CAN COGNITIVE LOAD BUFFER AGAINST THE NEGATIVE EFFECTS OF SOCIAL
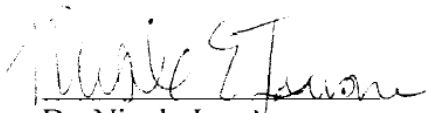
EXCLUSION?

by

Tyler Grossheim

A thesis submitted to the faculty of Radford University
in partial fulfillment of the requirements for the degree of
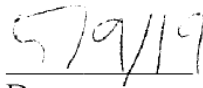Master of Arts in the Department of Psychology

Thesis Advisor: Dr. Nicole Iannone
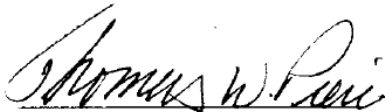
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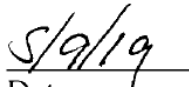Dr. Nicole Iannone   Date
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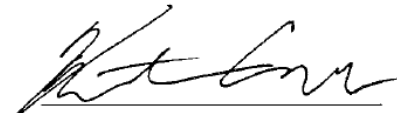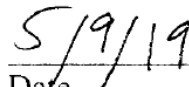
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Abstract

The purpose of this study was to explore the relationship between cognitive load and the need satisfaction and mood reduction associated with being ostracized. Specifically, the hypotheses were that those under higher cognitive load would score higher on need satisfaction and report a more positive mood when ostracized as opposed to those under a lower load, and that those under high load would recover faster from the need reduction. Additionally, a separate analysis was conducted to determine if those who were ostracized, rather than included, were more persuaded by a common product review, as prior research suggested. Fifty-two college age participants were recruited. They were randomly placed into either high load or low load conditions (through use of a short or long password), then asked to play a round of Cyberball (a pre-programmed virtual ball-tossing game) where they would be randomly ostracized or included. They were then administered a series of measures to test need satisfaction and mood, need and mood recovery, persuasion, and working memory capacity. The results show that none of the above hypotheses were supported.

Keywords: cognitive load, ostracism, memory, persuasion, Cyberball

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Chapter 1 - Introduction
Can Cognitive Load Buffer Against the Negative Effects of Social Exclusion?

Imagine sitting in a restaurant with a group of friends. These friends are chatting, bantering, and discussing what they all intend to do after dinner. The only exception? They are not talking to you. This is an example of being socially excluded or ostracized. Humans can have a profoundly negative reaction to being ostracized; it can hit us at the level of our fundamental needs (Williams, 2009). Ostracism is a powerful social force that plays into the very core of our society, one that everyone has likely experienced at one time or another (Williams, 2009). From the halls of the local high school, to college dorms, to the wider workforce, social exclusion plays a key role in moderating social behavior. Now, imagine the same restaurant example with a twist. In this case, while your friends exclude you from their conversation and planning, imagine being distracted by what's on TV and only half paying attention. Would this change your perception? Would it have the same impact?

Various forces act upon these processes, both from within and without. Of these forces, this study sought to examine the interaction between social ostracism and cognitive load and their combined effect on the satisfaction (or lack thereof) of our fundamental needs of belonging, self-esteem, control, and meaningful existence. Many factors can impact how we perceive an exclusion event, how it affects us, and how we recover from it. Several aspects have been explored, from the role of distractors and anxiety (Zadro, Boland, & Richardson, 2006), rumination (Williams, 2009), and the effects of individual differences on recovery (Oaten, Williams, Jones, & Zadro, 2008). One area that has not been addressed is the role of cognitive load on the initial detection of exclusion, and its role in how people react to ostracism experiences. This experiment was designed to address this idea.

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Social Ostracism and Need Fulfillment

Ostracism is defined by ignoring or excluding someone from a social group and is a tactic of social control (Williams, 2009). Human beings naturally seek to avoid ostracism because it threatens four fundamental human needs of belonging, self-esteem, control, and meaningful existence (Williams, 2009). Fulfillment of these core needs represents an essential element of human health, both mentally and physically. Lack of attachment, for example, has been shown to be linked to several negative health effects. Those who do not form adequate attachments suffer from elevated stress levels, and cancer patients with chronic loneliness may have weaker immune systems than those who are well adjusted (Baumeister & Leary, 1995; Goodwin, Hunt, Key, & Samet 1987). Early harm to one's self-esteem and self-image can have lasting effects on development and maturation. Adolescents with low self-esteem have been shown in adulthood to suffer from poorer mental and physical health, weaker economic prospects, and a higher level of criminal engagement (Trzesniewski et al., 2006)

How did ostracism become such a powerful force in human interaction? Theorists have speculated that social ostracism is itself an adaptive mechanism to shield a group from burdensome members that may threaten the group as a whole (Gruter & Masters, 1986). Additionally, the ability to quickly detect and react to ostracism must be highly adaptive (Williams 2009). As detailed above, the abridgment of these needs can have enough negative ramifications, such as loss of resources, that the evolutionary drive to prevent them is very much still present. As stated by Williams (2009), working within error management theory it is logical to assume that being an adaptive behavior, individuals would react quickly to and over-detect ostracism to avoid missing it. Given that these needs are so important to human well-being, this detection should still be present today.

Indeed, it seems that social exclusion can have a profound impact on our fundamental need satisfaction. Even when not face-to-face with another human being, it seems we nevertheless feel the effects of exclusion. Cyberball (Williams & Jarvis, 2006) is a software/game developed to induce feelings of social exclusion in participants without the need for direct human interaction. A participant is told he/she will be playing a "pass the ball" style game with two other human players who are, in fact, pre-programmed. The game can be modified to either *includ*e the player (where the artificial intelligence players will pass the ball to the participant equally) or to *exclude* the player by passing to him/her for the first few rounds, and then only between the AI for the subsequent rounds (Williams, 2009). During extensive testing, Williams, Cheung, and Choi's (2000) experiment yielded considerable negative effects on need threat and mood impairment from being ostracized by the AI players. Even when participants were told they were playing against a machine, they still experienced (at similar levels to when they were playing with "human" players) the negative impairments to their needs and mood (Zadro, Williams, & Richardson, 2004).

Social ostracism can be a powerful enough force as to override other influencing factors. An example can be found in Gonsalkorale and Williams' (2007) study that showed exclusion by out-group members of the opposite political party (and even polarizing groups such as the KKK) can trigger a reduction in need satisfaction. This was despite pretesting showing that individuals preferred members of their own political leaning and that they hated members of the KKK. Other research has shown that even if participants were told that the other players could not throw them the ball due to not being connected to the network, they still showed signs of distress (Eisenberger, Liberman, & Williams, 2003)

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The effects ostracism can have on an individual are quite clear. The question, then, becomes if any factor could moderate the effects of such exclusion. One possible source of moderation may come from cognitive load. Thinking back to the earlier example, could being distracted or otherwise cognitively overloaded affect the impact the exclusion event will have on our needs?

Cognitive Load

Defined, cognitive load is the total amount of mental resources one dedicates to using in his/her working memory (Petty & Cacioppo, 1986). The higher the cognitive load, the fewer resources that are available for information processing. The effects of load levels, and the drain they can have on our cognitive resources, can be quite striking. Given the rather fast impact that load levels can have on our cognitive abilities, it would not take much to extrapolate the effects of this process onto our perception of and recovery from social exclusion.

One area that suffers under the effects of load is that of attention. Attention, broadly speaking, is the ability to maintain focus on a particular task, event, or object (Lavie, 2005). Like many of the psychological processes, modulating load levels can impact our ability to attend to selected stimuli. One way this occurs is when decreased cognitive resources act as a detriment to cognitive control processes such as working memory. The depletion effect on our resources (through such acts as prolonged bouts of mental exertion) can hinder our working memory capacity (Chen, Castro-Alonso, Paas, & Sweller, 2017). Elevated levels of perceptual cognitive load can also hinder one's cognitive control mechanisms that filter out interference from distractors, leaving the individual more vulnerable to distraction (Lavie, Hirst, de Fockert, & Viding, 2004). Lavie (2010) noted in an experiment on distraction that being under elevated cognitive load that focuses on working memory can impair a person's ability to focus on a task,

providing a synthesis of the two previously mentioned concepts. This is further supported by looking back into Engle's (2002) study, which utilized a Stroop test to measure a participant's capacity to filter out extraneous information. In the Stroop experiment, it was found that participants with low working memory capacity had a more difficult time filtering out irrelevant information under the high load condition than those who had high working memory capacity.

Our ability to notice changes in our environment can also be detrimentally impacted by states of high cognitive load. Murphy and Murphy (2018) tested the effect of high perceptual load on participants' susceptibility to change blindness. Participants were put in either a sparse (low load) room or a densely packed (high load) room as part of a supposed study on personality. The participants would be greeted by the first "researcher," who would excuse him/herself briefly only to be replaced by another confederate. Those under the low load condition detected the change 71% of the time, while those under the high load condition only detected it 52% of the time (Murphy & Murphy, 2018).

A core element of ostracism perception is the early, and messy, detection of the actual social exclusion event (Williams, 2009). As detailed above, given its influence on our attentional processes, cognitive load may influence our perception of, and reaction to, any attempt at social ostracism. Working within the realm of memory, we find one possible effect. As shown in Lavie (2010) and Murphy and Murphy (2018), higher load makes it far more difficult to even attend to and recognize stimuli in our environment. It could be that under a high load condition, we may fail to attend to the social exclusion event or lack sufficient working memory resources to fully process the event in the first place. Although, it would be more likely that the increased load would merely moderate our perception of the exclusion event (weaken it) as opposed to

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completely prevent us from noticing. However, if the event is noticed, even in a weakened form, would the load level continue to affect need satisfaction recovery?

It has already been shown in Zadro et al. (2006) that a distractor between the initial ostracism event (and measure), and a secondary measure (45 minutes later) led to a faster recovery of the damaged needs. Williams (2009) postulated that this was due to the fact that the distracted individuals were unable to ruminate on the social exclusion event, and thus it was not reinforced in their minds. Without this reinforcement of the negative feelings, those feelings faded faster than in those who were able to ruminate. Indeed, this effect was replicated more directly in Swim and Williams (2008), where participants were asked after a round of Cyberball to either write down their current feelings (allowed to ruminate) or watch four change blindness slides and write about them (a distraction task). As expected, those in the distraction task recovered faster than those allowed to ruminate. Given that cognitive load stresses our attentional abilities, one can surmise that a higher load task will be more distracting, and thus would have greater impact on recovery than a lower load task.

Given the above information, this study tested the following hypotheses. Due to its effects on our attentional ability and our working memory capacity, being under high cognitive load while being ostracized will lead to a smaller initial impact on our need satisfaction, and thus participants will report higher scores on the measure, compared to being ostracized under low cognitive load. Additionally, given its enhancement of distraction, those ostracized under higher cognitive load will recover more swiftly from any damage to their fundamental needs compared to those ostracized under low cognitive load.

Persuasion

In this study, we will use a product review as a distractor task and explore any potential

effects of ostracism and load on persuasion. Persuasion is a powerful social and cognitive force

defined as attitude or behavioral changes, without force or duress, brought about by another

person or entity (Petty & Cacioppo, 1986). Persuasive forces are common in modern society,

with the most ubiquitous being advertising. As one of the most pervasive forms of persuasion,

advertisement factors heavily into our daily lives. According to Forbes, an estimated $143 billion

was spent on advertising by the end of 2016, making it very impactful on daily life (Katz, 2016).

At the 2018 Super Bowl, one of the most watched events on American television, the average

cost for a 30 second commercial was roughly five million U.S. dollars (Johnson, 2018).

Advertisements and reviews cover billboards, slide in between television shows, feature

prominently on store webpages, and pop up during internet videos.

Our available cognitive resources can have a noticeable influence on how easy it is to be

persuaded. According to the Elaboration Likelihood Model (ELM), persuasion typically occurs

via one of two routes: the central route or the peripheral route (Petty & Cacioppo, 1986). When

ability and motivation are high, persuasion is more likely to occur via the central route, a more

analytical process that dissects the value of the persuasive message. When such factors are low,

however, persuasion is more likely to occur via the peripheral route, where factors such as

presenter credibility, source similarity, and presenter attractiveness play a stronger role (Petty &

Cacioppo, 1986).

In the current study, we employed an advertisement as a distractor task. Participants were

presented with a mock product review and asked to rate the product and their likelihood to

purchase it. The study was used to explore any possible interactions with persuasion and social

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ostracism, while working within the framework of cognitive load. As is seen in the ELM of persuasion, when under high cognitive load, an individual is more likely to be susceptible to "peripheral" persuasion cues (e.g., presenter attractiveness, similar features, etc.). It is possible that a combination of being under high cognitive load, and being ostracized, may produce an effect with the product rating task employed during the study.

Evidence for possible interactions comes from Ruijten, Ham, and Midden (2014), who sought to explore how social exclusion affected the persuasive influence of a human-like, artificial intelligence on an individual. Once again using a similar methodology to the present study (e.g., using Cyberball to induce exclusion, followed by the introduction of the persuasive agent), it was discovered that socially ostracized individuals were more persuaded by feedback from their AI partner. Of note, however, is that the effect was only found in male participants, with a female avatar. Further evidence for this can be found in Carter-Sowell, Chen, and Williams' (2008) experiment pairing social ostracism with various compliance tactics. Results showed that ostracism increased compliance rates across multiple compliance tactics.

We may be hard-wired to become more susceptible to social factors when we feel that we are being socially ostracized. It is a simple task to extrapolate this to advertising. Prior research suggests that we may be more easily persuaded when we are excluded, so analyses were conducted to test this claim. This led to the third and final hypothesis, that while under higher load, participants would rate the products higher than those under low load. These additional analyses were secondary in nature.

Chapter 2 - Method

Participants and Design

A convenience sample totaling 52 participants (19 Male, 31 Female, 2 Other; $M_{age} =$ 20.79, age range = 18–25) was recruited through the Radford SONA system ($n = 18$) and two psychology classes offering extra credit for participating ($n = 34$). A majority (31) of the participants identified as Caucasian, with the next largest groups identifying as African American (11), Hispanic (7), and Other (3), respectively. The study employed a 2 (Cognitive Load: High vs. Low) X 2 (Inclusion condition: Ostracism vs. Inclusion) between-subjects design with a roughly even distribution across conditions with 13 in the High Load Ostracized condition, 12 in the Low Load Ostracized condition, 15 in the Low Load Included condition, and 12 in the High Load Included condition.

Procedure

Participants were first given an informed consent document to sign and were told they can ask questions about the study before doing so. The ostracism and survey portion of the study were administered through the third-party website Qualtrics. Qualtrics is an online survey construction and dissemination tool. The Operation Span Task required the use of the analytics program ePrime, installed and used on the same computer where the participants took the survey. After agreeing to participate, the cognitive load manipulation was administered. In order to induce high and low levels of cognitive load in participants, a password memorization task was used. Specifically, the current study employed a task similar to the one developed in Conway and Gawronski (2013), which was found to be effective at inducing high load levels. This procedure was altered slightly in Kelly, Iannone, and McCarty (2016) to include a shorter password for a "low load" condition. The latter study served as the basis for the load task to be utilized in the

present research. Low load passwords were short, and consisted of just one character, and the

high load passwords consisted of eight unique characters. High load password types contained a

mixture of letters, numbers, and special characters (e.g., N463#M1Q). The low load type, by

contrast, was just a numeric character (e.g., 8). See the materials and measures section for further

details on the administration of the passwords. Participants had to remember their password

across the first half of the experiment. They were encouraged to rehearse the passwords in order

to ensure that they actively attempted to memorize it.

Participants were instructed to remember their password for future recall. With their code

memorized, participants then moved to the exclusion portion of the experiment. Here, they were

randomly assigned into either the exclusion group or the inclusion group using the randomization

feature built into Qualtrics. They then proceeded to play a full game of the program "Cyberball"

(refer to Appendix A for the Cyberball instructions) while being told to mentally visualize the

players with which they are playing.

Upon completion of a full game of Cyberball, the first of two rounds of a survey to

measure their need satisfaction and mood were administered. Here, a self-report scale was

employed to measure perceived threats to the participants' fundamental need satisfaction

resulting from the feelings of social ostracism (the reflexive reactions). The scale measures four

needs: belonging, self-esteem, meaningful existence, and control, although the four needs are

typically combined to form one measure of need satisfaction (Williams, 2009) (see Appendix B

for all items). Mood was also assessed at this point.

Manipulation check items for ostracism were also asked (see Appendix C). Participants

were asked to rate if they felt they were being ignored, excluded, or included, and to estimate the

percentage of time they were passed the ball (Williams, 2009; Zadro et al. 2006) to assess the

effectiveness of the Cyberball manipulation. As a manipulation check for cognitive load, participants were administered three items from the State Ego Depletion Scale (Ciarocco, Twenge, Muraven, & Tice, 2010). Additionally, they were asked to write down the password they had been instructed to remember (see Appendix D).

Participants then moved on to a distractor task, a persuasive advertisement that they were asked to rate. The advertisement takes the form of a mock product review, presented in a format similar to an online comment featured under a product (i.e., on Amazon, Ebay, etc.). A picture of the product was shown (see Appendix E). The participants had a maximum of 5 minutes to review the product, after which they were asked to rate various aspects of the product (see Appendix F).

Following the distractor task, the participants were once again asked to complete the need satisfaction and mood measure in a reflective phrasing, with the tense changed from past to present (Williams, 2009). As final manipulation checks, the participants then answered the ego depletion questions again, and answered if they felt they were being ostracized (Ciarocco et al. 2010; Williams, 2009; Zadro et al. 2006). Lastly, the participants were asked a series of questions to assess such things as their memorization techniques, whether (and how frequently) they rehearsed their passwords, and how much effort they put into memorizing their password (see Appendix G). Once all the testing had concluded, the participants received a brief demographics survey asking about gender, ethnicity, age, and college year status (see Appendix H).

The final measure administered was an attention task to assess individual differences in span. The Shortened Operation Span Task was used to test individual differences in working

memory (Unsworth, Heitz, Schrock, & Engle, 2005) (see Appendix I). This section was administered through ePrime.

  With this section complete, participants were told that the study had concluded. They were then debriefed and told they could ask any questions they wished about the study. As this study involved deception, participants were asked to re-consent to allow us to use their data. Participants were thanked for their time, awarded their SONA credits or extra class credit, and then asked to exit the testing area.

Materials and Measures

  Cognitive load manipulation. This study employed a memory task in order to manipulate cognitive load. Participants were asked to memorize two password phrases at the start of the testing. Each password contains a mixture of letters, numbers, and special characters. For the low load condition, the password is short and simple to remember (8); the high load condition received a password that is longer and more complicated (N463@M5Q). They were given 20 seconds to memorize their password. In order to test for the cognitive load manipulation, three questions involving mental energy, effort, and concentration were included. A Cronbach's alpha test was conducted to ensure reliability ($\alpha = .51$). One of the items (Mental Energy) was dropped from the analysis due to poor reliability, and the other items were reliable, $r(52) = .96, p < .001$.

  Ostracism task/Cyberball. In order to invoke a sense of social ostracism, the participants engaged in the game Cyberball (Williams & Jarvis, 2006). In Cyberball, a participant is told that he/she will be playing a mental visualization game with two other human players. Participants were told the purpose of this task was about mental visualization, and that they should "visualize" the people they are playing with and the setting they are in. In truth, this

game is pre-programmed, and the purpose is to ostracize (or include) the participant. The

gameplay consisted of the three "players" passing the ball between each other. Participants in the

non-ostracized condition played a "normal" game of Cyberball where the AI players continued

to pass the ball to them. They received an equal number of passes as the AI players. A

manipulation check for load was performed. The first part consisted of asking three questions

related to exclusion (e.g., "I felt excluded") rated on a 1 (Not at All) to 7 (Extremely) scale. The

scale was reliable ($\alpha = .87$). The second part of the manipulation check was to ask the

participants the percentage they were passed the ball. Those in the ostracized condition had the

AI players pass to them twice before turning to exclusively pass to each other.

Need satisfaction and mood scale. Participants responded to a measure of need

satisfaction and overall mood. It consisted of statements rated on a 7-point, Likert-type scale

with 1 being "Not at all" and 7 being "Extremely." The questions represent the four fundamental

needs and mood. Example statements for each need included "I felt rejected" for the belonging

need; "I felt good about myself" for self-esteem; "I felt important" for meaningful existence; "I

felt I had control over the course of the game" for control; and finally, ratings for emotion such

as "I felt angry" for mood (Williams, 2009). The responses to the need satisfaction and mood

items were recoded when necessary and combined such that higher numbers on these scales

meant participants had higher need satisfaction and more positive mood; the needs are typically

assessed together as one need satisfaction scale, rather than individually (Williams, 2009). Later,

the same items were ranked to assess recovery from the ostracism experience. The statements

were the same except they were written in the present tense (e.g., "I feel angry," "I feel rejected,"

etc.). Cronbach's alpha tests were conducted to ensure reliability. The reflexive need satisfaction

scale consisted of 12 items and was reliable ($\alpha = .90$), and the reflexive mood scale consisted of

nine items and was reliable ($\alpha = .80$). The reflective need satisfaction scale consisted of 12 items

and was reliable ($\alpha = .88$), and the reflective mood scale consisted of nine items and was reliable

($\alpha = .85$).

Memory questions. Questions to assess memory strategies were employed. These

included asking if the participant rehearsed the password during the Cyberball game ("Did you

rehearse the password during the Cyberball game?"), how frequently they rehearsed it, and if,

and to what extent, they employed any specific strategy ("Did you employ any of the following

strategies to help you memorize the password?"). A description of each strategy was provided;

for example, "Chunking" was defined as "breaking down the password into manageable

chunks." These memory questions were explored individually to gather data on the load

manipulation.

Product review. The study employed a sample online product review. The review itself

was for a toaster. Visually, the sample review was designed after comment reviews one would

find on a shopping website. This consisted of a text box containing the review, and a picture of

the product.

Participants then answered eight questions about the product's usefulness, their

likelihood to purchase it, how likely they are to recommend it, and their overall rating of the

product. Each question was on a 5-point, Likert-type scale with 1 being "Poor" and 5 being

"Excellent." Example questions for the product included "How likely are you to recommend this

product to your friends?" and "What overall rating would you give this product?" All items were

combined and averaged, resulting in an eight-item scale that was reliable ($\alpha = .87$)

Working memory assessment task. In order to assess individual differences in attention

and memory, an operation span task was employed. Specifically, the Shorted Operation Span

task was used (Unsworth et al., 2005). The task consisted of a pairing of short mathematical equations with memorizing a string of letters. Participants then had to record the answer to the equation, and how many of the letters (and in what order) they recalled. The mean score was 16.5 with a standard deviation of 4.65 and a range of 5 through 25.

Chapter 3 - Results

Manipulation Checks

Cognitive load. A between-subjects Analysis of Variance (ANOVA) test was conducted to test the effectiveness of the load manipulation. There was no significant main effect for load on the cognitive load manipulation check, $F(1, 48) = .03$, $p = .859$, partial-$\eta^2 = .001$. This suggests there was no difference between the high load ($M= 3.14$, $SD = 1.78$) and low load conditions ($M = 3.04$, $SD = 1.83$). There was also no significant main effect of ostracism nor was there a significant interaction between ostracism and load, ps > .56.

Ostracism. An ANOVA was conducted to test the effectiveness of the ostracism manipulation. There was a significant main effect for the ostracism condition, $F(1, 48) = 20.99$, $p < .001$, partial-$\eta^2 = .30$. Participants in the ostracized conditions reported a significantly higher score on the ostracism measure ($M = 5.59$, $SD = 1.26$) compared to the inclusion groups ($M = 3.64$, $SD = 1.75$). Additionally, participants were asked to estimate how often the ball was passed to them. An ANOVA was conducted on this data. There was a significant main effect for the ostracism condition, $F(1, 48) = 10.17$, $p = .003$, partial-$\eta^2 = .18$. Those in the ostracism condition reported being passed the ball significantly less ($M = 13.71$, $SD = 12.90$) than the inclusion conditions ($M = 26.64$, $SD = 13.55$). These tests indicate that the ostracism manipulation was successful. There was no significant main effect for load nor was there a significant interaction between load and ostracism on either of these manipulation checks, ps > .20.

Reflexive Need Satisfaction

To assess the first hypothesis, that those in the ostracized high load condition would have higher need satisfaction immediately following ostracism compared to those in the ostracized low load condition, a between-subjects ANOVA was conducted. There was a significant main

effect for the ostracism condition, $F(1, 48) = 11.91$, $p = .001$, partial-$\eta^2 = .20$, such that those in

the ostracism conditions reported lower need satisfaction ($M = 3.10$, $SD = 1.08$) than those in the

inclusion conditions ($M = 4.21$, $SD = 1.22$). There was no significant main effect for the load

condition, $F(1,48) = .30$, $p = .584$, partial-$\eta^2 = .01$, nor was there a significant interaction

between load condition and ostracism condition, $F(1, 48) = .02$, $p = .883$, $\eta^2 = .00$ (see Figure 1).

Participants in the ostracized high load condition ($M = 3.16$, $SD = .88$) did not experience

significantly higher need satisfaction than participants in the ostracized low load condition ($M =$

3.03, $SD = 1.30$), $t(23) = -.30$, $p = .767$, $d = 0.12$. Thus, we did not find support for our first

hypothesis.[1]

Reflexive Mood Satisfaction

To further test the first hypothesis, a between-subjects univariate ANOVA between the

reflexive mood measure and the ostracism and load conditions was conducted. There was a

marginally significant main effect for the ostracism condition, $F(1, 48) = 3.45$, $p = .069$, partial-

$\eta^2 = .07$, such that those in the ostracized condition scored lower on the reflexive mood measure

($M = 4.09$, SD = .88) than those in the inclusion condition ($M = 4.47$, SD = 1.00). There was no

significant main effect of load, $F(1, 48) = .42$, $p = .518$, partial-$\eta^2 = .01$. There was also no

significant interaction between load and ostracism conditions on reflexive mood scores, $F(1, 48)$

$= .09$, $p = .772$, partial-$\eta^2 = .002$ (see Figure 2). Of the participants in the ostracism conditions,

those in the low load condition did not score significantly lower ($M = 3.97$, $SD = .94$) than those

in the high load condition ($M = 4.21$, $SD = .84$), $t(23) = -.65$, $p = .521$, $d = .26$. Given this, the

hypothesis that those in the high load conditions would have a significantly smaller mood

reduction than those in low load conditions was not supported.

Need Satisfaction Recovery

To assess the second hypothesis that participants in the ostracism high load condition would recover quicker than participants in the ostracism low load condition, a 2 (ostracism condition: ostracism vs. inclusion) x 2 (load condition: high vs. low) x 2 (need stage: reflexive vs. reflective) repeated-measures ANOVA was conducted with the ostracism condition and load condition as between-subjects variables and need satisfaction stages (reflexive vs. reflective) as the within-subjects variable.

There was a significant main effect between reflexive and reflective need satisfaction scores, $F(1, 48) = 49.79$, $p < .001$, partial-$\eta^2 = .51$, such that participants reported a significant increase in scores from the reflexive ($M = 3.68$, $SD = 1.28$) to the reflective stage ($M = 5.08$, $SD = .95$). There was also a significant main effect for the ostracism condition, $F(1, 48) = 9.94$, $p = .003$, partial-$\eta^2 = .17$. Those who were ostracized scored lower on both measures ($M = 4.02$, $SD = .80$) than those in the inclusion conditions ($M = 4.72$, $SD = .81$). There was also a significant interaction between the need stages and the ostracism condition, $F(1, 48) = 4.59$, $p = .037$, partial-$\eta^2 = .09$, such that participants' scores increased significantly between the reflexive ($M = 3.09$, $SD = 1.08$) and reflective stages ($M = 4.93$, $SD = 1.09$) in the ostracism conditions, $F(1, 24) = 40.32$, $p < .001$, partial-$\eta^2 = .63$. This recovery also occurred for those in the inclusion conditions, but to a lesser extent (reflexive: $M = 4.21$, $SD = 1.22$; reflective: $M = 5.22$, $SD = .79$), $F(1, 26) = 13.96$, $p = .001$, partial-$\eta^2 = .35$. This indicates that there was recovery across all conditions, but more so across ostracism conditions. There was not a significant three-way interaction between ostracism, load, and need satisfaction stage, $F(1, 48) = .00$, $p = .986$, partial-$\eta^2 = .00$ (see Figure 3). In looking at our specific hypothesis, for participants in the ostracism conditions, there was no significant two-way interaction between load and need stage, $F(1, 48) = .128$, $p = .943$, partial-$\eta2 = .00$. In probing this further, there was significant recovery within both

ostracized high load participants from the initial reflexive stage ($M = 3.16$, $SD = .88$) to the

reflective stage ($M = 4.83$, $SD = 1.23$), $F(1, 12) = 20.21$, $p < .001$, partial-$\eta^2 = .63$, and ostracized

low load participants from the initial reflexive stage ($M = 3.03$, $SD = 1.30$) to the reflective stage

($M = 5.04$, $SD = .96$), $F(1, 11) = 19.18$, $p = .001$, partial-$\eta^2 = .64$. There were no other significant

main effects or interactions, ps > .841. Thus, the hypothesis that those under higher load would

have a faster needs recovery was not supported.

Mood Recovery

To further assess the second hypothesis, a 2 (ostracism condition: ostracism vs. inclusion)

x 2 (load condition: high vs. low) x 2 (need stage: reflexive vs. reflective) repeated-measures

ANOVA was conducted with the ostracism condition and load condition as between-subjects

variables and mood stages (recovery between reflexive and reflective) as the within-subjects

variable. There was a significant main effect for overall mood recovery between the reflexive

and reflective stages, $F(1, 48) = 68.25$, $p < .001$, partial-$\eta^2 = .59$. Participants reported a

significant increase in mood scores from the reflexive ($M = 4.33$, $SD = .89$) to the reflective

stages ($M = 5.54$, $SD = .93$). There was no significant main effect for ostracism, $F(1, 48) = 2.40$,

$p = .128$, partial-$\eta^2 = .05$. Those who were ostracized did not score significantly lower ($M = 4.76$,

$SD = .84$) than those in the inclusion condition ($M = 5.56$, $SD = .95$). There was no significant

three-way interaction between ostracism, load, and mood stage, $F(1, 48) = .16$, $p = .690$, partial-

$\eta^2 = .00$ (see Figure 4). For participants in the ostracism conditions, there was no significant two-

way interaction between load and mood stage, $F(1, 23) = .24$, $p = .631$, partial-$\eta^2 = .01$. In

probing this further, there was significant recovery within both ostracized high load participants

from the initial reflexive stage ($M = 4.21$, $SD = .84$) to the reflective stage ($M = 5.46$, $SD = .95$),

$F(1, 12) = 27.45$, $p = .000$, partial-$\eta^2 = .70$, and ostracized low load participants from the initial

reflexive stage ($M = 3.97$, $SD = .94$) to the reflective stage ($M = 5.40$, $SD = 1.10$), $F(1, 11)=$ 11.93, $p = .005$, partial-$\eta^2 = .52$. Thus, the hypothesis was not supported as there was no difference in mood recovery across ostracized low load and high load conditions. There were no other significant main effects or interactions, ps $> .331$.

Product Review

The third hypothesis was that those who had been excluded would rate the product displayed during the distractor more highly than those who had been included. Additionally, it was predicted that those under high load would rate it even higher. A between-subjects univariate ANOVA between the review measure and the ostracism and load conditions was conducted. There were no significant main effects for the ostracism conditions nor load conditions with $F(1, 48) = .27$, $p = .603$, partial-$\eta^2 = .01$, and $F(1, 48) = .33$, $p = .570$, partial-$\eta^2 = .01$, respectively. There was no significant interaction between load and ostracism conditions on review scores, $F(1, 48) = .59$, $p = .445$, partial-$\eta^2 = .01$ (see Figure 5). An independent samples t-test was also conducted to examine the low and high load ostracism conditions. There was no significant effect of load on the ostracism condition, with those in the low load ostracism condition ($M = 3.42$, $SD = .62$) not scoring significantly lower than those in the high load ostracism ($M = 3.38$, $SD = .96$) condition, $t(23) = -.30$, $p= .898$, $d =.04$. Given these results, the hypothesis that those who were ostracized would rate the product higher was not supported, nor were they more likely to rate it higher when under increased load.

Chapter 4 - Discussion

This study explored the potential effects of cognitive load on the negative consequences of ostracism. It was hypothesized that those under higher cognitive load while being ostracized via Cyberball would suffer fewer negative consequences from the ostracism experience than those under low cognitive load while being ostracized. This was tested with an immediate measure of need satisfaction and mood following the ostracism experience as well as recovery from the ostracism experience. Despite there being a significant main effect for the ostracism condition, suggesting participants who were ostracized felt worse (on measures of need satisfaction and mood) than participants who were included, there was no significant interaction between ostracism and cognitive load. There was also no significant interaction between ostracism, load, and the initial reflexive and delayed reflective responses, although there were general effects of recovery and particularly need satisfaction recovery for those ostracized, compared to those included. These findings suggest that load does not buffer against the negative consequences of ostracism; thus, there was no support for these hypotheses.

This study also explored the potential effects of ostracism and high cognitive load on persuasion—via an online product review. It was predicted that those who were ostracized would rate a product higher than those who were included, and those who were under high load would rate the product higher than those under low load. There were no effects of ostracism or load on the review, nor was there an interaction. Thus, there was no support found for these hypotheses.

Ultimately, the lack of a significant interaction between load and ostracism may not be surprising. Ostracism may be such a powerful force that it can override the effects of being under high cognitive load. Williams (2009) discussed how humans may have developed a sensitive ostracism detection system. There is evidence for this in that people experience negative

consequences following ostracism, regardless of the context of the ostracism situation. As established in Gonsalkorale & Williams (2007), even when ostracized by members of a diametrically opposed group (such as the KKK) participants still felt a reduction in need satisfaction. Additionally, in Zadro et al. (2004), participants experienced a negative impact on mood despite being told it was a machine, not a person, ostracizing them. Ostracism may be an effect that is so powerful, it can override our natural bias against our outgroups and even result in negative consequences when ostracized by non-human entities. Indeed, anecdotally, during the debriefing phase of this study, even participants that admitted to working out that they were playing against an AI still claimed to have felt bad about the ostracism event. Cognitive load may well be another force that is not strong enough to overcome ostracism. As Williams (2009) pointed out, detecting ostracism is a powerful adaptive force, hardwired into us by evolution. Thus, it might be difficult to lessen the negative impact ostracism has on people.

Although the ostracism manipulation was strong, leading to lower need satisfaction and more negative mood in those who were ostracized compared to included, the cognitive load manipulation was not effective. It is possible the load manipulation was not strong enough to produce a significant difference between high and low load conditions. Anecdotally, several participants stated during debriefing that the password was not as hard to memorize as they first expected. This suggests that the load manipulation may simply not be strong enough to tax cognitive resources effectively. Although previous research showed this manipulation was effective (Kelly et al., 2016), the low sample size in the current study may not have been enough to produce a difference in high and low load conditions with a weaker manipulation. Additionally, in the past, participants have been made to memorize multiple passwords throughout the study (Kelly et al., 2016). Maybe only giving one password throughout the

present study lessened the effect of the manipulation. It is also possible that the questions asked

to ascertain the cognitive load level (the Ego Depletion Scale) were not capturing participants'

actual load. Under many circumstances, people may not be aware as to if they are under any

substantial mental load and may overestimate their available capacity. Texting while driving is a

perfect example of a situation where people may believe they have more available mental

resources than they currently possess.

Another possibility is that participants did not actually work hard enough at the high load

task to experience high cognitive load. Questions were included to assess participants'

engagement with the password task. In looking at the data, it seems that of those in the high load

conditions, 63% (16) said they rehearsed the password. Of those 16, three participants were off

by more than one character, and one additional participant failed to recall the password at all. Of

the nine who did not rehearse in the high load group, three were more than two characters off

from the correct password (one person reporting the individual's own name instead of the

password). This might suggest that some participants were not actually engaging in the task to

induce high cognitive load during the ostracism experience, and with a small sample size, these

participants could have had a larger impact.[2]

There was also a noted difference between this study and previous research in terms of

distraction. Swim and Williams (2008) and Zadro et al. (2006) previously examined the effect a

distractor task would have on need recovery following ostracism, particularly compared to

rumination. This is similar to cognitive load, as those under high load should, in theory, have

fewer resources with which to ruminate. These previous studies showed that those who

completed a distractor task rather than being allowed to ruminate on the ostracism experience

recovered quicker (Swim et al. 2008; Zadro et al., 2006). Despite this, no significant effect was

found in the present study between cognitive load and needs or mood recovery. This may be due, in part, to the failure of the load manipulation. It might also be that these previous studies presented the distractor task following the initial need satisfaction and mood assessment, whereas the load task in the present study was presented during the ostracism experience. Future research should test the differences in distraction during ostracism versus following ostracism.

Strengths and Limitations

One key strength of the study was the use of Cyberball. As previous research has shown, Cyberball is an excellent way to induce feelings of ostracism. The program worked as expected for the purposes of this experiment. The results of the manipulation check confirmed that those in the ostracized conditions did indeed experience lower need satisfaction and mood. This is in line with previous literature showing as much (see Williams, 2009). Additionally, this study replicated previous research suggesting ostracism is a powerful effect that can override possible moderators. There was a significant main effect of ostracism condition on both need satisfaction and mood. This was bolstered by the high effect sizes for ostracism main effects.

One limitation of the study was the small sample size (52 total participants). This sample size may have been enough to detect the large effects of ostracism, but may not have been large enough to detect smaller effects of cognitive load. Studies that employed this password manipulation, such as Conway and Gawronski (2013) and Kelly et al. (2016), had larger sample sizes, suggesting this manipulation may have worked with a higher-powered study. There are also slight differences between the means of those under the load conditions that is consistent with the hypotheses. This small trend toward a relationship may further reinforce the need for more participants within the study.

Given that there was no significant difference in the self-report measures on load, it is possible that the manipulation was not strong enough, as discussed. Alternatively, the nature of Cyberball may have interfered with the manipulation. In order to maintain the cover story of why people are playing Cyberball, participants are told to visualize the people they may be playing against. This, in and of itself, may induce enough cognitive load to disrupt the results. Thus, it could be that participants in both high and low load conditions were exerting mental effort in their mental visualization and that the additional memorization task did not lead to significantly more effort in the high load conditions. It may be worth exploring if this is the case potentially by dropping the mental visualization aspect altogether.

The final limitation comes from potential differences in participant populations. Some participants were recruited directly from two upper-level psychology classes for the reward of extra credit, while others were mostly freshmen completing the study as part of course requirements for introductory psychology. This might have played a role in ability on the cognitive load task. Upperclassmen might be more adept at rehearsing and memorizing information to remember than lowerclassmen, thus making the high cognitive load condition not as mentally strenuous.

Future Directions

Future research should attempt to explore this question further. The current study had limitations in its small sample size and potentially weak cognitive load manipulation that should be addressed. The most obvious future direction for this research would be to address the limitations of the study and conduct a replication. Specific attention should be focused on the cognitive load manipulation. Utilizing a longer password or multiple passwords to increase load may be one solution. Another may be to utilize a more extreme, extraneous task that may impact

cognitive resources more than just memorizing a password, such as having participants listen to a highly distracting conversation or television broadcast. Although the findings of this experiment did not support the hypotheses, the low sample size and homogenous population, coupled with the possible failure of the load manipulation, mean that its results should be taken with a grain of salt. A more powerful load manipulation may yet be able to help lessen the negative consequences of ostracism.

From a more theoretical perspective, there are some possible future avenues of exploration. One possibility would be to replicate this experiment in a non-academic setting. Given the social nature of the modern office setting, it would be intriguing to explore a modified variant of this experiment with employees in a naturalistic work setting. Specifically, it could be beneficial to explore the interaction between ostracism and cognitive load with leadership styles that favor close bonds with employees, such as Leader-Member-Exchange (LMX) theory or Servant Leadership. LMX involves a reciprocal dyadic relationship between a manager and their workers. Servant leadership, on the other hand, entails a leader sharing power with his/her subordinates and putting their needs first. Both involve the formation of social bonds between the leaders and their staff. From a deeper industrial/organizational psychology perspective, it would also be intriguing to look at ostracism's effect on work efficacy. Particularly taxing work may induce enough cognitive load to spark an interaction with ostracism, and those under both may suffer reductions in their work efficiency. In their paper on performance motivation, Jamieson, Harkins, and Williams (2010) found that participants that had been ostracized through Cyberball outperformed the included conditions on antisaccade tasks (a task that links visual attention with emotional processing, tracking eye movements to emotionally stimulating stimuli) when they were allowed to compare performances. This was mediated by the need to belong,

suggesting that those who have been ostracized may seek to use cognitive task ability as a means to become included. Seeing how ostracism affects the task performance of those in the workplace (where many are under high cognitive load) is important.

It would also be useful to continue to explore the various other factors that may in some way interact with ostracism. Similar to cognitive load, future studies could attempt to see if directly distracting a person experiencing an ostracism event decreases the need reduction suffered from the exclusion. The present study focused more on utilizing load to prevent a participant from fully mentally processing the ostracism event. A natural social setting would likely not involve remembering a password. Instead, future studies could focus on distracting participants as opposed to merely putting them under load. These studies could provide proxies to more organic distractors (e.g., loud conversations, distracting features such as televisions, and the use of a smartphone) and seeing if these in any way moderate the need satisfaction reductions. Rather than prevent processing, these distractions may prevent the participant from even recognizing the ostracism event. A distracting television program, game, or task may be sufficient in preventing them from taking notice of potential ostracism. Looking at social (such as the conversation) versus non-social (such as a game or task) distractors and comparing the reflexive need satisfaction reduction may be of interest as well. In addition, future studies may wish to explore possible moderators such as individual personality differences. It would be interesting, for example, to possibly explore the interaction between self-esteem, needs reduction, and ostracism.

Future research should also focus on addressing the failings of the product review. In the present study, the review was not constructed in the proper way to capture the relationship of interest. Under the principles of ELM, when using the peripheral route, one should focus more

on surface level details. Ideally, to test this, the experimenter would vary the surface level details from the deeper, more central elements that the participants would examine. For example, it might have been good to construct the manipulation in such a way as to have the surface level details appear "good," while having the deeper details be much poorer by comparison, something that was not done in the present study. A future study could involve having the visual indication of the product rating (the stars, for example) not line up with the actual text of the review. So presumably, those that were under higher cognitive load would merely see the stars, and rate the product higher, while not absorbing much from the text review.

Conclusion

The purpose of this experiment was to test whether cognitive load could serve as a buffer against the negative effects of ostracism. This was done as a continuation of previous literature that has attempted to find a moderator that reduces the negative consequences of ostracism. Although this study found strong effects of ostracism, there was no amelioration of negative consequences from cognitive load. This could be due to the low sample size, a weak manipulation of cognitive load, or it might be that cognitive load (like many other situations and individual differences) does not help to alleviate the negative consequences of ostracism. Future studies may deal with the methodological limitations of the present research and expand upon the topic further.

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Endnotes

1. We conducted all the main analyses using attention span as a covariate (the Operational Span Partial scores) and all the results remained similar. All significant results remained significant and all non-significant results remained non-significant. Regression analyses were also conducted between the Operation-Span partials, load condition, and ostracism condition on the reflexive need satisfaction and reflexive mood variables. There were no three-way interactions, ps > .22. There was a marginally significant two-way interaction between load and operation span on need satisfaction, $t(48) = -1.76$, $p = .085$. At low levels of load, there was a marginally significant effect such that higher operation span scores were associated with lower need satisfaction, $t(48) = -1.88$, $p = .067$. There were no other significant effects on need satisfaction and there were no significant effects on mood.

2. Follow-up tests were done where those who failed to recall the password by more than two characters were excluded. All results remained similar.
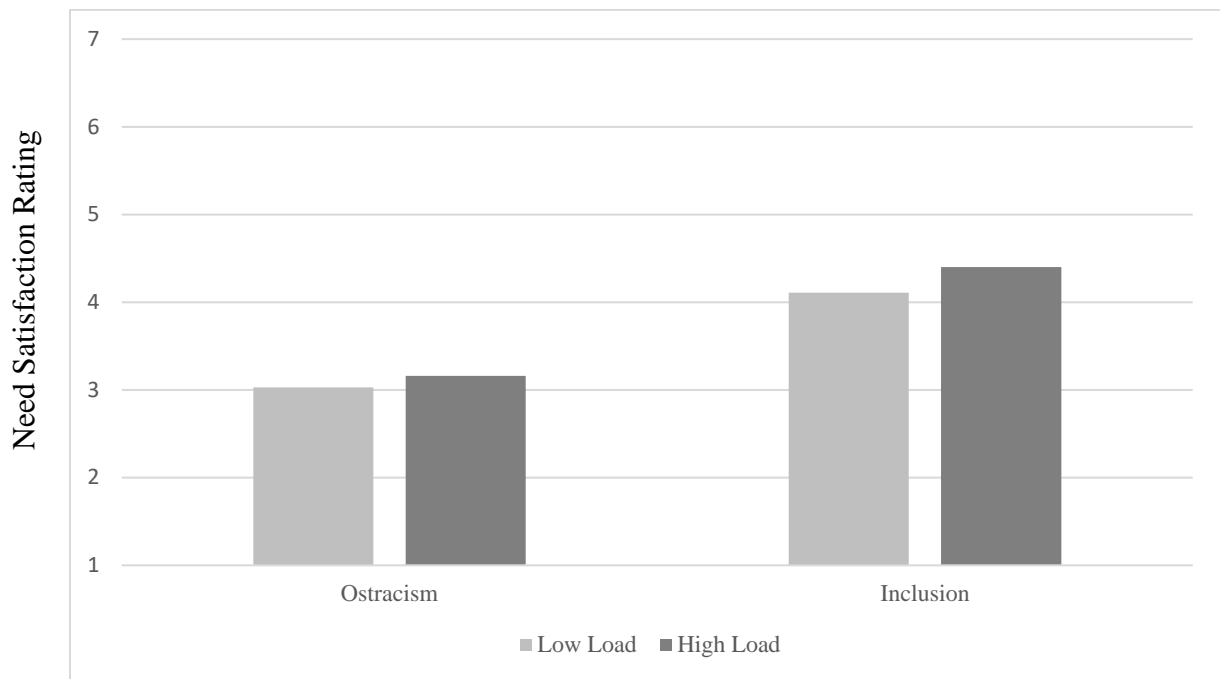
Figure 1. Mean scores and interaction of the ostracism and inclusion conditions for the reflexive need satisfaction subscale by cognitive load condition.
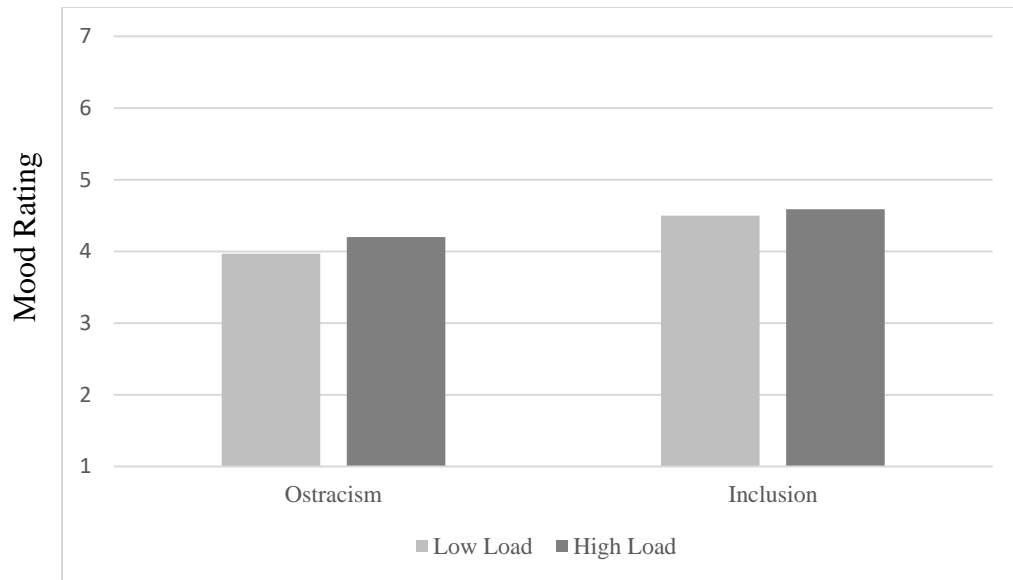
Figure 2. Mean scores and interaction of the ostracism and inclusion conditions for the reflexive mood subscale by cognitive load condition.
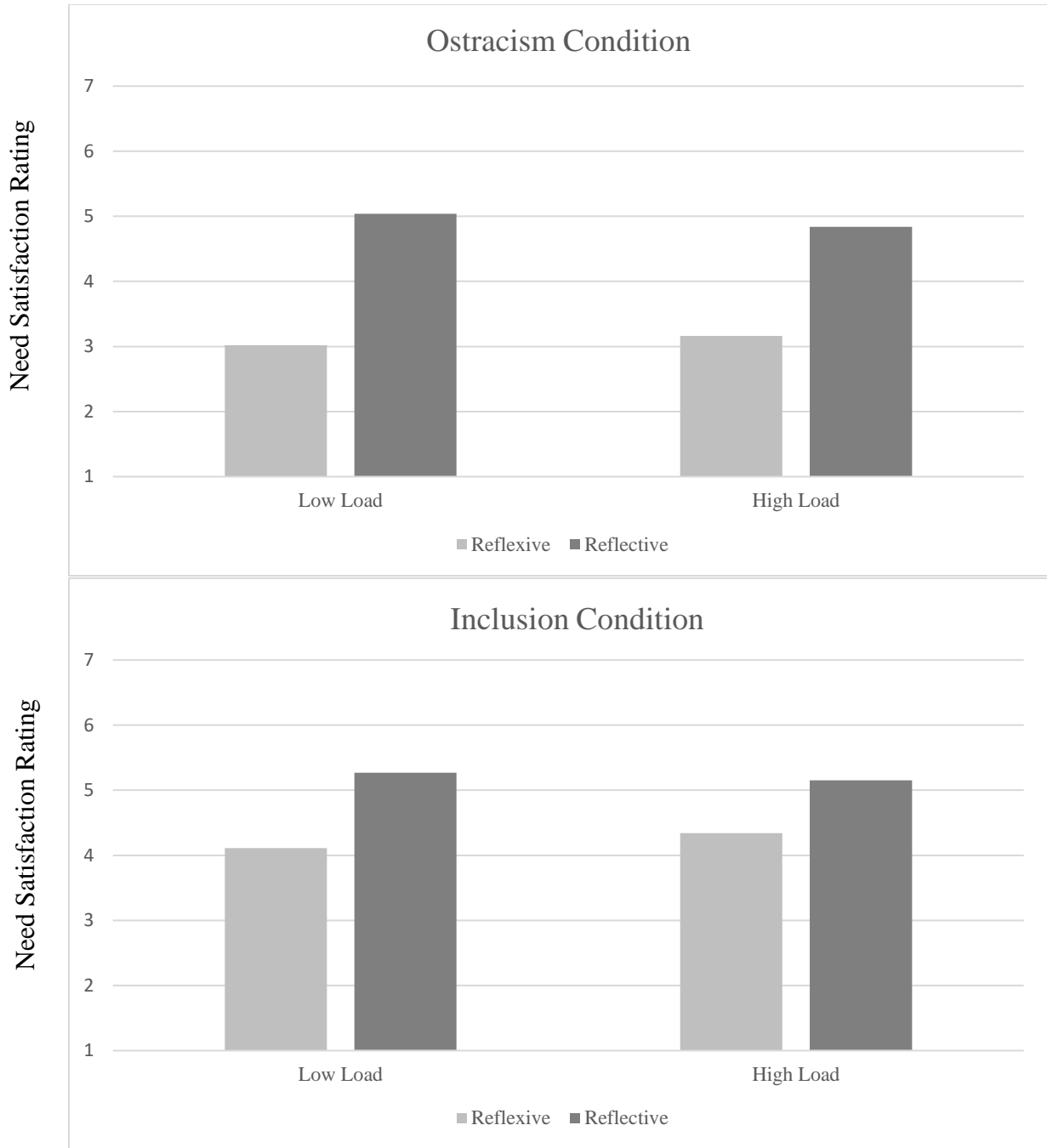
Figure 3. Mean scores and interactions by cognitive load condition for recovery in both the ostracism and inclusion conditions on the needs subscale.
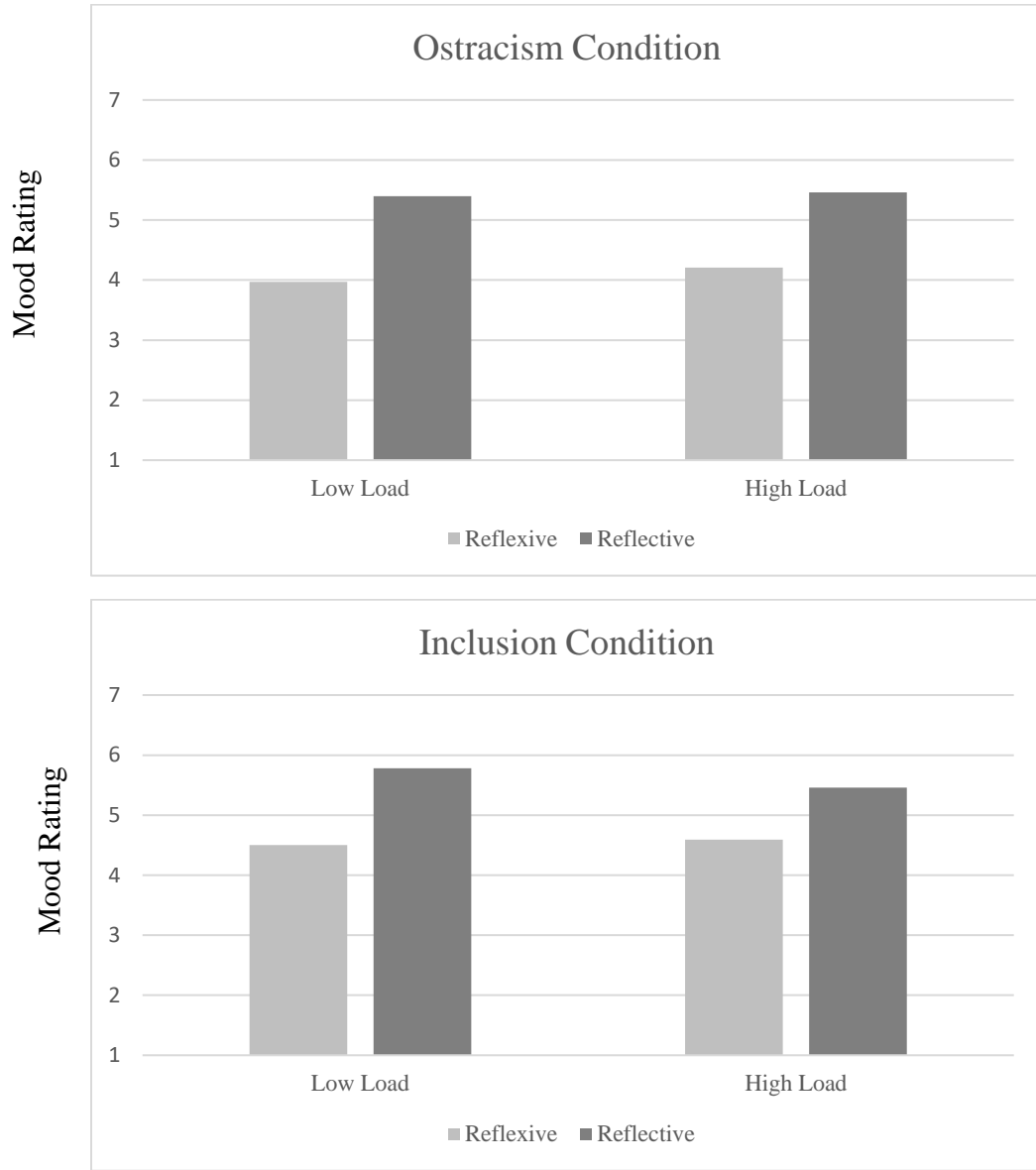
Figure 4. Mean scores and interactions by cognitive load condition for recovery in both the ostracism and inclusion conditions on the mood subscale.
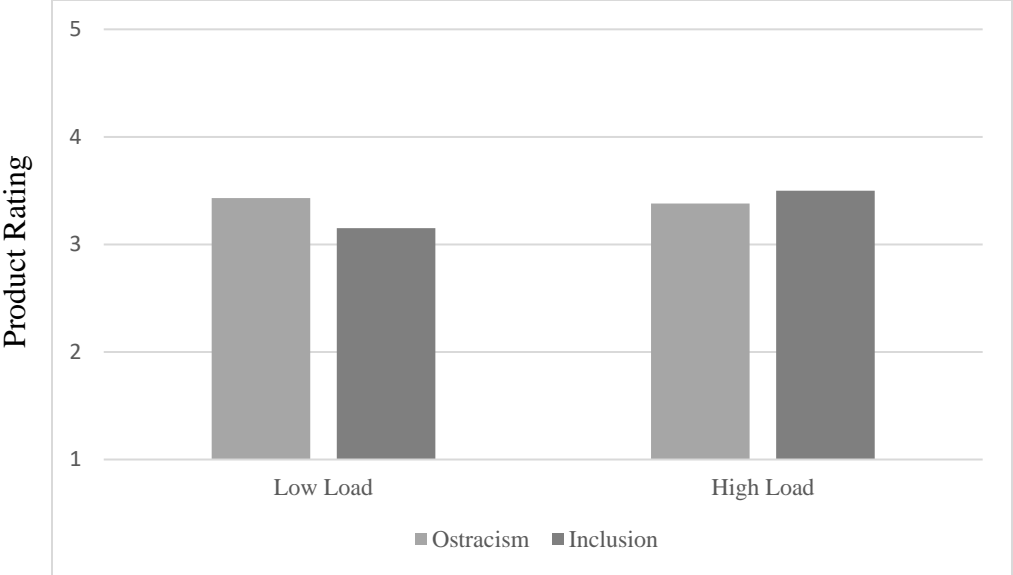
Figure 5. Mean scores of the product rating and interactions between cognitive load conditions.

Appendix A

CyberBall Instructions

"Now we are going to have you practice your mental visualization skills. We have found that

the best way to do this is to have you play an online ball-tossing game with other participants

who are logged on at the same time.

In a few moments, you will be playing a ball-tossing game with other students over our

network. The game is very simple. When the ball is tossed to you (PLAYER 2), simply click

on the icon of the player you want to throw it to. When the game is over, continue to follow

the instructions.

What is important is not your ball-tossing performance, but that you MENTALLY

VISUALIZE the entire experience. Imagine what the others look like. What sort of people are

they? Where are you playing? Is it warm and sunny or cold and rainy? Create in your mind a

complete mental picture of what might be going on if you were playing this game in real life.

Click the below arrow to connect to the game."

Appendix B

Assessment of Need Satisfaction and Mood

For each question, please select the number that best represents the feelings you were experiencing during the game.							
	Not at All						**Extremely**
I felt ''disconnected''	1	2	3	4	5	6	7
I felt rejected	1	2	3	4	5	6	7
I felt like an outsider	1	2	3	4	5	6	7
I felt good about myself	1	2	3	4	5	6	7
My self-esteem was high	1	2	3	4	5	6	7
I felt liked	1	2	3	4	5	6	7
I felt invisible	1	2	3	4	5	6	7
I felt meaningless	1	2	3	4	5	6	7
I felt nonexistent	1	2	3	4	5	6	7
I felt powerful	1	2	3	4	5	6	7
I felt I had control over the course of the game	1	2	3	4	5	6	7

I felt I had the ability to significantly alter events	1	2	3	4	5	6	7
I felt Good	1	2	3	4	5	6	7
I felt Bad	1	2	3	4	5	6	7
I felt Friendly	1	2	3	4	5	6	7
I felt Unfriendly	1	2	3	4	5	6	7
I felt Angry	1	2	3	4	5	6	7
I felt Pleasant	1	2	3	4	5	6	7
I felt Happy	1	2	3	4	5	6	7
I felt Sad	1	2	3	4	5	6	7

Appendix C

Ostracism Manipulation Check

For the next three questions, please select the number (or fill in the blank) that best represents the thoughts.

	Not At All						Extremely
I was ignored	1	2	3	4	5	6	7
I was excluded	1	2	3	4	5	6	7
I was included	1	2	3	4	5	6	7
Assuming that the ball should be thrown to each person equally (33% if three people; 25% if four people), what percentage of the throws did you receive?		_____%					

Appendix D

State Ego Depletion Scale Items

Please indicate how much you agree with the following statements.						
My mental energy is running low.						
1 **Not True**	**2**	**3**	**4**	**5**	**6**	**7** **Very True**
Right now, it would take a lot of effort for me to concentrate on something.						
1 **Not True**	**2**	**3**	**4**	**5**	**6**	**7** **Very True**
I can't absorb any more information.						
1 **Not True**	**2**	**3**	**4**	**5**	**6**	**7** **Very True**
Please type in your passcode to the best of your ability.						

Appendix E

Mock Review

★★★★★ **3 years and counting**
July 17, 2016
Color: Brushed Stainless | Size: 4-Slice

This is a review for Cuisinart CPT-180 Metal Classic 4-Slice Toaster, Brushed Stainless.

This toaster has been in daily service for three years and has performed well. It's a moderately priced appliance so I don't expect perfection, but this unit has come pretty close. The bagel setting heats the entire bagel, not just the exterior like other toasters with bagel settings. The reheat button comes in handy, especially when I space out - which happens a little more often these days ;) There are lots of toasters that claim to have a retro look but this is unique in it's old school feel. With periodic maintenance (emptying the crumb trays, using a toothbrush to clean the elements, etc.) this is a great investment.

Note: I'm sorry to hear about some of the problems reported in other reviews. If it were me, I'd send the unit back in a New York second because Cuisinart needs the feedback, and more than that, the reviewers need a toaster they can count on.

Appendix F

Persuasion Distractor Task

Product Rating					
What overall rating would you give this product?					
	Poor **1**	**2**	**3**	**4**	**Excellent** **5**	
Please rate how useful you believe this product to mbe					
	Poor **1**	**2**	**3**	**4**	**Excellent** **5**	
How good of an addition would this product make to your kitchen?					
	Poor **1**	**2**	**3**	**4**	**Excellent** **5**	
How effective would you believe this product to be based on this review?					
	Poor **1**	**2**	**3**	**4**	**Excellent** **5**	
How would you rate the buy-ability of this product?					
	Poor **1**	**2**	**3**	**4**	**Excellent** **5**	
How Likely would you be to recommend this product to your immediate friends?					
	Very **Unlikely** **1**	**2**	**3**	**4**	**Very** **Likely** **5**	
How Likely would you be to recommend this product to your immediate family?					
	Very **Unlikely** **1**	**2**	**3**	**4**	**Very** **Likely** **5**	
How Likely would you be to purchase this product?					
	Very **Unlikely** **1**	**2**	**3**	**4**	**Very** **Likely** **5**	

Appendix G

Memory Questions

Did you rehearse the password during the Cyberball game?	Yes		No	
If yes: How frequently did you rehearse the password?	Very Little	Somewhat Often	Often	Very Often
Did you employ any of the following strategies to help you memorize the password?				
Chunking (breaking down the password into manageable chunks)	Yes		No	
Story/Mnemonics (constructing a story or song to memorize the parts of the password)	Yes		No	
Imagery (associating the password with certain images)	Yes		No	
Repeating	Yes		No	
If yes to any of the above, to what extent did you make use of these?	Very Little	Somewhat Often	Often	Very Often
How much effort did you put into memorizing the task?	Very Little	Some Effort	Moderate Effort	A lot of Effort
How much did you think about the game during the product review?	Very Little	Somewhat Often	Often	Very Often

Appendix H

Demographics Survey

Please select or write in your answer.					
Age (In years)					
Gender		Male		Female	Other
Ethnicity	Caucasian/ non-Hispanic	Hispanic	Asian/Pacific Islander	African American	Other

Appendix I

Operation Span Task