Research—Basic Technical Research

Modelling the direct and indirect effects of thought suppression on personal choice

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ABSTRACT

The current study sought to provide an empirical model of the direct and indirect effects of thought suppression on personal choice. In Experiment 1 (direct effect) participants were required to make a preference on a dichotomous choice task. After making their choice they were instructed to repeat the selection task while suppressing all thoughts of a target word which was programmed to appear each time they selected their originally preferred item. Results showed that participants gradually changed their original preference to avoid coming into contact with the target unwanted thought. Experiment 2 (indirect effect) extended Experiment 1 by examining whether a similar effect might be seen via trained and derived relations respectively and by comparing possible effects seen in original target, trained and derived conditions with patterns seen in a control condition. In Experiment 2 participants in each of four groups (target, trained, derived and control) were first trained and tested for the formation of three derived equivalence relations using a match-to-sample procedure. They then received exposure to suppression and choice phases similar to the protocol employed in Experiment 1. However this protocol differed in terms of the presence or absence of a stimulus that might function to depress value derived). Findings showed that participants in each of the three experimental conditions demonstrated depressed values choice in comparison with the control condition. Implications and future research directions are discussed.

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1. Introduction

There is an increasing amount of empirical evidence suggesting that valuing plays a key role in psychological health and well-being. For example, values affirmation and goal setting have been linked with longitudinal well-being (Sheldon & Elliot, 1999), reduced rumination after failure (Sherman, Nelson, & Steele, 2000), reduction in stress and perceived threat (Creswell, Welch, Taylor, Sherman, Gruenewald, & Mann, 2005) and greater well-being among cancer sufferers (Ciarciochi, Fisher, & Lane, 2011), while increased values pursuit has been related to increased happiness (Sheldon & Houser-Marko, 2001).

In the project of further advancing our understanding of psychological processes such as values, one key strand of empirical work is the modelling of these processes at a basic level. This research, which allows us to examine and manipulate these processes under relatively well-controlled conditions enables us to explore and understand their interaction in ways that more field-oriented research cannot. There is already a considerable amount of basic contextual behavioural work on certain important processes including, for example, avoidance (e.g., Dymond et al., 2011). There is arguably less work on other processes, including values. Considering the central role of values in healthy human functioning, it is important that we provide more avenues of basic exploration with respect to this phenomenon. The aim of the current study was to contribute in this regard.

According to Acceptance Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) a value is the highest point in a hierarchical relational network that is ultimately founded on personal preferences for particular experiences. For example, one important foundation for a person’s value of ‘family’ might be their preference for interacting with other people rather than spending time alone. From this point of view, the key to successful living is to continue to choose in accordance with such personal preferences and act congruent with those choices as often as possible throughout one’s life (Plumb, Stewart, Dahl, &
and extended this empirical work on thought suppression to the controlled distracter search can generate distracters. In addition to this, associations are made between the unwanted thought and the generated distracters leading to a heightened accessibility of the unwanted thought.

The theoretical constructs employed by ECH are less helpful from a contextual behavioural perspective than alternative functional analytic descriptions of the phenomena involved might be. However, the data are readily reinterpreted in functional analytic terms and the protocols employed are potentially useful means of exploring thought suppression as a covert behaviour. By this point, the predictions of ECH are reasonably well empirically supported (Wegner, Schneider, Knutson, & McMahon, 1991; Wegner & Erber, 1992; Najmi & Wegner, 2008). Furthermore, the basic protocol has been used by at least one recent study that approached the phenomena involved from a functional contextualist perspective. This study used this alternative perspective on the events involved to extend the work in potentially important respects. Recent research by Hooper, Saunders, and McHugh (2010) suggested that ECH in fact underestimates the counterproductive nature of thought suppression because it only considers the impact of stimuli associated directly with the unwanted stimulus. Hooper et al. provided evidence that it is not only stimuli directly associated with an unwanted thought that can interfere with attempted suppression; stimuli in indirect or derived relations with it can also do so.

The current paper reports on two studies that have drawn on and extended this empirical work on thought suppression to model a process in which thought suppression can interfere with personal choice. Experiment 1 provides a model of this phenomenon that draws on the basic paradigm utilised in ECH research while Experiment 2 extends this work to demonstrate values suppression interference via derived relations.

2. Experiment 1

In Experiment 1, participants were required to make a preference on a dichotomous selection task. After making their preference they were instructed to repeat the selection task while suppressing all thoughts of a target word which was programmed to appear each time they selected their originally preferred stimulus. It was predicted that participants would change their original choice to avoid coming into contact with the target unwanted thought.

2.1. Method

2.1.1. Participants

Twenty-seven undergraduate student participants ranging in age from 18 to 35 years (mean = 24.5; SD = 4.12) were recruited from the Swansea University subject pool system and received credit for their participation. Participant data could be excluded if no selection preference was made in the first part of the selection task. The data from five of the participants was excluded on this basis.

2.1.2. Design

The study involved a within-subjects experimental design involving 1 factor (block) operationalised at 6 levels (i.e., each of the ten trial blocks across parts 1 [Block 1] and 2 [Blocks 2–6] of the selection task). The dependent variable was number of preferred selections made per trial block.

2.1.3. Materials and apparatus

Presentation of instructions and stimuli and recording of responses was conducted using a Dell XPS 420 desktop PC with 550 MHz processor with a 14-inch colour monitor screen and a standard computer mouse as interface. Two separate customised experimental protocols programmed using Visual Basic™ were used in the current experiment. The ‘suppression induction’ protocol presented instructions and recorded ‘thought intrusion’ space bar press responses. The protocol for the ‘selection task’ phase presented instructions and selection tasks stimuli and recorded button press responses.

2.1.4. Procedure

On arrival at the experimental cubicle, each participant was greeted by the researcher and was asked to complete a consent form. The general procedure consisted of 3 phases: (1) Suppression induction; (2) Concurrent task; (3) Selection task.

2.1.4.1. Suppression induction

For this phase, participants were instructed to suppress all thoughts of the word ‘Bear’ for a five-minute period. Each time they thought of the word ‘Bear’ they were required to press the space bar on the keyboard. The purpose of this phase, which was adopted from Wegner and Erber (1992), was to familiarise participants with the suppression task.

2.1.4.2. Concurrent task

In the second phase, participants were instructed to suppress all thoughts of a target word which was programmed to appear each time they selected their originally preferred stimulus. It was predicted that participants would change their original choice to avoid coming into contact with the target unwanted thought.
2.1.4.3. Selection task. In this phase, participants were exposed to a multi-trial selection task involving two parts. Before the first part the following instructions appeared on the computer screen:

“This segment of the experiment will consist of two parts. You will receive the instructions for the 2nd part after you have completed the 1st part. Over the next few minutes you will see two doors. One of these doors will be a red door and one will be a blue door. You can open either door. If you would like to open the red door then please press the ‘Q’ button. If you would like to open the blue door then please press the ‘P’ button. Your task is simply to pick a door to open in each case. You will repeat this task several times during the first part, which will take only a couple of minutes. Keep in mind that there is no right or wrong answer; simply click on whichever door you wish.”

On each trial participants saw two images appear on the computer screen, one of a red door (approximately 14 cm by 18 cm) with the letter ‘P’ above it that appeared on the left side of the screen, and one of a blue door (the same dimensions) with the letter ‘Q’ above it that appeared on the right side. They were required to press either the ‘P’ or ‘Q’ buttons on the keyboard to choose either the red or blue door respectively. Once they had chosen a door, that door would appear to open, and a black space would be seen behind it. Then a new trial would begin. During the first part of this task the participants were presented with 10 trials.

At the start of the second part of this phase, participants saw the following instructions displayed on the screen:

‘The 2nd part is very similar to the 1st part. You will have to continue to click on whichever door you wish. However, instead of a blank space appearing, when the door opens now, a word will appear behind the door. In addition to choosing doors during the experiment, you are also required to suppress (try your best not to think about) the word/thought ‘Bear’. Please try your best not to think about this word/thought. This part will last around five minutes.’

During the second part of this phase, participants were again required to choose either the red or the blue door on each trial. However, Part 2 differed from Part 1 in two key ways. First, the participant was instructed to suppress the target thought ‘Bear’ for the duration of the task. Second, when the participant opened either door, one of a number of words would appear in white 2 cm high font in the middle of the black space revealed by the opened door. There were two groups of words used, one for each of the two doors. Whenever participants chose the colour door for which they had shown an initial preference in Part 1, one of a group of words that included the target word (namely, Bear, Samolt and Rigund) would appear in the black space. The order of appearance of the three words was quasi-random across trials so that the three words appeared an equal number of times and each appeared on average once every three trials. Whenever a participant chose the colour door that had not been their initial preference one of a different group of words that did not include the target stimulus (namely, Lewoly, Matsor and Casors) would appear, and again, the order of appearance of these three words was quasi-random. Once this final phase of the experiment was complete, the participant was thanked and debriefed.

2.2. Results and discussion

The dependent variable was the number of times participants selected their preferred colour door in each ten trial block across both parts of the selection task (Phase 3). In Part 1, participants had to make ten colour door selections. In Part 2 they were exposed to 50 further selection trials during which they had to make selections while suppressing a target item. The 50 trials in Part 2 were analysed in blocks of ten and thus the data includes findings from six ten-trial blocks, one from Part 1 and five from Part 2. Fig. 1 shows the mean number of times a participant’s originally preferred colour was chosen in each block. The pattern seems to suggest that participants gradually changed preference over the course of the five blocks in Part 2, so that by the end they were consistently choosing the initially non-preferred door.

A one way ANOVA revealed a significant main effect ($F_{(5, 105)}=26.237; p<0.05, \eta^2_p=0.56$) for number of preferred selections across the 6 blocks of Phase 3 and thus paired sample t-tests were carried out between all possible pairings of Phase 3 blocks to further investigate this result. The first batch of tests, which compared preferred selections in Block 1 (Part 1) with preferred selections in each of the blocks in Part 2, found significant differences for each pairing (see Table 1), which suggests that participants changed their preference in the first block of Part 2 and at the very least maintained that change in preference over each of the following ten trial blocks.

Table 1: t-Tests conducted on the data between each ten trial block, Experiment 1.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Part vs. Block 1</td>
<td>t(21)=5.721, p=.000, SE=0.44</td>
</tr>
<tr>
<td>1st Part vs. Block 2</td>
<td>t(21)=6.049, p=.000, SE=0.66</td>
</tr>
<tr>
<td>1st Part vs. Block 3</td>
<td>t(21)=6.967, p=.000, SE=0.61</td>
</tr>
<tr>
<td>1st Part vs. Block 4</td>
<td>t(21)=7.604, p=.000, SE=0.57</td>
</tr>
<tr>
<td>1st Part vs. Block 5</td>
<td>t(21)=8.880, p=.000, SE=0.55</td>
</tr>
<tr>
<td>Block 1 vs. Block 2</td>
<td>t(21)=2.321, p=.03, SE=0.63</td>
</tr>
<tr>
<td>Block 2 vs. Block 3</td>
<td>t(21)= -.826, p=.418, SE=0.33</td>
</tr>
<tr>
<td>Block 3 vs. Block 4</td>
<td>t(21)=-.219, p=.04, SE=0.31</td>
</tr>
<tr>
<td>Block 4 vs. Block 5</td>
<td>t(21)=1.641, p=.116, SE=0.28</td>
</tr>
</tbody>
</table>

![Fig. 1. Mean number of choice responses made by participants in Phase 3, Parts 1 and 2, Experiment 1.](image-url)
the course of exposure to subsequent blocks. In addition, the $t$ values seem to get larger with each successive comparison suggesting that participants continued to move away from their initial selection as they progressed through Part 2. Further $t$-tests were conducted to determine if there were significant differences across any other block pairs. Findings suggest that preferences tended to change significantly from Block 1 to Block 2 after which a ceiling was reached such that further (statistically) significant change was not possible.

These findings suggest that the presence of the target word behind the initially preferred colour door resulted in each participant gradually changing their selection so that by the end of Part 2 of the door selection task they would rarely choose their initially preferred stimulus. This provides a preliminary experimental model of how thought suppression might interfere with a personal choice. The apparent success of this demonstration accords with the 3rd wave cognitive behavioural view of the clinical significance of experiential avoidance and in this case specifically how thought suppression as a form of avoidance might detrimentally affect values congruent choice.

One question that might arise from this demonstration is how a neutral stimulus in an experiment might acquire an avoidance function. From the current perspective, this might happen as follows. Essentially, participants are given a rule which requires that they not think of the word ‘Bear’. Participants engaged in a psychology experiment are already following social norm type rules concerning the behaviour of someone in a social contract, in this particular case in the context of a psychology experiment. Through transformation of functions, obeying such rules has positive functions of coherence and social reinforcement, while disobeying them acquires the opposite functions and thus may be aversive. Obeying the given rule about suppressing the word ‘Bear’ is hierarchically related to the following of rules given to them by the experimenter in general and thus they will attempt to follow this rule just as they are attempting to follow others. As such, any action that makes rule breaking more likely, such as opening a door that reveals a to be avoided word or a word that is linked with such a word, also becomes aversive.

Many previous studies have investigated the phenomenon of thought suppression by requiring participants to respond in a particular way (e.g., press a button) in the presence of a to-be-suppressed stimulus (e.g., Wegner & Erber, 1992). By demonstrating that participants will often show increases rather than decreases in frequency of responding following suppression instructions, these studies have attempted to provide evidence of the futility of thought suppression. The present study has provided an important extension of this work by demonstrating how thought suppression can affect not just behaviours directly or explicitly connected with it (such as button pressing, for example, in an experiment in which participants have been explicitly told to press a button on the appearance of a to-be-suppressed thought), but can also affect behaviours not directly or explicitly connected with it, such as a behavioural selection task.

Hence, the first experiment in this study not only shows that thought suppression can interfere with personal choice but also constitutes a demonstration of the indirect effects of thought suppression. This theme of the indirect effects of thought suppression is further explored and extended in Experiment 2, which shows how the basic model of interference with personal choice can generalise through indirect (derived) relations.

3. Experiment 2

Experiment 1 provides a basic model of how thought suppression might negatively influence choice behaviour. The purpose of Experiment 2 was to extend this model to show that this type of interference can happen not just on the basis of suppression of the original to-be-suppressed thought but also on the basis of thoughts in trained (direct) and derived (indirect) relations with that thought.

Hooper et al. (2010) recently provided the first basic model of the generalisation of thought suppression via indirect (derived) relations. More specifically, they demonstrated derived transfer of thought suppression functions via a derived stimulus equivalence (SE) relation. SE is an empirically demonstrable effect in which training particular relations between arbitrary stimuli (e.g., nonsense words) leads to the derivation of several further untrained (derived) relations between those stimuli. It typically involves using conditional discrimination procedures to train a number of unidirectional relations between stimuli and then testing for the emergence of derived relations. For example, a participant might be trained to choose stimulus B in the presence of stimulus A and stimulus C in the presence of B. In subsequent testing (without feedback), she may reverse the taught relations by choosing A in presence of B, and B in presence of C (‘derived symmetry’) and may also combine taught relations by choosing A in presence of C (‘derived transitivity’) and vice versa. The overarching response pattern is labelled ‘stimulus equivalence’ because it suggests that the participant is treating the stimuli as ‘equivalent’ or mutually substitutable (e.g., Sidman, 1994).

One additional phenomenon connected with SE is transfer of function (TOF). This phenomenon means that if one member of an SE relation acquires a psychological function then other members of that relation will acquire the same function. It was this phenomenon that Hooper et al. (2010) employed to model generalisation of the effects of thought suppression. Participants were first trained and tested for the emergence of three member equivalence relations. They were then instructed to suppress all thoughts of a target word which was a member of one of the derived equivalence relations. Subsequent testing showed TOF of thought suppression by demonstrating increased frequency of responding not just in the presence of the original to-be-suppressed stimulus and stimuli in trained relations with it but also in the presence of stimuli in derived relations with it.

The purpose of Experiment 2 was to extend the basic model of choice interference via thought suppression by showing that this interference can also occur indirectly with stimuli in trained and derived relations with the original to-be-avoided stimulus through the transfer of function. To investigate this effect, a derived relational training and testing paradigm similar to that employed by Hooper et al. (2010) was incorporated into the experimental design. One group of participants was first exposed to relational training and testing designed to produce 3 member equivalence relations. Next, they were exposed to a thought-suppression procedure similar to that employed in Experiment 1 but in which the to-be-suppressed stimulus was a member of one of the three equivalence relations. Then, finally, they were exposed to a two part selection task similar to that seen in Experiment 1. However, during the second part of this task, only words related to the suppression target via derived relations and not the actual target itself appear behind the preferred door. It was predicted that participants would change their initially preferred selection, this time to avoid items in derived relations with the target. This group was designated the ‘derived’ word group. Experiment 2 also included three other groups, each of whom was exposed to a similar protocol to that provided for the ‘derived’ word group. However, whereas for the latter, the word that appeared behind the door in part 2 of the selection task was in derived relations with the to-be-suppressed word, for the remaining groups this was replaced by, respectively, the original to-be-suppressed stimulus (‘target’ word group); a word directly
trained to the to-be-suppressed stimulus (‘trained’ word group); and a neutral, previously unseen word (‘control’ group).

Hence Experiment 2 constitutes an extension of Experiment 1 in a number of important ways. First, it extended the effect seen in Experiment 1 in which participants’ preferences in the final phase shifted apparently in response to the appearance of the target word behind the preferred door. It did this by including additional groups, for one of which words directly trained as related to the target appeared behind the preferred door, and for the other of which words in derived relations with the target appeared behind the preferred door. Second, in order to support the claim that the shift in preference shown in the first experiment and potentially replicated in the second was based on thought suppression/avoidance as opposed to than being an artefact of some other aspect of the procedure, this experiment included a control group.

Two other minor changes in procedure were employed in Experiment 2. First, whereas in Experiment 1, the red door always appeared on the left side of the screen and the blue always appeared on the right side, in Experiment 2, the red and blue doors alternated between left and right quasi randomly. Second, in an attempt to increase the chance that participants might make a choice in the first part of the door selection task, the number of trials in this part of the task was increased from 10 to 20. It was predicted that the control group would show no mean change in colour preference from Part 1 to Part 2 of the selection task while the target, trained and derived word groups would show a mean change in preference.

3.1. Method

3.1.1. Participants

40 Participants, 20 males and 20 females ranging in age from 18 to 31 years old (mean = 24.6) were recruited from the Swansea University subject pool system in which credits are granted for research participation. Participants were randomly assigned to one of four conditions as follows: (i) Target; (ii) Trained; (iii) Derived; (iv) Control (see Section 3.1.4). Participant data in the current study could be excluded if no selection preference was made in the first part of the choice selection task. The data for two participants, one in the ‘Trained’ condition and one in the ‘Control’ condition, was excluded on this basis.

3.1.2. Design

The study involved a mixed 4 (group) × 6 (block) factorial design. The first factor (group) was operationalised at 4 levels (target, trained, derived, control) while the second factor (block) was operationalised at 6 levels (i.e., each of the ten trial blocks across parts 1 [Block 1] and 2 [Blocks 2–6] of the selection task). The dependent variable was number of preferred selections made per trial block.

3.1.3. Materials/apparatus

This was identical to Experiment 1 except for the addition of computer-based relational training and relational testing protocols which appeared in Phases 1 (Relational training) and 2 (Relational testing). A number of real word and nonsense syllable stimuli appeared in these protocols as follows: ‘Bear’ (A1), ‘Boceem’ (B1), ‘Gedeer’ (C1), ‘Door’ (A2), ‘Murben’ (B2), ‘Remond’ (C2), ‘Shoe’ (A3), ‘Surtel’ (B3), ‘Sipher’ (C3). The accompanying alphanumeric labels are employed in this report for ease of communication. Participants never saw these labels.

3.1.4. Procedure

For all participants, the procedure was similar to that employed in Experiment 1 though differed in a number of respects. The key difference was the inclusion of equivalence training and testing before exposure to other phases. There were five phases; (1) Relational training, (2) Relational testing, (3) Suppression induction, (4) Concurrent task, (5) Selection task.

3.1.4.1. Relational training. The participant was shown into the experimental cubicle and was seated in front of the computer. Relational training commenced with the following instructions displayed across the middle of the computer screen:

“Look at the Box Above and then Click on the Box Below that GOES WITH the one at the Top. Try Your Best NOT to Make Any Mistakes.”

This stage provided participants with match-to-sample conditional discrimination training designed to provide the basis for the following three equivalence relations: A1–B1–C1; A2–B2–C2; A3–B3–C3. Each predicted relation included one real word (the A stimulus) and two nonsense words (the B and C stimuli; see Fig. 2 for a diagram of the trained and tested relational networks).

![Fig. 2. The network of taught (B–A and C–B) and untaught or derived (A–C) equivalence relations in Experiment 2.](image-url)
Training involved both B–A and C–B trial-types. In B–A trial-types, participants were presented with B1, B2, or B3 as the sample stimulus and then had to choose from among the three comparison stimuli A1, A2, and A3. A correct response was A1 given B1, A2 given B2, and A3 given B3. For the B–A trial-types, participants were presented with C1, C2 or C3 as the sample stimulus and had to choose from the three comparison stimuli B1, B2, and B3. A correct response was B1 given C1, B2 given C2, and B3 given C3.

In all trials, the sample stimulus was positioned in the top centre of the computer screen while the three comparisons were arrayed along the bottom of the screen. The middle comparison lined up underneath the sample and the other two comparisons equidistant from the middle one to the right and to the left. Across trials, the spatial positioning of the comparison stimuli and of the correct comparison stimulus (left, middle or right) was counterbalanced.

There was no time limit for responding to individual trials. If the participant responded correctly, the stimulus display cleared and the word “Correct” appeared on the screen for 3000 ms. If the participant responded incorrectly, the stimulus display cleared and the word “Wrong” appeared on the screen for 3000 ms. The 6 trial-types (3 AB and 3 BC) were presented in a repeating quasi-random cycle and the criterion for proceeding to the testing phase was 12 consecutive correct responses. Once the criterion had been reached, the computer automatically cycled the participant into the next phase.

3.1.4.2. Relational testing. The relational testing phase was designed to probe for derived A–C relations. On the first test trial, the following instructions were shown across the middle of the computer screen:

“Look at the Box Above and then Click on the Box Below that GOES WITH the one at the Top. Try Your Best NOT to Make Any Mistakes. DURING THESE TRIALS THE COMPUTER WILL NOT GIVE YOU ANY FEEDBACK.”

This phase involved three A–C trial-types. On A–C testing trials, participants were presented with either A1, A2, or A3 as the sample stimulus and then had to choose from among the three comparison stimuli C1, C2, and C3. A correct (equivalence) response was C1 given A1, C2 given A2, and C3 given A3. The format of the A–C testing was similar to that for B–A and C–B training, except that no feedback was provided on any trials. Participants were exposed to twelve trials involving four presentations of each of the three trial types. A mastery criterion of 11/12 was required to advance to the next phase of the experiment. Failure to achieve this meant being recycled back through both training and testing. All participants reached criterion after a maximum of two training and testing cycles.
selections across the 6 blocks of Phase 5 and thus paired sample t-tests were carried out to compare all possible pairings of Phase 5 blocks to further investigate this result (see Table 2). These reveal significant differences between Part 1 and Part 2 Block 2; Part 1 and Part 2 Block 3; Part 1 and Part 2 Block 4; Part 1 and Part 2 Block 5; and between Part 2 Block 1 and Part 2 Block 2. As in Experiment 1, this suggests that participants changed their preference during Part 2. More specifically, it seems that they changed their preference between Blocks 1 and 2 of Part 2 and then maintained that change throughout the remainder of this part.

3.2.2. Trained condition

Participants in this condition occasionally saw the word in trained relations with the target thought (i.e., B1 ['Bocem']) behind their initially chosen door during Part 2 of the selection task. One participant in this condition did not show a preference behind their initially chosen door during Part 2 of the selection task. Fig. 4 suggests that, similar to the pattern seen for participants in the target condition, during Part 2 of the task, these participants tended to change their preference from that seen in Part 1. A one way ANOVA revealed a significant main effect ($F[5, 40] = 7.44; p < 0.05, \eta^2 = 0.50$) for number of preferred selections across the 6 blocks of Phase 5 and thus paired sample t-tests were carried out to compare all possible pairings of Phase 5 blocks to further investigate this result (see Table 2). These reveal significant differences between Part 1 and Part 2 Block 2; Part 1 and Part 2 Block 3; Part 1 and Part 2 Block 4; and Part 1 and Part 2 Block 5. As in Experiment 1, this suggests that participants changed their preference during Part 2. More specifically, it seems that they changed their preference in Part 2 Block 1 and then maintained that change throughout the remainder of this part.

3.2.3. Derived condition

Participants in this condition occasionally saw the word in derived relations with the target thought (i.e., C1 ['Gedeer']) behind their initially chosen door during Part 2 of the selection task. Fig. 5 suggests that, similar to the pattern seen for participants in the target condition, during Part 2 of the task, these

![Fig. 4. Mean number of choice responses made by the Trained condition in Phase 5, Parts 1 and 2, Experiment 2.](image)

![Fig. 5. Mean number of choice responses made by the Derived condition in Phase 5, Parts 1 and 2, Experiment 2.](image)

Table 2

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Target</th>
<th>Trained</th>
<th>Derived</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Part vs. Block 1</td>
<td>$t(9) = 1.86, p = .096, SE = 0.83$</td>
<td>$t(8) = 2.08, p = .071, SE = 0.96$</td>
<td>$t(10) = 3.48, p = .006, SE = 0.42$</td>
</tr>
<tr>
<td>1st Part vs. Block 2</td>
<td>$t(9) = 3.68, p = .005, SE = 1.07$</td>
<td>$t(8) = 3.78, p = .005, SE = 0.91$</td>
<td>$t(10) = 2.64, p = .025, SE = 0.72$</td>
</tr>
<tr>
<td>1st Part vs. Block 3</td>
<td>$t(9) = 4.27, p = .002, SE = 1.08$</td>
<td>$t(8) = 4.1, p = .003, SE = 1.00$</td>
<td>$t(10) = 4.31, p = .002, SE = 0.55$</td>
</tr>
<tr>
<td>1st Part vs. Block 4</td>
<td>$t(9) = 3.93, p = .003, SE = 1.31$</td>
<td>$t(8) = 3.03, p = .016, SE = 1.13$</td>
<td>$t(10) = 3.83, p = .003, SE = 0.59$</td>
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<td>1st Part vs. Block 5</td>
<td>$t(9) = 3.99, p = .003, SE = 1.26$</td>
<td>$t(8) = 2.83, p = .022, SE = 1.21$</td>
<td>$t(10) = 2.22, p = .050, SE = 1.06$</td>
</tr>
<tr>
<td>Block 1 vs. Block 2</td>
<td>$t(9) = 2.93, p = .017, SE = 0.81$</td>
<td>$t(8) = 2.04, p = .076, SE = 0.71$</td>
<td>$t(10) = 0.49, p = .635, SE = 0.93$</td>
</tr>
<tr>
<td>Block 2 vs. Block 3</td>
<td>$t(9) = 0.87, p = .406, SE = 0.80$</td>
<td>$t(8) = 1.11, p = .299, SE = 0.60$</td>
<td>$t(10) = 0.58, p = .572, SE = 0.78$</td>
</tr>
<tr>
<td>Block 3 vs. Block 4</td>
<td>$t(9) = 0.86, p = .413, SE = 0.58$</td>
<td>$t(8) = 1.63, p = .141, SE = 0.41$</td>
<td>$t(10) = 0.16, p = .875, SE = 0.56$</td>
</tr>
<tr>
<td>Block 4 vs. Block 5</td>
<td>$t(9) = 0.17, p = .868, SE = 0.59$</td>
<td>$t(8) = 0.00, p = .100, SE = 0.53$</td>
<td>$t(10) = 0.09, p = .925, SE = 0.94$</td>
</tr>
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participants tended to change their preference from that seen in Part 1. A one way ANOVA revealed a significant main effect ($F[5, 50]=2.77; p < 0.05, \eta^2_g = 0.22$) for number of preferred selections across the 6 blocks of Phase 5 and thus paired sample t-tests were carried out to compare all possible pairings of Phase 5 blocks to further investigate this result (see Table 2). These reveal significant differences between Part 1 and Part 2 Block 1; Part 1 and Part 2 Block 2; Part 1 and Part 2 Block 3; Part 1 and Part 2 Block 4; and Part 1 and Part 2 Block 5. As in Experiment 1, this suggests that participants changed their preference during Part 2. More specifically, it seems that they changed their preference in Part 2 Block 1 and then maintained that change throughout the remainder of this part.

3.2.4. Control condition

Participants in the Control condition saw words with no history of either direct or potential derived association with the target ‘Bear’ behind their initially chosen door during Part 2 of the selection task. One participant in this condition did not show a preference in the initial part of the Phase 5 selection task and thus her data were not analysed further. This left a total of 9 participants whose data were analysed. Fig. 6 suggests that these participants may have shown a slight decrease in preference for their initially selected door over the course of both parts of the selection task. However, a one way ANOVA revealed no significant main effect ($F[5, 40]=1.42; p > 0.05, \eta^2_g = 0.15$) for number of preferred selections across the 6 blocks of Phase 5.

3.3. Summary

First, it is interesting to note that the procedural adjustment from 10 to 20 initial selection trials appeared to be a successful modification, since exclusions due to ‘no preference’ dropped from 5 of 27 to 2 of 40. Graphical representation of the selection of the preferred door across Parts 1 and 2 of Phase 5 for each of the four groups in the current experiment appears to show trends in the selection responding. Namely, participants in each group showed less selection of their initially preferred door in Part 2 than in Part 1. Comparing trends seen in the four graphs, the ‘Target’ condition seems to show the strongest trend, the ‘Trained’ condition shows a weaker trend, the ‘Derived’ condition a weaker trend again and the ‘Control’ condition the weakest. Analysis of variance reveals significant selection differences between Parts 1 and 2 for participants in the ‘Target’, ‘Trained’ and ‘Derived’ conditions, with no significant difference for participants in the ‘Control’ condition.

Both the trends suggested by the graphs and the statistical differences revealed by inferential analysis are as might have been predicted. If it is expected that participants would avoid their initially selected preference to avoid the to-be-suppressed stimulus, then it would be predicted that the ‘Target’ condition would show less ‘initially preferred door’ selection. This is a repetition of the pattern seen in Experiment 1.

In addition to this, however, participants in both the ‘Trained’ and ‘Derived’ conditions showed similar patterns though with the ‘Trained’ group showing a less pronounced pattern than the ‘Target’ group and the ‘Derived’ group showing a less pronounced pattern than either of the other two groups. The participants in the trained and derived conditions show significant avoidance responding. However, their avoidance was weaker than observed in the target condition. Given their training and the literature on derived stimulus relations, it seems likely that BOCEEM and GEDEER acquired similar psychological functions as BEAR via the relational training procedures. Furthermore, they showed less avoidance in the derived than in the trained condition since a directly trained relation would be expected to produce stronger conditioning than a derived relation.

Finally, participants in the ‘Control’ condition showed no significant decrease in the selection of their initially preferred stimulus. Assuming the effect seen in the other conditions is indeed based on avoidance of the to-be-suppressed stimulus or a related stimulus, then this is to be expected since these participants saw neither in the critical part of the experiment. At the same time, though non-significant, there is a slight trend toward selection of the non-initially preferred door. It may be argued that this is an artefact of the extinction schedule which participants are under once the experimental blocks begin, since extinction is known to induce variability in responding (Neuringer, Kornell, & Olufs, 2001). In any event, the fact that there is a significantly weaker pattern for this condition bolsters the suggestion that both experiments have successfully shown avoidance based choice suppression and that Experiment 2 has additionally shown directly (trained) and indirectly (derived) conditioned avoidance based choice suppression.

4. General discussion

Acceptance and Commitment Therapy sees choosing in accordance with one’s personal preferences as a foundational element of valuing and sees avoidance as a potential threat to this process. The current study sought to extend on previous work by Hooper et al. (2010) by modelling the direct and indirect effects on personal choice of thought suppression as a common form of
avoidance. In Experiment 1 (direct effect) participants were required to make a preference on a dichotomous choice. After making their choice they were instructed to repeat the selection task while suppressing all thoughts of a target word which was programmed to appear each time they selected their originally preferred item. Results showed that participants gradually changed their original preference to avoid coming into contact with the target unwanted thought. These results extend on the wide literature on the negative effects of thought suppression (Erskine, Georgiou, & Kvavilashvili, 2010) and provide the first basic empirical model of the effect of thought suppression on personal choice.

Experiment 2 (indirect effect) extended Experiment 1 by showing that a similar effect might be seen via trained and derived relations respectively and by comparing possible effects seen in original target, trained and derived conditions with patterns seen in a control condition. In Experiment 2 participants in each of four groups (target, trained, derived and control) were first trained and tested for the formation of three derived equivalence relations using a match-to-sample procedure. They then received exposure to suppression and door choice phases similar to the protocol employed in Experiment 1 but differing in important respects also, depending on the condition in question. As in the Experimental 1 protocol, the protocol for the three experimental conditions in Experiment 2 involved a stimulus that might function to depress choice congruent behaviour; however, the protocol for the three Experiment 2 conditions differed in terms of the nature or origins of this stimulus (i.e., target, trained or derived). Outcome data for these three conditions were compared with those for a fourth (control) condition for whom no ‘psychoactive’ stimulus was present. This comparison revealed that participants in each of the three experimental conditions demonstrated depressed personal choice in comparison with the control condition.

This experiment supports and extends the result seen in Experiment 1. Demonstration that the effect does not occur in a control condition shows that the effect is not simply based on drift in participant choice. Specifically, participants not instructed to suppress items involved in the preference selection task did not shift from their original preference. However, participants instructed to suppress task relevant stimuli (either direct or indirectly related) were more likely to change their preference. Additionally, this experiment extends Experiment 1 by showing that the constraining effects of thought suppression can also occur through directly conditioned and derived relations. That is, Experiment 2 aimed to examine whether or not the change in preference selection would occur via stimuli that had been previously related to the target unwanted thought stimulus through directly trained, and also through derived stimulus relations. The latter phenomenon, which is of particular interest, as it models the potential indirect effects of language, is referred to as the transfer, or transformation, of function. It has been demonstrated with a number of derived stimulus relations (e.g., same, opposite, more/less) and behavioural functions (e.g., avoidance, self discrimination, moods, preference responses; see Dymond & Rehfeldt, 2000, for a review).

Perhaps the major limitation of the current study is the low valence of the choice stimuli employed. Participants were instructed to choose between colours as opposed to making a more psychologically important choice. In the world outside of the laboratory, in contrast, avoidant behaviour moves people away from high valence choices connected with potentially strongly reinforcing experiences (e.g., sexual intimacy). Future work employing the present paradigm should seek to increase the ecological validity of the model by examining effects of suppression with respect to stimuli or situations with higher valence (e.g., stimuli verbally linked with important declared values such as family, career or relationship). Future work might also improve ecological validity by increasing the (negative) valence of the to-be-avoided stimuli (e.g., using spider related stimuli with spider fearful participants). As well as increasing validity, the latter would also make avoidance much more likely even given choices involving high valence.

Another possible future improvement might be made with respect to the critical data of choice responding. Specifically, there might be a focus on individual participant data as opposed to group means. In the current study participants’ responses were grouped into blocks of ten and individual participant data was subsumed into group means. However, analysis of individual response patterns in addition to group data and of individual choices over time in future work might allow greater clarity as regards the phenomena of interest.

A strength of the current study is that a simple procedure has been developed which models the effect that experiential avoidance can have on the decisions people make. Experiential avoidance is currently thought to underpin the majority of psychological disorders and forms a major principle of some third wave therapies including ACT. The development of a clean analogue model of how this process interacts with decision making takes us a step further to understanding the nature of experiential avoidance. In particular it takes us a step further to understanding how experiential avoidance may interfere with valued living. In addition to promoting basic understanding of experiential avoidance in this way, the behavioural shift in choice demonstrated in the present study is of importance in understanding behaviour in applied contexts, such as psychotherapy. In this study, participants avoided a previously preferred stimulus in order to avoid other stimuli. The latter included not just a stimulus that they had previously been required to avoid but also stimuli in directly trained and derived relations with that stimulus. These results model how individuals will select away from activities or experiences that they might otherwise have chosen in order to avoid particular private experiences. In particular, the results demonstrate that suppression functions can transfer to stimuli related to the to-be-suppressed item and that this can exacerbate psychological problems. In everyday life, these kinds of effects can cause a negative cascade of behavioural avoidance and thus seriously aggravate disorders such as depression or anxiety (Walther, Nagengast, & Trasselli, 2005).

The results of the current study also have implications for further work in this area. First, it may be possible to replicate the Experiment 2 procedure to include relations other than equivalence. For example, if the participants in Experiment 2 were trained and tested instead in same-opposite relations, then it is possible that they would not only change their preference but also stimuli functionally opposite to it. This would suggest that in real life, people would not just have to change their behaviour to avoid the target of their suppression attempt, or to items learned and derived as being similar to the target, but to items in any other relations on the target including opposition or distinction. This again could be investigated in terms of stimuli in trained opposite and derived opposite relations to the target. Another relation that may be of interest in this domain is comparative relations. For example, it would be interesting to see the pattern of emergent avoidance when encountering a stimulus trained as ‘greater than’ the target stimulus. One would theoretically assume that the pattern of avoidance would be more pronounced. Related to this is the idea of nodal distance. Participants’ patterns of avoidance might be stronger to items that are closer in a relational network than those further away (Wang, Dack, Wheelan, & McHugh, 2011).

The results also have more applied implications for therapists. Specifically, therapists will have to be aware of indirect stimuli impacting experiential avoidance. For example, ‘I do not want to...
switch jobs because I am afraid I might fail’ is an obvious and perhaps ‘direct’ avoidance response. The person here is altering their behaviour in order to avoid feelings of failure. But the results of the current study suggest that there may be subtle less obvious variables at play that the therapist would have to try to contact. For example, maybe a client is deriving that switching jobs is disloyal but cannot describe the derived response. However, a clinician oriented to the many possible sources of avoidance might note signs of the derived basis for this response. For instance, perhaps the patient remembers his father’s anger after reading about a player who was disloyal to a beloved sports team.

From the perspective of 3rd wave cognitive behavioural therapy, the current study provides a potentially useful model for studying the possible effects of thought suppression on valued living. Derived stimulus relations (DSR) are said to underpin the ACT model of psychopathology (Hayes et al., 1999). Values are a critical component of the ACT model (Plumb et al., 2009). However, there is a lack of basic research linking DSR and valued living. The current study provides an initial demonstration of how thought suppression and derived relations can alter behavioural choices which could be consistent with a chosen value. This is an important step in furthering research into these issues which may be helpful to others interested in the exploration of this domain.

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References
