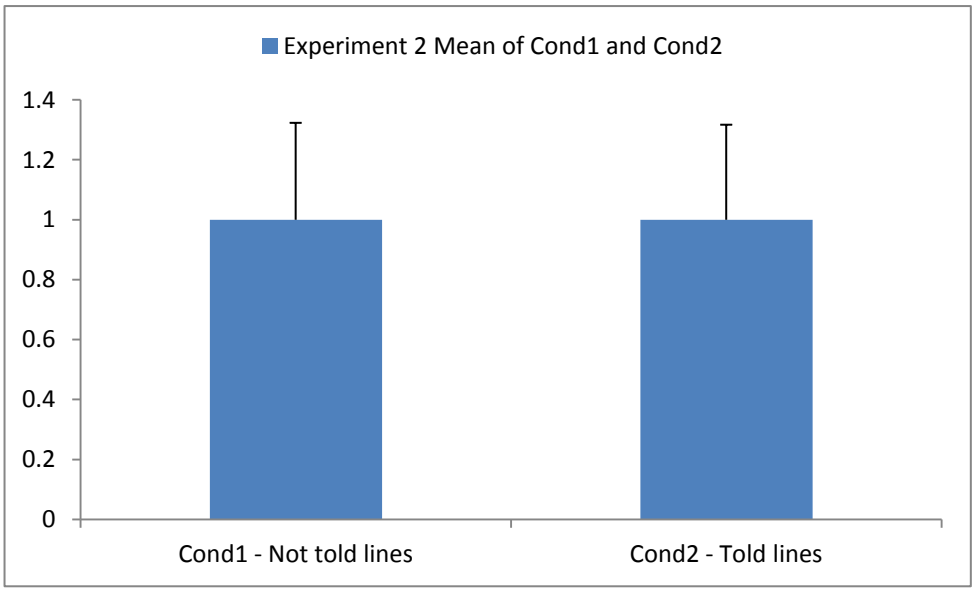


Figure 11. Shows the mean of Experiment 2 Condition 1 (no verbal instruction of lines) and Condition 2 (Verbal instruction of lines).

Figure 12. Shows the average of the standard deviation of Experiment 2 Condition 1 (no verbal instruction of lines) and Condition 2 (verbal instruction of lines).

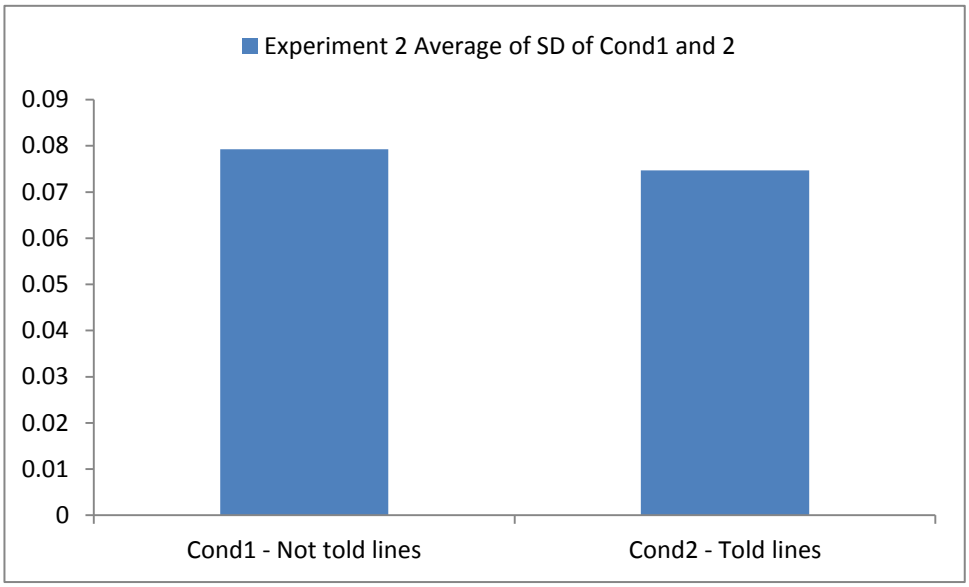


Figure 12. Shows the average of the standard deviation of Experiment 2 Condition 1 (no verbal instruction of lines) and Condition 2 (verbal instruction of lines).

EXPERIMENT 2

Discussion

Experiment 2 was designed with a view to making the lines effective at eliminating peak shift. The introduction of a verbal label in the conditions did not make a significant difference and had little effect on the number of correct responses. The mean and standard deviations were the same and should have been smaller for the verbal condition however the results were that there was not a great difference suggesting that the labelling procedure did not have an effect as expected by Thomas and Thomas (1974) and Bizo and McMahon (2007).

The failure to find the anticipated result might well be due to the use of shorter durations than those used by Thomas and Thomas (1974). Overall it is still not clear how one can effectively eliminate peak shift and other anomalies of judgement in these experiments. In spite of our intensive efforts we have not been able to bring any further clarity to understanding what accounts for peak shift.

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Appendix 1: Consent Form

Consent Form

School of Psychology

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

RESEARCHER'S COPY

Research Project: Temporal Generalization and Peak Shift
Name of Researcher: Louise Hay
Name of Supervisor (if applicable): Dr Lewis Bizo and Dr James McEwan

I have received an information sheet about this research project or the researcher has explained the study to me. I have had the chance to ask any questions and discuss my participation with other people. Any questions have been answered to my satisfaction.
I agree to participate in this research project and I understand that I may withdraw at any time. If I have any concerns about this project, I may contact the convenor of the Research and Ethics Committee.

Participant's Name: _____Signature:_____ Date:_____

PARTICIPANT'S COPY

Research Project: Temporal Generalization and Peak Shift
Name of Researcher: Louise Hay
Name of Supervisor (if applicable): Dr Lewis Bizo and Dr James McEwan

I have received an information sheet about this research project or the researcher has explained the study to me. I have had the chance to ask any questions and discuss my participation with other people. Any questions have been answered to my satisfaction.
I agree to participate in this research project and I understand that I may withdraw at any time. If I have any concerns about this project, I may contact the convenor of the Research and Ethics Committee (Dr Nicola Starkey, Tel: 07 838 4466 ext 6472 and email: nstarkey@waikato.ac.nz)

Participant's
Name:_____Signature:_____Date:_____

Appendix 2: Demographic Questionnaire

DEMOGRAPHIC QUESTIONNAIRE

Partcipant No: _____

AGE (years): _____

GENDER: M / F

ETHNICITY: _____

Have you heard anything about this research before? Yes ? No

Appendix 3: Information Sheet for Condition 1 – No lines

PARTICIPANT INFORMATION SHEET

This experiment is useful in understanding the basic processes with regard to the perception of time. This experiment will also help inform our understanding of how simple stimuli can come to control behaviour.

The tasks involved will be participants judgements between different stimuli of short durations of visual stimuli displayed on a computer screen. You will be trained to respond on a keyboard if the stimulus is the target stimulus and not to respond if it is not the target stimulus. During the training you will be told if you are correct or not. During the test phase you will not receive any feedback.

The entire experiment will take no more than 50 minutes.

The experimenter will be seated in the room throughout the experiment but will not be visible.

Participants have their right to withdraw from the experiment at anytime during the information briefing prior to their participation

If you have any questions about the experiment you may speak to the Researcher prior to the experiment or contact by email:

Experimenter: Louise Hay - louhmail@gmail.com

Ethics Contact: Dr Nicola Starkey: nstarkey@waikato.ac.nz

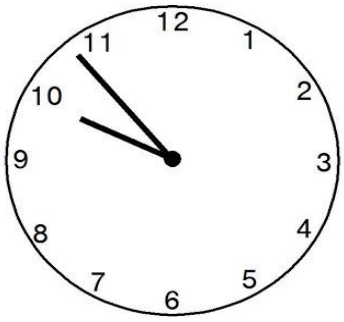
Appendix 4: Information Sheet Condition 2 – lines

PARTICIPANT INFORMATION SHEET

This experiment is useful in understanding the basic processes with regard to the perception of time. This experiment will also help inform our understanding of how simple stimuli can come to control behaviour.

The tasks involved will be participants judgements between different stimuli of short durations of visual stimuli displayed on a computer screen. You simply be trained to respond on a keyboard if the stimulus is the target stimulus and not to respond if it is not the target stimulus. During the training you will be told if you are correct or not. During the test phase you will not receive any feedback.

It is useful to remember the target stimulus by the lines that are shown as they are similar to a clock face.



The entire experiment will take no more than 50 minutes.

The experimenter will be seated in the room throughout the experiment but will not be visible.

Participants have their right to withdraw from the experiment at anytime during the information briefing prior to their participation.

If you have any questions about the experiment you may speak to the Researcher prior to the experiment or contact by email: Experimenter:

Louise Hay - louhmail@gmail.com

Ethics Contact: Dr Nicola Starkey: nstarkey@waikato.ac.nz

Appendix 5: Configuration File

CONFIGURATION PAGE FOR EXPERIMENT 2 – CONDITION 1

// Config for RD2

// The filename prefix to identify the type of trial that this config represents, alphanumeric only
Condition C1

// The filename of the stimulus picture to use
Stimulous Line.png

// the set of test times (seconds), MUST include both the Target and NonTarget Durations above
Dur_TestSet 0.30 0.375 0.469 0.586 0.732 0.916 1.144 1.431 1.788

Dur_Target 0.732 // time (seconds) which is the target stimulus
Dur_NonTarget 0.916 // time for the non-target during the training phase

Itterations_Trial 12 // the itterations in the training phase
Itterations_Test 6 // the number of times the test set is presented

// (total number of training trials = 2 x Itterations_Trial, with minimum of 10,
// only proceeding when 8 of the last 10 are correct)

Inst_0
{Welcome to the Reddot experiment
Instructions.
This is an experiment in time perception.
A reddot will be presented repeatedly on the screen in
front of you for various durations.
The first duration you will see is called the 'test duration'.
Try to remember this duration because you will have to distinguish
it from all the other durations.
When you do recognise the test duration press the z-key.
If a subsequent duration is different from the test duration,
do not press the z-key.}

Inst_1
{Remember, after each time the reddot is presented, try to respond as quickly as possible if you think it's the target stimulus.
The computer will tell you whether you are 'correct' or incorrect' on the training phase trials; then you will continue without further feedback.
The first stimulus is the test stimulus. Remember this stimulus.
For every reddot presentation after that, respond by pressing
the z-key as quickly as you can if,
and only if, it is the same duration as the original reddot presentation.

Any questions?
}

Inst_2
{The training phase is about to begin}
Inst_Z1 Press "Z" after the target stimulus
Inst_Z2 Press "Z" key if that was the target stimulus
Inst_11 Correct! That was the target
Inst_10 Correct! That wasn't the target
Inst_01 Incorrect! That was the target
Inst_00 Incorrect! That wasn't the target
Inst_4 Those were the training trials.
Inst_5 The test phase is about to begin
Inst_7 Thank you for your participation
Error Please wait until instructed to respond

Dur_Z1 1.0 // time (seconds) for which the Inst_Z1 message is displayed
Dur_Pre 0.5 // time blank before the stimulus is displayed
Dur_Post 0.5 // time blank after the stimulus is displayed
Dur_Z2 1.5 // time for which the Inst_Z2 message is displayed
Dur_Result 1.5 // time for which the Result (Inst_00 - Inst_11) is displayed
Dur_Next 1.5 // time blank until the next trial
Dur_Error 1.0 // the time for which the Error message is displayed if the user responds too early

Beep_Frequency 0 // Hz
Beep_Duration 0 // ms

// Entries below this line are generated automatically

PROGRESSTICKS 13
Appendix 6
CONFIGURATION PAGE FOR EXPERIMENT 2 – CONDITION 2

```
// Config for RD2

// The filename prefix to identify the type of trial that this config represents, alphanumeric only
Condition       C1

// The filename of the stimulus picture to use
Stimulous       Line.png


// the set of test times (seconds), MUST include both the Target and NonTarget Durations above
Dur_TestSet             0.30 0.375 0.469 0.586 0.732 0.916 1.144 1.431 1.788

Dur_Target      0.732           // time (seconds) which is the target stimulus
Dur_NonTarget   0.916           // time for the non-target during the training phase


Itterations_Trial       12      // the itterations in the training phase
Itterations_Test        6       // the number of times the test set is presented

// (total number of training trials = 2 x Itterations_Trial,  with minimum of 10,
//  only proceeding when 8 of the last 10 are correct)


Inst_0
{Welcome to the Reddot experiment
Instructions.
This is an experiment in time perception.
A reddot will be presented repeatedly on the screen in
front of you for various durations.
The first duration you will see is called the 'test duration'.
Try to remember this duration because you will have to distinguish
it from all the other durations.
When you do recognise the test duration press the z-key.
If a subsequent duration is different from the test duration,
do not press the z-key.}
```

Inst_1
{Remember, after each time the reddot is presented, try to respond as quickly as possible if you think it's the target stimulus.
The computer will tell you whether you are 'correct' or incorrect' on the training phase trials; then you will continue without further feedback.
The first stimulus is the test stimulus. Remember this stimulus.
For every reddot presentation after that, respond by pressing
the z-key as quickly as you can if,
and only if, it is the same duration as the original reddot presentation.
Some people find it helpful in trying to remember this line to think of it as a hand or hands on a clockface.
Any questions?}

Inst_2
{The training phase is about to begin}

Inst_Z1 Press "Z" after the target stimulus
Inst_Z2 Press "Z" key if that was the target stimulus
Inst_11 Correct! That was the target
Inst_10 Correct! That wasn't the target
Inst_01 Incorrect! That was the target
Inst_00 Incorrect! That wasn't the target
Inst_4 Those were the training trials.
Inst_5 The test phase is about to begin
Inst_7 Thank you for your participation
Error Please wait until instructed to respond

Dur_Z1 1.0 // time (seconds) for which the Inst_Z1 message is displayed
Dur_Pre 0.5 // time blank before the stimulus is displayed
Dur_Post 0.5 // time blank after the stimulus is displayed
Dur_Z2 1.5 // time for which the Inst_Z2 message is displayed
Dur_Result 1.5 // time for which the Result (Inst_00 - Inst_11) is displayed
Dur_Next 1.5 // time blank until the next trial
Dur_Error 1.0 // the time for which the Error message is displayed if the user responds too early

Beep_Frequency 0 // Hz
Beep_Duration 0 // ms

// Entries below this line are generated automatically
PROGRESSTICKS 13