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**The transfer of social exclusion and inclusion functions through derived stimulus relations.**

Anita Munnelly<sup>1</sup>, Georgina Martin,<sup>1</sup> Charlotte Dack<sup>2</sup>, Ann Zedginidze<sup>1</sup>, Louise McHugh<sup>1</sup>

- 1. University College Dublin
- 2. University College London

Correspondence address: Dr. Louise McHugh  
School of Psychology  
University College Dublin  
Belfield  
Dublin 4  
Ireland

Email: [louise.mchugh@ucd.ie](mailto:louise.mchugh@ucd.ie)  
Phone number: +353879545330

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26

Abstract

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Previous studies have found that social exclusion can cause distress to those excluded. One method used to study social exclusion is through a virtual ball-toss game known as Cyberball. In this game, participants may be excluded from or included in the ball-toss game and typically report lower feelings of self-esteem, control, belonging and meaningful existence following exclusion. Experiments 1 and 2 sought to explore the transfer of feelings of exclusion and inclusion through stimulus equivalence classes. In both experiments, participants were trained to form two three-member equivalence classes (e.g., A1-B1, B1-C1; A2-B2, B2-C2) and tested with novel stimulus combinations (A1-C1, C1-A1, A2-C2, C2-A2). Thereafter, participants were exposed to the Cyberball exclusion and inclusion games. In this game, one stimulus (C1) from one equivalence class was assigned as the Cyberball inclusion game name, while one stimulus (C2) from the other equivalence class was assigned as the Cyberball exclusion game name. In Experiment 2, participants were only exposed to the Cyberball exclusion game. During a subsequent transfer test, participants were asked to rate how included or excluded they thought they would be in other online games, corresponding to members of both equivalence classes. Participants reported that they felt they would be excluded from online games if they were members of the same equivalence class as C2. In contrast, participants reported that they felt they would be included in online games if they were members of the same equivalence class as C1. Results indicated the transfer of feelings of inclusion (Experiment 1) and feelings of exclusion (Experiments 1 and 2) through equivalence classes.

## Derived Transformation of Exclusion Functions

50           A growing body of research now shows that being ostracised or excluded can have  
51 a strong aversive influence on an individual's behavior and emotions (e.g., MacDonald &  
52 Leary, 2005; Warburton, Williams, & Cairns, 2006; Williams, Cheung, & Choi, 2000;  
53 Williams, Govan, Croker, Tynan, Cruickshank & Lam, 2002; Zadro, Boland, &  
54 Richardson, 2006; Zadro, Williams, & Richardson, 2004). For example, following an  
55 episode of exclusion, an individual typically reports lower feelings of self-esteem, control,  
56 and a lowered sense of meaningful existence (e.g., Williams et al., 2000, 2002; Zadro et al.,  
57 2004, 2006). Instances of exclusion can involve nonverbal cues such as avoiding eye  
58 contact, ignoring someone's presence or excluding someone from activities (Williams et al.  
59 2002). In addition, it has been reported that exclusion via the internet (i.e., cyberostracism)  
60 has the same adverse effect on an individual as face-to-face instances of exclusion (e.g.,  
61 Williams et al., 2000, 2002). Thus, given the increase in the number of people  
62 communicating online via social media sites and the potential for exclusion on these sites,  
63 it is important that researchers understand the effects that cyberostracism can have on an  
64 individual's personal and social life.

65           One of the first studies to examine the effects of cyberostracism was conducted by  
66 Williams et al. (2000). In this study, participants were exposed to an online virtual ball toss  
67 game called "Cyberball" which involved a number of other players. Unknown to  
68 participants however, the other players were computer-generated and controlled. That is,  
69 the researchers manipulated the program so that they could vary how included or excluded  
70 the participant was from the game (e.g., whether the participant received the ball the same  
71 number of times as the other players or less times). Findings revealed that the more  
72 excluded, or ostracised participants were, the more they reported feeling bad, having a  
73 lower sense of belonging, and less control (e.g., Williams et al., 2000; see also Williams et  
74 al., 2002). This led Williams et al. (2000) to propose that exclusion threatens at least four

## Derived Transformation of Exclusion Functions

75 fundamental needs: belonging, self-esteem, control, and meaningful existence (Williams,  
76 2009; Williams et al., 2000). For example, an individual may lose his or her sense of  
77 belonging if he or she, is excluded by others (Jamieson, Karkins, & Williams, 2010;  
78 Williams, 2009). In addition, an individual may suffer lower self-esteem following an  
79 episode of exclusion as self-esteem is based, in part, on one's social inclusionary status  
80 (Jamieson et al., 2010; Leary, Haupt, Strausser, & Chokel, 1998; Leary, Tambor, Terdal, &  
81 Downs, 1995). The significance of cyberostracism on participants' experience of exclusion  
82 and its impact on how the participants feel about themselves is critical with the increase in  
83 online communication. Thus, it is important to understand the mechanisms behind the  
84 impact of ostracism and how this experience can generalise to other contexts, or areas, in  
85 an individual's life. One method in which such an analysis may be undertaken is through  
86 an examination of derived stimulus relations.

87 Numerous studies have shown that two stimuli can become associated with one  
88 another merely on the basis of their shared associative history (i.e., despite sharing no  
89 physical properties and despite never having been directly paired; Sidman, 2000). The  
90 derivation of stimulus relations is an empirically demonstrable phenomenon in which, by  
91 training a series of unidirectional relations between arbitrary stimuli, a number of untrained  
92 or derived relations emerge in an overall pattern according to which the stimuli seem  
93 subsequently to be treated as mutually substitutable or equivalent. Using the simplest  
94 possible example, imagine participants are trained, using arbitrary stimuli A, B and C to  
95 choose B in the presence of A, and C in the presence of B. Stimulus equivalence is  
96 subsequently demonstrated if they show a number of further 'derived' relations including  
97 reversing the trained relations by choosing A in presence of B, and B in presence of C; and  
98 combining the trained relations by choosing C with A and vice versa. If all emergent  
99 relations proposed here control responding, then A, B and C are effectively being treated

## Derived Transformation of Exclusion Functions

100 by the participant as equivalent or mutually substitutable and are said to function as a  
101 derived equivalence relation or equivalence class. Furthermore, stimulus functions are  
102 found to transfer through equivalence classes (e.g., Augustson & Dougher, 1997; Dack,  
103 McHugh & Reed, 2009; Dack, McHugh & Reed, 2010; Dougher, Augustson, Markham,  
104 Greenway, & Wulfert, 1994). That is, a function attached to one member of an equivalence  
105 class is often found to transfer to other stimuli in that class. For example, ratings of self-  
106 efficacy and causal-effectiveness have been demonstrated to transfer across equivalence  
107 classes (Dack et al., 2009, 2010; Valdivia-Salas, Dougher, & Luciano, 2013). In one such  
108 study, Dack et al. (2009) found that an evaluation made towards one stimulus transferred to  
109 another stimulus through a relation between the latter stimulus with the former. That is,  
110 stimuli that were associated with schedules of reinforcement that produced either good or  
111 bad causal evaluations were later categorized with stimuli that had previously been  
112 established as having the same function ('good' or 'bad') through stimulus equivalence  
113 classes. The authors proposed that these findings have the potential to account for the  
114 processes involved in disorders such as depression in which the negative evaluations spread  
115 to many areas (e.g., people and events) of an individual's life. Just as causal evaluations  
116 can transfer through equivalence classes, it is possible that so too can feelings of exclusion.  
117 Such findings would have important implications for our understanding of how exclusion  
118 from one activity (e.g., badminton) may generalize to other contexts or activities in an  
119 individual's life without the person having experienced direct exclusion from these  
120 activities (e.g., to similar sports or activities such as basketball or tennis).

121 Experiments 1 and 2 aimed to determine whether the functions of ostracism  
122 (feelings of exclusion and inclusion) would transfer across equivalence classes. That is,  
123 would participants expect to feel excluded from (or included in) a new game based on the

## Derived Transformation of Exclusion Functions

124 fact that this game was in an equivalence class with a game from which they were directly  
125 excluded from?

126

### 127 **Experiment 1**

#### 128 **Method**

##### 129 **Participants and Design**

130 Twelve students, 5 male and 7 female, ranging in age from 20 to 39 ( $M = 25.67$ ,  
131  $SD = 6.21$ ) were recruited through campus wide advertisements at University College  
132 Dublin. In return for participation, individuals received €5 in cash. All participants were  
133 naive to the purpose of the experiment (e.g., participants were told that the current study  
134 sought to examine online gaming), and were fully debriefed on completion.

135 Ethical approval was obtained from the departmental ethics committee before research  
136 commenced. The experiment involved a 2 x 2 repeated measures factorial design with  
137 Game type (inclusion vs. exclusion) and Equivalence Class (Class 1 vs. Class 2) as the  
138 repeated measures.

##### 139 **Apparatus and Setting**

140 The experiment was conducted in a quiet room containing a computer with a 15-  
141 inch color monitor and a standard keyboard. The presentation of the derived stimulus  
142 training and testing and all responses were recorded by a program written in Visual Basic  
143 6. All responses were made using the computer mouse or on the keyboard. The Cyberball  
144 game V 4.0 was downloaded from <https://cyberball.wikispaces.com> and adapted to include  
145 the relevant 'game name' on the screen.

##### 146 **Derived Stimulus Relations Training**

147 The stimuli employed as members of the two equivalence classes were nonsense  
148 words. The nonsense words and corresponding letter-number designations are shown in

## Derived Transformation of Exclusion Functions

149 Table 1. All of the stimuli were composed of Arial Bold characters in black, each of which  
150 occupied a certain proportion of the screen (screen width/4 in.). Each stimulus was  
151 surrounded by a box (4 in. width and 1 in. height) against a white background. On each  
152 trial, participants were presented with two comparison stimuli in the lower portion of the  
153 screen and a sample stimulus in the upper portion (horizontal position 1.25 in., and vertical  
154 position, 7.75 in.). All feedback choices (CORRECT, WRONG) were in red surrounded by  
155 a box (6 in. width and 1.5 in. height), presented in the middle of the screen.

### 156 **Cyberball Exclusion and Inclusion Conditioning Games**

157 In this task, the C1 (Boceem) stimulus was employed as the Cyberball inclusion  
158 game name, while the C2 (Casors) stimulus was employed as the Cyberball exclusion game  
159 name.

### 160 **Measures**

161 Participants were required to complete the University of Wales Institute of Science  
162 and Technology (UWIST) Mood Adjective Checklist questionnaire (MACL; Mathews,  
163 Jones & Chamberlain, 1990), which was administered in order to assess participants'  
164 current mood state. The UWIST MACL was administered at the start of the experiment and  
165 also at the end in order to capture any potential changes in participants' moods as a result  
166 of exposure to the Cyberball exclusion and inclusion games.

167 A post-experimental Cyberball questionnaire (e.g., Williams, et al., 2000; Zadro et  
168 al., 2006) was administered to measure four types of needs: Belonging (e.g., "I felt I  
169 belonged to the group"), Self-esteem (e.g., "I felt good about myself"), Control (e.g., "I felt  
170 I had the ability to significantly alter the course of the game"), and Meaningful Existence  
171 (e.g., "I felt meaningless"), following both the inclusion and exclusion Cyberball games.  
172 Participants rated these needs based on how they felt *during the game* on a scale of 1 (*not*  
173 *at all*) to 5 (*extremely*). Items were reversed scored where necessary. In addition,



## Derived Transformation of Exclusion Functions

174 participants were asked to rate certain positive (e.g., “I felt happy”) and negative (e.g., “I  
175 felt sad”) emotions that they experienced *during the game*. Three manipulation checks were  
176 also included at the end of the post-experimental Cyberball questionnaire to determine  
177 whether or not participants felt excluded and ignored during the Cyberball game.  
178 Participants were asked to respond to the following statements on a scale of 1 (*not at all*) to  
179 5 (*extremely*): “I was ignored” and “I was excluded”. The third manipulation check  
180 consisted of participants responding to the following open-ended question: ‘Assuming the  
181 ball should be thrown to each person equally (33%), what percentage of the throws did you  
182 receive?’ by recording the percent of overall tosses they recalled received.

183 A post-experimental Transfer of Function Questionnaire was administered to  
184 determine whether participants felt they would be included in or excluded from games that  
185 were related to the Cyberball inclusion and exclusion games, respectively (see below for  
186 more details on the Transfer of Function Questionnaire).

### 187 **Procedure**

188 Each participant was taken into a quiet room and given an information sheet to read,  
189 and a consent form to sign. Next, the experimental task began and the general procedure  
190 was as follows: *Phase 1*: Pre-experimental Questionnaires (UWIST MACL Questionnaire);  
191 *Phase 2A*: Derived Stimulus Relations Training and *Phase 2B*: Testing Emergent  
192 Relations; *Phase 3*: Cyberball Inclusion and Exclusion Conditioning Games; *Phase 4*:  
193 Transfer of Function Questionnaire; *Phase 5*: Post-experimental Questionnaires (Cyberball  
194 Questionnaire and the UWIST MACL).

### 195 ***Phase 1***

196 **UWIST MACL.** Participants were required to complete the pre-experimental  
197 UWIST MACL which assessed their current mood to positive and negative adjectives. This  
198 involved the presentation of twenty-four mood related words that were both positive and

## Derived Transformation of Exclusion Functions

199 negative (e.g., “anxious” or “happy”). Participants were instructed to rate their mood  
200 “Right Now” (i.e., at the time of administration) to a number of adjectives by circling one  
201 of four options including “Definitely”, “Slightly”, “Slightly not” to “Definitely not”.

### 202 *Phase 2A*

203         **Derived Stimulus Relations Training.** All training and testing was conducted  
204 using a 2 x 3 matching-to-sample conditional discrimination paradigm using stimuli that  
205 consisted of three nonsense words (see Table 1). Two three member equivalence classes  
206 were established by training AB and BC relations in a linear series structure. Each relation  
207 (A1–B1, A2–B2, B1–C1, and B2–C2) was presented at least three times during training.  
208 The criterion to proceed to the testing phase was 12 consecutively correct trials across all  
209 stages. There was no time limit for responding to individual trials. Each trial started with  
210 the presentation of a sample (Sa) and two comparison stimuli. The positive comparison  
211 (Co1) stimulus was chosen from the same equivalence class as Sa, and the negative  
212 comparison (Co2) stimulus was chosen from the other class. The stimuli were displayed in  
213 an isosceles triangle display on the monitor, with Sa at the vertex of the triangle and Co1  
214 and Co2 at the corners of the base. At the start of the equivalence training phase,  
215 participants were told that they were going to be exposed to nonsense words that  
216 represented online game names, and that their task was to learn these game names.  
217 Participants were instructed that these nonsense words represented game names as they  
218 were later going to be exposed to online ball-toss games, in which two of these nonsense  
219 words would appear as the game names. The following instructions were then presented  
220 across the middle of the screen on the first trial only: “Look at the Box Above and then  
221 Click on the Box Below that GOES WITH the one at the Top. Try Your Best NOT to Make  
222 Any Mistakes.” The participants chose a comparison by clicking on the left- or righthand  
223 box. Participants were given feedback for their choices. Choosing the positive comparison

## Derived Transformation of Exclusion Functions

224 (Co1) produced a 1-sec display of the word “Correct,” whereas choosing the negative  
225 comparison (Co2) produced a 1-sec display of the word “Wrong.” Feedback was displayed  
226 in red across the middle of the computer screen.

### 227 *Phase 2B*

228         **Testing Emergent Relations.** Once the criterion for the training session had been  
229 met, the test phase commenced. On the first test trial, the following instructions were  
230 shown across the middle of the computer screen: “Look at the Box Above and then Click  
231 on the Box Below that GOES WITH the one at the Top. Try Your Best NOT to Make Any  
232 Mistakes. DURING THESE TRIALS THE COMPUTER WILL NOT GIVE YOU ANY  
233 FEEDBACK.” All tests for one-node transitivity (A-C) and equivalence (C-A) were  
234 presented in a single block. Each type of relation (A1–C1, A2–C2, C1–A1, and C2–A2)  
235 was presented nine times, with 32 trials in total. All trials were unreinforced. The mastery  
236 criterion for testing was at least 28 correct class-consistent selections across the block of 32  
237 test trials. If participants failed to reach this criterion, then they were re-exposed to  
238 equivalence training and testing for three more times. Thus, a total of three and seven  
239 participants required additional equivalence training and testing in Experiments 1 and 2,  
240 respectively.

### 241 *Phase 3*

242         **Cyberball Exclusion and Inclusion Conditioning Games.** Upon reaching  
243 criterion during the equivalence testing phase, participants were immediately exposed to  
244 the Cyberball inclusion and exclusion games. When exposed to the exclusion game,  
245 participants were informed by the computer program that they were going to play the  
246 Casors (C2) game, with players (i.e., students) from other universities. For the inclusion  
247 game, participants were informed that they were going to play the Boceeem (C1) game.

## Derived Transformation of Exclusion Functions

248 For example, participants were informed that they were going to play the Casors (C2)  
249 game, and were presented with the following instructions onscreen:

250 *The CASORS Game.*

251 *In a few moments, you will be playing a ball tossing game, called the CASORS*  
252 *game, with other students over our network. The game is very simple. When the*  
253 *ball is tossed to you, you simply click on the name of the player you want to*  
254 *throw it to. When the game is over, click on the Next button.*

255 *Okay, ready to begin?*

256 *Please click on the “Next” button below to begin.*

257

258 The only difference between instructions for the Cyberball inclusion and exclusion  
259 games was that for the Cyberball inclusion game (C1), the word “CASORS” was replaced  
260 with the word “BOCEEM”.

261 When participants clicked on the Next button, the computer program instructed  
262 them to wait while they connected to other players. In total, there were three players  
263 involved in the game (the participant and two other students). The player icon for the  
264 participant was always positioned at the bottom of the screen, and was labelled “You”.  
265 Two other player icons were positioned above the participant player icon, on the left and  
266 right of the screen respectively (see Figure 1 for a screenshot example). The player on the  
267 left-hand side of the screen was named “Paul”, while the player on the right-hand side of  
268 the screen was named “Catherine”. Each player icon consisted of a white figure with a  
269 black outline. A line of text reminding participants of the game name (e.g., “The CASORS  
270 game”) was presented in the top portion of the screen during both the exclusion and  
271 inclusion games.

## Derived Transformation of Exclusion Functions

272           At the beginning of the game, one of the players threw the ball to the participant. In  
273 order for the participant to throw the ball to another player, he or she clicked on the  
274 appropriate player icon. Reminder instructions on how to throw the ball remained onscreen  
275 for the duration of the game. During the Cyberball exclusion game, the participant only  
276 caught and threw the ball twice at the start of the game, and was then excluded by the other  
277 players for the remainder of the game. That is, the participant did not receive the ball again.  
278 The Cyberball exclusion game lasted approximately three minutes, and for a total of 30  
279 trials. In contrast, during the Cyberball inclusion game, participants caught and threw the  
280 ball the same number of times as the other players. That is, participants randomly caught  
281 and threw the ball 33% of the time (10 times out of the 30 trials). Half of participants  
282 played the Cyberball inclusion game first, followed by the Cyberball exclusion game, while  
283 the other half played the Cyberball exclusion game first, followed by the Cyberball  
284 inclusion game.

285 *Phase 4*

286           **Transfer of Function Questionnaire.** Having completed the Cyberball inclusion  
287 and exclusion conditioning games, participants were required to complete a post-  
288 experimental Transfer of Function Questionnaire. This questionnaire sought to determine  
289 whether participants felt they would be included in games that were previously established  
290 as being part of the same equivalence class (e.g., A1 and B1) as the Cyberball inclusion  
291 game (C1), and excluded from games (e.g., A2 and B2) that were from the same  
292 equivalence class as the Cyberball exclusion game (C2). Participants were also asked to  
293 rate whether they felt they would be excluded from or included in the directly trained C2  
294 exclusion and C1 inclusion games. The instructions presented to participants in the  
295 Transfer of Function Questionnaire can be seen below:

## Derived Transformation of Exclusion Functions

296 *Please rate on a scale of 1-9 (1 = Excluded, 9 = Included), how included or*  
297 *excluded you think you would be in the following games based on your experience*  
298 *of the CASORS and BOCEEM games.*

299 Thus, participants were asked to rate on a scale of 1-9 whether they felt they would  
300 be included or excluded from the following games: Lewoly (A2), Gedeer (B2), Casors  
301 (C2), Matser (A1), Rigund (B1) and Boceem (C1).

302 *Phase 5*

303 **Cyberball Questionnaire.** Participants were also asked to complete a post-  
304 experimental Cyberball questionnaire following both the exclusion and inclusion games.

305 **UWIST MACL.** This was identical to the pre-experimental UWIST MACL  
306 measure.

307 **Debrief.** Having completed the final post-experimental questionnaire, participants  
308 were thanked for their participation in the study and provided with a debrief information  
309 sheet outlining the purpose of the current study. Participants were informed that the other  
310 players in the Cyberball game were not students from other universities, but were in fact,  
311 computer-generated participants. However, it must be noted that the current study did not  
312 undertake a manipulation check to determine whether the experimental deception worked.

## 313 **Results and Discussion**

314 **Statistical Analysis.** Trials to criterion and mean percentage correct were examined  
315 for equivalence training and testing, respectively. For the Transfer of Function  
316 Questionnaire, a repeated measures Multivariate Analysis of Variance (MANOVA), with  
317 Equivalence class (Class 1 and Class 2) and Game type (Exclusion or Inclusion) as factors,  
318 and ratings to the Transfer of Function questionnaire as the dependent measure, was used to  
319 examine potential differences between the trained and derived exclusion and inclusion  
320 games. Changes in mood as measured by the UWIST MACL were examined using a

## Derived Transformation of Exclusion Functions

321 repeated measures MANOVA, with time (Time 1 and Time 2) and item (Hedonic, Stress,  
322 and Arousal) as factors, and ratings to these items, as the dependent measure. T-tests were  
323 conducted to examine differences between the composite ratings of need satisfaction to the  
324 Cyberball inclusion and exclusion games. A significance level of .05 was adopted for  
325 statistical analysis.

326         **Equivalence Training and Testing.** Two participants terminated their participation  
327 in the experiment before the end of the study and their data are therefore excluded from  
328 further analysis. When a participant ended their participation, the experimenter took note of  
329 his or her game order (i.e., exclusion or inclusion game first) so that the next participant  
330 would receive this game order. This was done as to ensure that the correct counterbalancing  
331 of games was achieved across participants. For the remaining ten participants, all met  
332 criteria during both equivalence training and test phases and required between 1 and 3  
333 exposures to do so ( $M = 1.40$ ,  $SD = 0.7$ ). Participants required between 12 and 145 trials to  
334 meet criterion during equivalence training ( $M = 36.93$ ,  $SD = 37.48$ ). All ten participants  
335 met criterion during the equivalence test phase, with an overall mean of 98.44% ( $SD =$   
336 1.27) correct class consistent responding.

337         **Transfer of Function Questionnaire.** Results demonstrated that eight out of ten  
338 participants responded as predicted to C1 and C2. That is, 80% of participants rated that  
339 they felt they would be included in the C1 game and excluded from the C2 game. Of these  
340 participants, seven out of eight (87.5%) rated that they felt they would be excluded from  
341 games related (A2 and B2) to the C2 exclusion game, and included in games (A1 and B1)  
342 related to the C1 inclusion game (see Table 2 for participants' ratings with respect to the  
343 games on the Transfer of Function Questionnaire).

344         Figure 2 displays the mean ratings for participants on the post-experimental  
345 Transfer of Function Questionnaire. From this figure it can be seen that participants rated

## Derived Transformation of Exclusion Functions

346 an average of 2.33 ( $SD = 1.58$ ) for the directly trained C2 exclusion game, and rated an  
347 average of 8.11 ( $SD = .78$ ) for the directly trained inclusion game. In addition, Figure 2  
348 shows participants' ratings for the derived exclusion games. On average, participants rated  
349 3.11 ( $SD = 1.54$ ) to A2, and 3.00 ( $SD = 1.94$ ) to B2. To the derived inclusion games,  
350 participants rated an average of 7.67 ( $SD = 1.12$ ) to A1 and 7.44 ( $SD = 1.01$ ) to B1.

351 A MANOVA revealed a significant effect for Equivalence class ( $F(3, 12) = 91.545$ ,  
352  $p = .001$ ,  $\eta_p^2 = .958$ ). Follow-up comparison revealed a significant difference in ratings to  
353 the directly trained C1 and C2 games ( $p = .001$ ), the derived symmetrical B1 and B2 games  
354 ( $p = .001$ ), and the derived equivalence A1 and A2 games ( $p = .001$ ). Thus, participants  
355 rated that they felt they would be excluded from games that were members (A2 and B2) of  
356 the same equivalence class as the directly trained exclusion game (C2), and included in  
357 games that were members (A1 and B1) of the same equivalence class as the directly trained  
358 inclusion game (C1).

359 **Cyberball Questionnaire.** In order to determine whether the Cyberball exclusion  
360 game was successful in inducing feelings of exclusion (ostracism), three manipulation  
361 checks were included at the end of the Cyberball Questionnaire. Average ratings to these  
362 questions indicated that when participants were exposed to the Cyberball exclusion game,  
363 they felt more ignored ( $M = 1.5$ ,  $SD = .71$ ) than when they were exposed to the Cyberball  
364 inclusion game ( $M = 3.8$ ,  $SD = 1.55$ ,  $t(9) = -4.867$ ,  $p = .001$ ;  $d = .69$ ). In addition, when  
365 participants were exposed to the Cyberball exclusion game, they reported that they felt  
366 more excluded ( $M = 1.5$ ,  $SD = .50$ ) than when they were exposed to the Cyberball  
367 inclusion game ( $M = 4.1$ ,  $SD = 1.30$ ;  $t(9) = -6.50$ ,  $p = .001$ ;  $d = .80$ ). Furthermore, when  
368 participants were exposed to the Cyberball exclusion game, they correctly reported that  
369 they received the ball on a smaller percentage of throws ( $M = 5.1\%$ ,  $SD = 4.11\%$ ) in  
370 comparison to when they were exposed to the Cyberball inclusion game ( $M = 35.4\%$ ,  $SD =$



## Derived Transformation of Exclusion Functions

371 10.89%;  $t(9) = -10.324, p = .001; d = .88$ ). Thus, responses to these questions  
372 demonstrated that the ostracism manipulation was successful.

373 A composite score to Williams et al.'s (2000) four needs (belonging, self-esteem,  
374 meaningful existence and control) was taken for each participant when they were exposed  
375 to the exclusion (Cronbach's alpha = .495) and inclusion (Cronbach's alpha = .949) games.  
376 This analysis revealed that when participants were exposed to the Cyberball exclusion  
377 game, need satisfaction was, on average, 2.35 ( $SD = 1.04$ ). In contrast, when participants  
378 were exposed to the Cyberball inclusion game, need satisfaction was, on average, 3.99 ( $SD$   
379  $= .50$ ). The difference proved to be significant ( $t(9) = -6.317, p = .001; d = .71$ ). Thus,  
380 composite scores following exposure to the Cyberball findings from this experiment are  
381 consistent with research in the area of ostracism (Jamieson et al., 2010; Williams, 2009),  
382 which demonstrate that being excluded threatens fundamental needs.

383 **UWIST MACL.** Potential changes in self-reported mood ratings as measured by  
384 the UWIST MACL were examined using a MANOVA. For this analysis, averages were  
385 taken for participant ratings to items in the Hedonic, Stress, and Arousal groups (see Figure  
386 3). However, this analysis revealed no significant effect for Time ( $F(3, 16) = .168, p =$   
387  $.916; \eta_p^2 = .031$ ). Thus, no significant differences between pre- and post-test measures of  
388 mood ratings were observed following exposure to the Cyberball inclusion and exclusion  
389 games. In addition, no main effect for item was observed.

390 The results of Experiment 1 demonstrated the transfer of exclusion and inclusion  
391 functions through equivalence classes. That is, in the Transfer of Function Questionnaire, 7  
392 out of 10 participants rated that they would be included in the directly trained inclusion  
393 (C1) game, and excluded from the directly trained exclusion (C2) game. In addition, these  
394 participants rated that they would be included in games related to C1 (A1 and B1), and  
395 excluded from games related to C2 (A2 and B2). Findings from Experiment 1 also revealed

396 that participants reported lower need satisfaction following exposure to the Cyberball  
397 exclusion game, than following exposure to the Cyberball inclusion game. Thus, consistent  
398 with findings in the literature (Jamieson et al., 2010; Williams, 2009), results from  
399 Experiment 1 revealed that need satisfaction is threatened following exclusion on the  
400 Cyberball game.

401 Although findings from Experiment 1 revealed the transfer of exclusion and  
402 inclusion functions through equivalence classes, it may have been possible that  
403 participants' responses were a result of the comparison between the two games rather than  
404 the exclusion episode. That is, exposure to both an exclusion and inclusion game may have  
405 resulted in the observed transfer of functions. Thus, in order to more clearly determine the  
406 conditions under which exclusion functions transfer, it may be necessary to expose  
407 participants only to one game type. To that end, Experiment 2 was designed to expose  
408 participants to the Cyberball exclusion game, with no function attached to the second  
409 equivalence class. It was predicted that participants would rate the equivalence class with  
410 no function attached to it as neutral in terms of likelihood of future exclusion. Participants  
411 were first exposed to derived stimulus relations training and testing identical to Experiment  
412 1, followed by the Cyberball exclusion game.

413

## 414 **Experiment 2**

### 415 **Method**

#### 416 **Participants**

417 Twenty students, 8 male and 12 female, ranging in age from 19 to 41 ( $M = 24.45$ ,  
418  $SD = 6.53$ ) were recruited through campus wide advertisements at University College  
419 Dublin. In return for participation, individuals received €5 in cash. Ethical approval was  
420 obtained from the departmental ethics committee before research commenced.

421 **Apparatus and Setting**

422 This was identical to Experiment 1.

423 **Procedure**

424 The entire experimental procedure for Experiment 2 was identical to Experiment 1  
425 with the following exceptions:

426 Participants were exposed to only the Cyberball exclusion game, and the Transfer  
427 of Function Questionnaire differed in terms of the following instructions:

428 *Please rate on a scale of 1-9 (1 = Excluded, 9 = Included), how included or excluded you*  
429 *think you would be in the following games based on your experience of the CASORS game.*

430

431

**Results and Discussion**

432 **Statistical Analysis.** Trials to criterion and mean percent correct were reported for

433 the equivalence training and testing phases, respectively. For the Transfer of Function

434 Questionnaire, a one-way within subjects Analysis of Variance (ANOVA) with

435 Equivalence class member (Class 1 and Class 2) as the factor and ratings to the Transfer of

436 Function questionnaire as the dependent measure, was used to examine differences

437 between average ratings to the directly trained and derived games, and the unrelated games.

438 Changes in mood as measured by the UWIST MACL were examined using a MANOVA,

439 with time (Time 1 and Time 2) and item (Hedonic, Stress, and Arousal) as repeated

440 measures, and ratings to these items as the dependent measure. A significance level of .05

441 was adopted for statistical analysis.

442 **Equivalence Training and Testing.** Five participants were unable to meet criterion  
443 during the equivalence test phase, and their data is therefore excluded from further analysis.

444 For the remaining fifteen participants, all met criteria during both equivalence training and

445 test phases, and required between 1 and 3 exposures to do so ( $M = 1.67$ ,  $SD = .82$ ).

## Derived Transformation of Exclusion Functions

446 Participants required between 12 and 119 trials to meet criterion during equivalence  
447 training ( $M = 31.80$ ,  $SD = 25.01$ ). All 15 participants met criterion during the equivalence  
448 test phase, with an overall mean of 97.28% ( $SD = 1.41$ ) correct class consistent responding.

### 449 **Transfer of Function Questionnaire.**

450 Results demonstrated that of 10 out of 15 participants rated that they felt they would  
451 be excluded from the C2 game. Of these participants, all rated that they felt they would be  
452 excluded from games related (A2 and B2) to the C2 exclusion game. In addition, and  
453 contrary to predictions, participants did not make neutral ratings to the unrelated games, but  
454 instead, rated that they would be “more” included in, or “less” excluded from, games (A1,  
455 B1, and C1) that were unrelated to the C2 exclusion game (see Table 3 for participants’  
456 ratings to all games during the Transfer of Function Questionnaire).

457 Figure 4 displays the mean ratings for participants included in the transfer group to  
458 the post-experimental Transfer of Function Questionnaire. As can be seen in Figure 4  
459 participants rated the directly trained C2 exclusion game on average at 1.6 ( $SD = .70$ ). In  
460 addition, participants’ rated A2 at 2.9 ( $SD = 2.33$ ), and B2 at 4.00 ( $SD = 3.02$ ). Thus,  
461 feelings of exclusion were on average slightly less for participants to the derived A2 and  
462 B2 games. Figure 4 also displays the mean rating to the three game names that were  
463 unrelated (i.e., A1: Master; B1: Rigund; C1: Boceem) to the directly trained and derived  
464 exclusion games. On average ratings to the unrelated game names were 6.13 ( $SD = 2.50$ ).

465 A within-subjects ANOVA revealed a significant main effect for Equivalence class  
466 member ( $F(3, 27) = 6.37$ ),  $p = .022$ ;  $\eta_p^2 = .415$ ). Post-hoc comparisons with a Bonferroni  
467 correction applied revealed a significant difference between feelings of exclusion to C2 and  
468 the unrelated games ( $p = .001$ ). No other differences were observed. Thus, feelings of  
469 exclusion were significantly less to games (A1, B1, and C1) that were unrelated to the  
470 directly trained exclusion game (C2). In contrast, there were no significant differences

471 between ratings to the derived exclusion and unrelated games. Such findings suggest that  
472 the transfer of feelings of exclusion to the derived members (A2 and B2) of the C2  
473 exclusion equivalence class were not as strong as those reported in Experiment 1.

474 **Cyberball Questionnaire.** In order to determine whether the Cyberball exclusion  
475 game was successful in inducing feelings of exclusion (ostracism), three manipulation  
476 checks were included at the end of the Cyberball Questionnaire. This analysis revealed that  
477 the average rating to the feeling of being ignored was 3.7 ( $SD = 1.06$ ), and the average  
478 rating was 3.6 ( $SD = 1.07$ ), to the feeling of being excluded. In addition, on average,  
479 participants correctly reported that they received the ball less than the other participants ( $M$   
480  $= 6.5\%$ ,  $SD = 4.12\%$ ). Thus, average ratings to the question regarding the percentage of  
481 throws demonstrated that the ostracism manipulation was successful. However, average  
482 ratings to the feelings of being ignored and excluded were higher than those previously  
483 reported in the literature (see Jamieson et al., 2010; Williams, 2009).

484 A composite score (Cronbach's alpha = .826) to the four needs (belonging, self-  
485 esteem, meaningful existence and control) was taken for each participant (see Jamieson et  
486 al., 2010; Williams, 2009). This analysis revealed that, on average, need satisfaction for  
487 participants was 2.23 ( $SD = 0.34$ ). Thus, consistent with research in the area of ostracism  
488 (Jamieson et al., 2010; Williams, 2009), being excluded threatens fundamental needs.

489 **UWIST MACL.** Potential changes in self-reported mood ratings, as measured by  
490 the UWIST MACL, were examined using a MANOVA. For this analysis, averages were  
491 taken for participant ratings to items in the Hedonic, Stress and Arousal groups (see Figure  
492 5). This analysis revealed a significant main effect for Time ( $F(3, 26) = 3.043$ ,  $p = .047$ ,  $\eta_p^2$   
493  $= .260$ ). Follow-up analysis revealed a significant difference in participants' ratings to  
494 Hedonic items at pre- and post-test ( $p = .024$ ). No other differences were observed and no

495 main effect for item was observed. Thus, in Experiment 2, participants had significantly  
496 higher ratings to Hedonic items before exposure to the Cyberball exclusion game.

497

498

### **General Discussion**

499 In Experiments 1 and 2, we aimed to examine the transfer of exclusion and  
500 inclusion functions across equivalence classes. Taken together the results demonstrated that  
501 both inclusion functions (Experiment 1) and exclusion functions (Experiments 1 and 2)  
502 transferred across equivalence classes. That is, participants rated that they felt they would  
503 be excluded from the directly trained exclusion game (C2) and included in the directly  
504 trained inclusion game (C1). These ratings also transferred to other words (i.e., game  
505 names) that were experimentally trained as related to the exclusion (A2 and B2) and  
506 inclusion (A1 and B1) game. However, it must be noted that in Experiment 2, the  
507 difference in ratings to the derived exclusion and unrelated games was not statistically  
508 significant. In saying this however, the transfer of exclusion functions across an  
509 equivalence class in Experiments 1 and 2 suggest that the equivalence phenomenon might  
510 explain why individuals' response to exclusion is so strong (Williams et al., 2002). If  
511 exclusion on one game translates to potential exclusion from all games related to the target  
512 game, the relational nature of equivalence enhances the potential impact of an exclusion  
513 incident. Consistent with predictions from the equivalence literature (Dack, et al., 2009)  
514 participants' exclusion and inclusion ratings transferred to other words (i.e., game names)  
515 that were experimentally trained as related to the word present during the Cyberball game.

516 Although findings from Experiment 1 demonstrated the transfer of exclusion and  
517 inclusion functions it was questioned as to whether exposure to both types of games  
518 resulted in the observed transfer of functions. Experiment 2 was therefore designed in an  
519 attempt to address this issue and participants were exposed to only the Cyberball exclusion

## Derived Transformation of Exclusion Functions

520 game. Findings revealed that for a number of participants, feelings of exclusion transferred  
521 to the directly trained (C2), and related games (A2 and B2). In addition, participants rated  
522 that they felt they would be “more” included in, or “less” excluded from, games (A1, B1,  
523 and C1) that were unrelated to C2. Although differences between ratings to the derived  
524 exclusion games and the unrelated games were non-significant, a number of participants in  
525 Experiment 2 rated that they would be included in games that were part of the unrelated  
526 equivalence class despite having never directly experienced feelings of inclusion on the  
527 Cyberball game.

528         The Cyberball questionnaire employed in Experiments 1 and 2 sought to measure  
529 four types of needs: Belonging, Self-esteem, Control, and Meaningful existence. Findings  
530 from this analysis revealed a significant difference in participants’ ratings to the four needs  
531 following the exclusion and inclusion games in Experiment 1. That is, exclusion from the  
532 Cyberball game was found to threaten need satisfaction. Similar findings were observed for  
533 participants in Experiment 2, following the Cyberball exclusion game. The finding that  
534 reported need satisfaction was threatened following exposure to the C2 exclusion game  
535 suggests that similar results would be observed if need satisfaction ratings were also taken  
536 for the related exclusion games (A2 and B2). Although the current proposal is speculative,  
537 the generalization of such ratings may have important implications for the development and  
538 implementation of interventions to reduce feelings (e.g., lowered sense of self-esteem,  
539 threats to meaningful existence) associated with an episode of ostracism. For instance, a  
540 recent study examined the effectiveness of focused attention (i.e. participants focus their  
541 attention on the here-and-now) on reducing the distress caused following ostracism from  
542 the Cyberball game (Molet, Macquet, Lefebvre, & Williams, 2013). Molet et al. (2013)  
543 found that although focused attention did not reduce the distress during the ostracism  
544 experience, recovery from ostracism was aided, as participants did not experience recurring

## Derived Transformation of Exclusion Functions

545 feelings of ostracism, after the task had concluded. Thus, future studies should seek to  
546 examine the effectiveness of similar interventions in reducing the potential generalization  
547 of feelings associated with exclusion (e.g., lower self-esteem) following an episode of  
548 ostracism.

549         The current experiments also sought to examine potential changes in mood as a  
550 result of being excluded or included in the Cyberball game. This was done by taking both  
551 pre- and post-experimental measures of mood, as measured by the UWIST MACL.  
552 Findings revealed no significant changes in participants' mood from pre- to post-times in  
553 Experiment 1. In Experiment 2, however, participants had significantly higher ratings to the  
554 Hedonic items before exposure to the Cyberball exclusion game. One potential reason for  
555 the lack of differences in Experiment 1, was that the post-experimental mood ratings, were  
556 taken following completion of both the exclusion and inclusion games. Thus, any changes  
557 in mood as a result of exclusion from the Cyberball game may not have been detected.

558         In addition to promoting basic understanding of exclusion in a new  
559 paradigm, and the factors (e.g., perceived lack of control) in the environment that affect  
560 social exclusion, the current experiment explored the effects of exclusion that are  
561 potentially important to understanding clinical disorders such as depression. For instance,  
562 the current findings may bear relevance to the literature on learned helplessness in which  
563 an individual learns to behave helplessly due to a perceived lack of control over the  
564 outcome of a situation (Seligman, 1975). That is, following repeated exposure to an  
565 aversive situation from which an individual cannot escape, feelings of helplessness may  
566 govern behavior. Later, when the individual is presented with the opportunity to escape the  
567 aversive situation, they are unable to do so due to this perceived lack of control. With  
568 respect to the current findings, following exposure to the Cyberball exclusion game,  
569 participants reported a decreased sense of "control". The current findings may therefore be



## Derived Transformation of Exclusion Functions

570 important in the sense that the feelings of lack of control reported following exclusion on  
571 the Cyberball game may, generalize to other situations (e.g., work and personal life) in an  
572 individual's life. The current results may also inform us about the problems experienced by  
573 people that can occur without direct experience (e.g., a fear of spiders without ever being in  
574 contact with one). Furthermore, and as demonstrated in the current experiment, exclusion  
575 attempts can transfer to stimuli that are closely related to the targeted stimulus, such  
576 generalization could cause a negative cascade that would aggravate disorders such as  
577 depression (Walther, Nagengast, & Trasselli, 2005).

578         The current findings demonstrate that feelings of exclusion can generalize from  
579 direct exposure to exclusion to other activities related to the exclusion exposure that have  
580 never been directly encountered. This has implications for the literature on both cyber and  
581 social exclusion in that the negative effects of exclusion are far broader than an individuals'  
582 response to the exclusion instance (e.g., mood change, lower self esteem, etc.) but also to  
583 contexts that are linked to the exclusion instance (e.g., any game labeled as similar to the  
584 original game an individual is excluded from). For example, previous research has shown  
585 that exclusion negatively impacts a sense of belongingness, which in turn, can lead to  
586 higher levels of withdrawal (O'Reilly & Robinson, 2009). In addition, threats to control  
587 following an instance of exclusion may result in antisocial thoughts and behaviors  
588 (Williams, Case, Govan, & Forgas, 2003). Accounting for the generalized impact of  
589 exclusion in terms of derived stimulus relations provides a bottom up account of the  
590 mechanisms involved in the pervasive impact of exclusion.

591         Future research could examine the effects of varying the instructions given to the  
592 participants when they are rating their level of exclusion functions. In complex human  
593 performance, there are many rules that may be derived, and which could impact on the  
594 generalization of exclusion functions, especially in clinically-relevant situations. One

595 avenue for future research might examine whether different patterns of relational  
596 responding result in ‘derived exclusion’. For example, previous research has demonstrated  
597 derived relational responding in accordance with multiple stimulus relations such as  
598 ‘distinction,’ ‘hierarchy,’ ‘conditionality,’ ‘causality,’ and ‘opposition’ (e.g., Dymond, &  
599 Barnes, 1995; Dymond, Roche, Forsyth, Whelan, & Rhoden, 2008; Gil, Luciano, Ruiz, &  
600 Valdivia-Salas, 2012; Steele & Hayes, 1991). Two examples that may be particularly  
601 interesting in respect to the current phenomenon is the relations of ‘opposition’, and  
602 ‘comparison’ (i.e., ‘more than’/ ‘less than’). Expanding the model from equivalence  
603 relations to multiple stimulus relations would bolster the derived stimulus relations’  
604 account of the generalization of exclusion. In turn, this may provide additional dimensions  
605 to a model of how exclusion (e.g., how ostracised an individual is socially) are produced by  
606 certain contingencies, and how they can generalize to other stimuli related to the initial  
607 exclusion episode.

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609

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## Derived Transformation of Exclusion Functions

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694 Table 1

695 Nonsense Words Used As Game names and their Assignment to Equivalence Classes

	A	B	C
Class 1	Matser	Rigund	Boceem
Class 2	Lewoly	Gedeer	Casors

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## Derived Transformation of Exclusion Functions

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716 Table 2

717 Individual ratings to the games presented during the Transfer of Function Questionnaire for

718 participants in Experiment 1 (1 = *Excluded*; 9 = *Included*).

Participant	A1	B1	C1	A2	B2	C2
1*	5	8	6	6	5	4
2	7	8	9	3	1	1
3	8	8	8	3	3	3
4	8	8	8	2	2	2
5	8	9	9	3	3	2
6	8	8	8	1	1	1
7	5	5	7	5	5	1
8	8	8	8	2	2	2
9	7	7	7	3	3	3
10*	8	8	9	6	7	6

719 \* represents participants that did not demonstrate the basic effect (i.e., rate C2 as excluded

720 and C1 as included), and thus, these participants were not included in the transfer group for

721 statistical analysis.

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## Derived Transformation of Exclusion Functions

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730 Table 3

731 Individual ratings to the games presented during the Transfer of Function Questionnaire for

732 participants in Experiment 1 (1 = *Excluded*; 9 = *Included*).

Participant	A1	B1	C1	A2	B2	C2
1	8	8	7	2	3	2
2	8	8	8	3	4	2
3*	1	1	1	9	9	9
4*	2	2	7	2	8	7
5	5	5	5	4	6	1
6*	2	2	2	7	9	9
7	8	8	8	2	2	2
8*	8	9	9	7	6	7
9*	6	6	6	9	8	8
10	6	7	7	2	2	2
11	9	9	9	1	1	1
12	1	1	1	9	9	1
13	6	6	6	3	9	3
14	1	4	4	2	3	1
15	7	7	7	1	1	1

733 \* represents participants that did not demonstrate the basic effect (i.e., rate C2 as excluded),

734 and thus, these participants were not included in the transfer group for statistical analysis.

735



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738

739 **List of figures**

740 *Figure 1.* A screenshot example of the Cyberball game participants were exposed to in

741 Experiments 1 and 2.

742

743 *Figure 2.* The mean ratings to the directly trained exclusion (C2) and inclusion (C1) games

744 presented in the Transfer of Function Questionnaire in Experiment 1. Also shown are the

745 mean ratings to the derived exclusion (A2 and B2) and inclusion (A1 and B1) games. “T

746 Exclusion” refers to the directly trained exclusion game (C2), “T Inclusion” refers to the

747 directly trained inclusion game (C1), “S Exclusion” refers to ratings to the derived

748 symmetrical exclusion game (B2), “S Inclusion” refers to ratings to the derived

749 symmetrical inclusion game (B1), “E Exclusion” refers to ratings to the derived

750 equivalence exclusion game (A2), and “E Inclusion” refers to the derived equivalence

751 inclusion game (A1). \* =  $p < .05$

752

753 *Figure 3.* The mean ratings to the Hedonic, Stress and Arousal adjective groups in the

754 UWIST MACL, at pre- and post-test in Experiment 1. Error bars represent standard errors.

755

756 *Figure 4.* The mean ratings to games presented in the Transfer of Function Questionnaire in

757 Experiment 1. “T” refers to ratings to the directly trained exclusion game, “S” refers to

758 ratings to the derived symmetrical exclusion game (B2), “E” refers to ratings to the derived

759 equivalence exclusion game (A2), while “Unrelated” refers to the mean ratings to the three

## Derived Transformation of Exclusion Functions

760 games (A1, B1 and C1) that were unrelated to the directly trained and derived exclusion

761 games. \* =  $p < .05$

762

763 *Figure 5.* The mean ratings to the Hedonic, Stress and Arousal adjective groups in the

764 UWIST MACL, at pre- and post-test in Experiment 1. Error bars represent standard errors.

765 \* =  $p < .05$

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767

768

Figure 1

769

This is the CASORS Game.

Once other players join, please play the game below.

You can throw the ball by clicking on the name or picture of another player



Paul



Catherine



YOU

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Derived Transformation of Exclusion Functions

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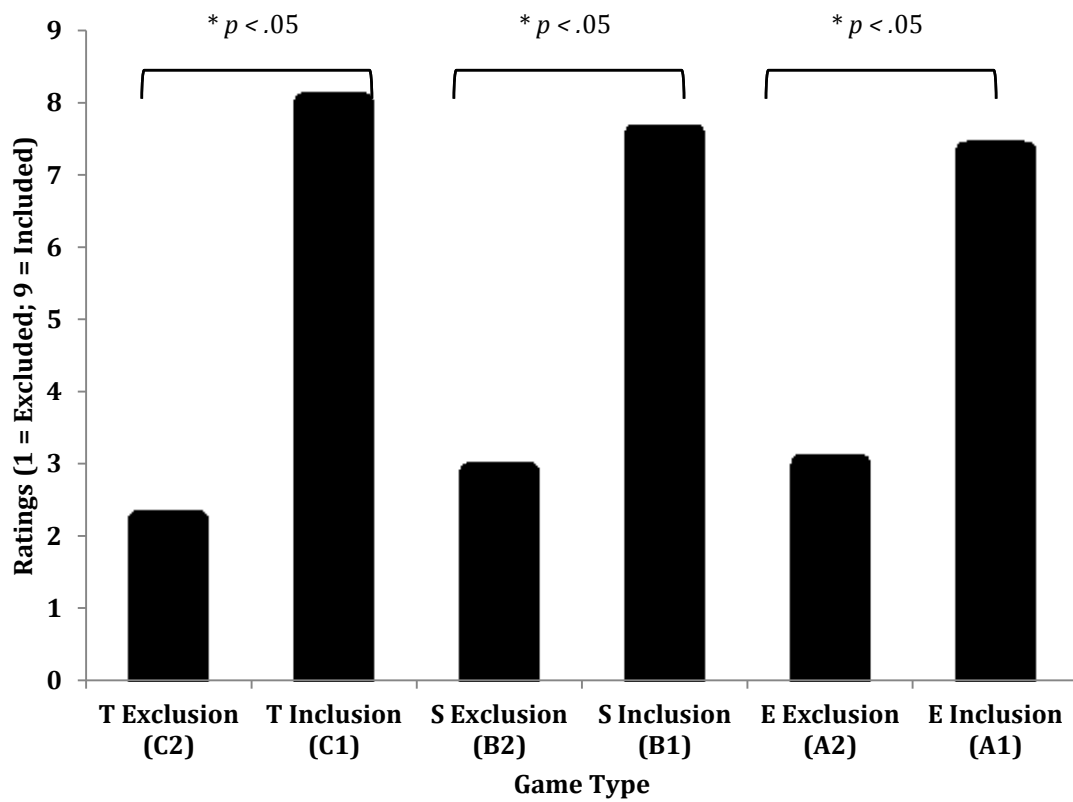
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Figure 2



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Derived Transformation of Exclusion Functions

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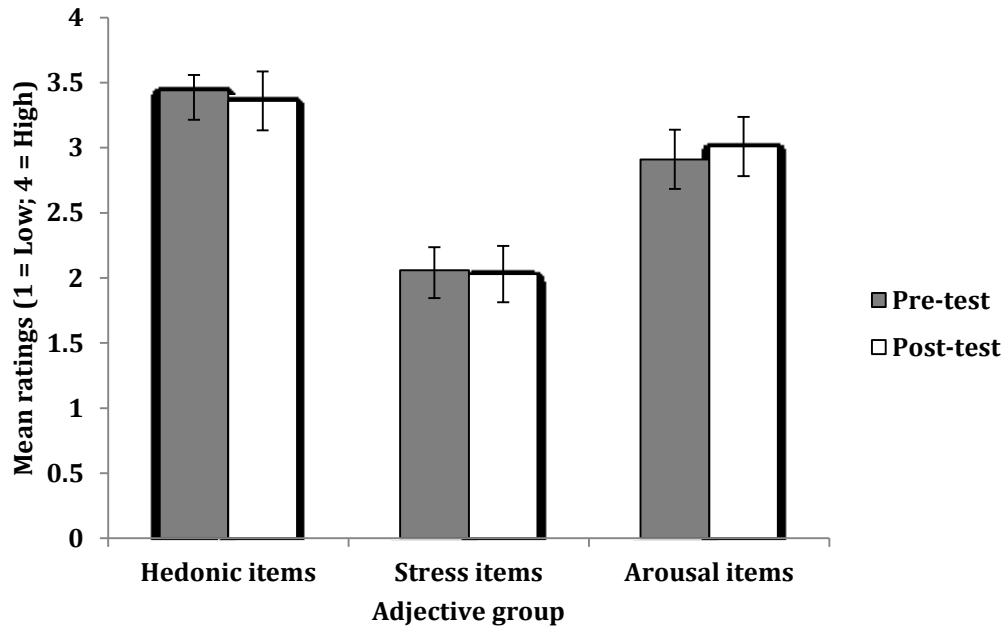
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Figure 3



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Derived Transformation of Exclusion Functions

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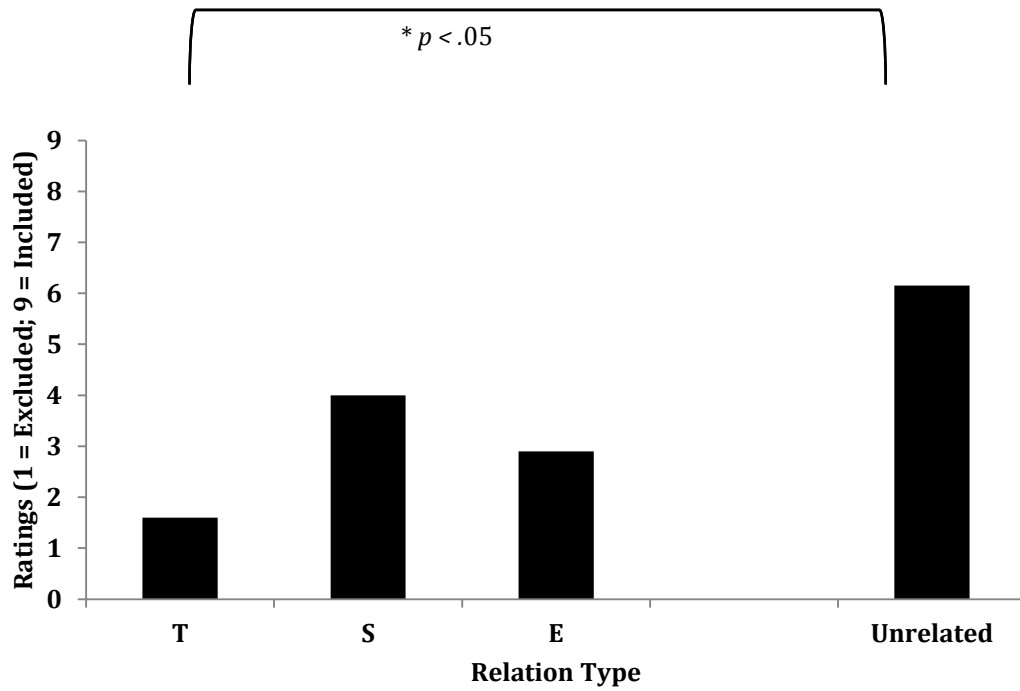
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Figure 4

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Derived Transformation of Exclusion Functions

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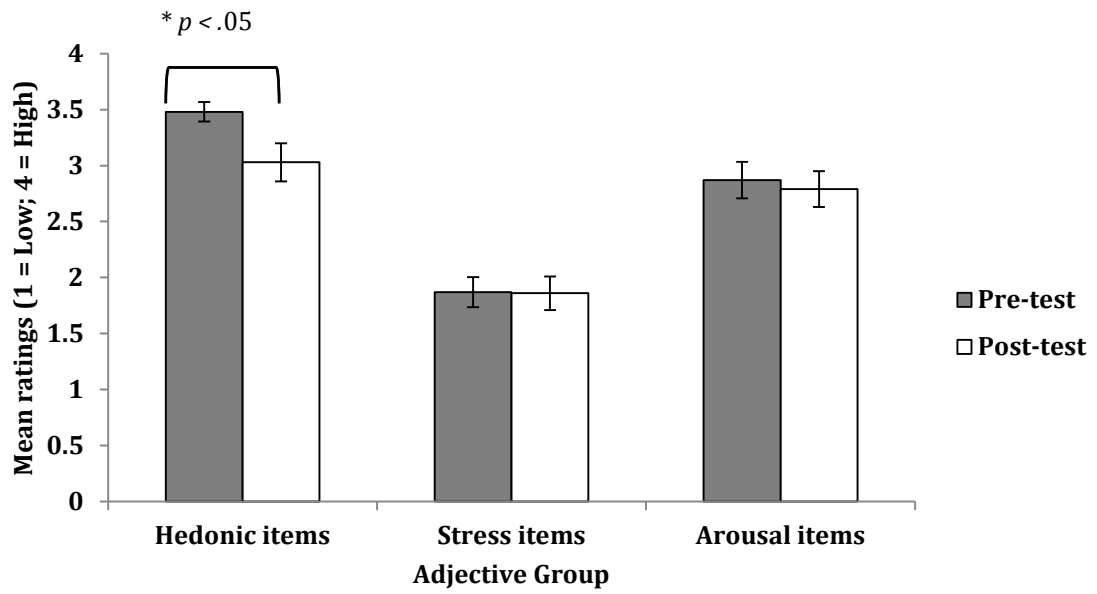
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Figure 5



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