One 650-mg Dose of Acetaminophen Does Not Reduce Social Pain in Young Adults: Results from a Randomized and Placebo Controlled Trial



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Submitted to the Psychology Department, Allegheny College
in partial fulfillment of the requirements for the degree of
BACHELOR OF SCIENCE

April 4, 2016

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Acknowledgments

Dr. Conklin, thank you so much for inspiring me to always strive to achieve the best! Thank you for peaking my interest in health and psychology research, your unwavering support and enthusiasm, and making the past two years fun! I truly believe that because of the comp process and having you as my advisor I have become a better researcher and person who is ready for life after Allegheny. Thank you!

I would also like to thank my second reader, Professor Jackson. It was really because of you and your one class sophomore year that I switched majors and am sitting here writing a psychology comp. I cannot thank you enough for everything that you have helped me with in the classroom and out. Every time I talked to you I left feeling more sure of myself and decisions to be made, completely helping to make my senior year a little bit easier! Also, thanks for first introducing me to this amazing topic!

Finally, I would like to thank my family and friends for their constant love and support. To my family, I truly would not be the person who I am today without you all! Thank you for always being a phone call away to hear how excited I was that something was working or how upset and mad I was when it wasn't! I love you! To my friends, thank you for making senior year amazing! I know that you all are always there for the ups and the downs, the late night library cramming, or the late night ice cream trips. I am so lucky to have had Allegheny bring us all together and cannot thank you enough for being amazing people and friends!

Abstract

Physical pain and social pain are neuroanatomically linked. Acetaminophen, a widely used over-the-counter analgesic, has been shown to decrease social pain when consumed for 21 days; a 1000-mg dose yielded decreased scores on a hurt feelings scale and a 2000-mg dose showed decreased activation of the dorsal anterior cingulate cortex and anterior insula through fMRI imaging. The current study examined if a single 650-mg dose of acetaminophen reduced social pain. Participants were randomly assigned to receive acetaminophen or a matched placebo and then completed a Cyberball ostracism manipulation followed by a measure of social pain. It was determined that a 650-mg dose of acetaminophen was not associated with less social pain compared to an inactive placebo.

One 650-mg Dose of Acetaminophen Does Not Reduce Social Pain in Young Adults: Results from a Randomized and Placebo Controlled Trial

Social pain and physical pain share anatomical pathways in the brain (Eisenberger, Leiberman, & Williams, 2003; Riva, Wirth, & Williams, 2011). Pain, either social or physical, is an unavoidable part of life, with most people experiencing social pain at least once during their life (Williams, 2009) and millions of people reporting chronic or acute physical pain each year. Social pain causes hurt feelings, but also increases the prevalence of anger, sadness, depression, and jealousy (DeWall & Bushman, 2011). Increased social pain is associated with reduced performance trends on intellectual tests (Baumeister, Twenge, & Nuss, 2002), hypersensitivity to threat (DeWall, Twenge, Gitter, & Baumeister, 2009), increased signs of aggression (Twenge, Baumeister, Tice, & Stucke, 2001), weaker impulse control (Baumeister, DeWall, Ciaracco, & Twenge, 2005), and a slower heart rate (Gunther Moor, Crone, & van der Molen, 2010). Almost unbelievably, previous research has shown that a 2000-mg dose of acetaminophen daily for three weeks yielded decreased activation of the dorsal anterior cingulate cortex and anterior insula following exposure to an ostracism manipulation as well as a 1000-mg dose daily for the same time frame yielded decreased scores on a measure of state hurt feelings compared to a placebo (DeWall et al., 2010). The present study examined the acute effects of a single 650-mg dose of acetaminophen, an effective physical pain reliever, on reducing social pain created in the laboratory.

Social Pain

Social rejection, exclusion, and ostracism are types of social pain that undermine fundamental need to belong and experience acceptance (DeWall & Bushman 2011; Wesselmann, Ren, & Williams, 2015). Realistic or perceived feelings of social pain result in desire to reconnect, hypervigilance, and feelings of vulnerability (Hawkley & Cacioppo, 2010). Humans are very social creatures who crave interactions with others, therefore social pain, experienced through events such as rejection, exclusion, ostracism, and loneliness, can be detrimental to both mental and physical health. Physically, effects of social pain have been linked with increased morbidity and mortality through increases in cardiovascular health risks including: BMI, blood pressure, HDL cholesterol levels, glycated hemoglobin concentration, and maximum oxygen consumption (Hawkley & Cacioppo, 2010). Additionally, there is a positive correlation between loneliness and overall pain intensity ratings (Wolf, Davis, Yeung, & Tennen, 2015). Mentally, social pain is devastating with 75% of people ranking losing a close relationship as the most negative event in their life (Jaremeka, Gabriel, & Carvallo, 2011).

Ostracism and Cyberball

Social pain can be created in a laboratory setting through use of ostracism. Ostracism occurs when people do not wish to engage with others and exclude them from groups and relationships (Leary, 2010). Social ostracism can consist of a range of behaviors from ignoring others to actively declining them from a group or relationship (DeWall & Bushman, 2011). Ostracism threatens physical and psychological well-being (Williams & Nida, 2011), causes people to demonstrate increased assimilations to social

pressures (Williams, Cheung, & Choi, 2000), and has even been implicated as a cause in acts of mass violence (Leary, Kowalski, Smith, & Philips, 2003).

Williams (2009) suggests three different stages that accompany ostracism. Stage one consists of the actual act of ostracism. Stage two involves the target attempting recovery from the ostracism, often times people do this by focusing on the attributions for the ostracism and ways to mend the situation. Finally, stage three occurs in chronically ostracized individuals and causes psychological and physical damage (Williams, 2009). When people constantly have attempts at relieving pain of ostracism disrupted, they develop a helplessness that results in the extreme psychological and physiological consequences of social pain (Wesselman, Ren, & Williams, 2015).

There are multiple tasks that researchers have created in order to manipulate feelings of ostracism in a laboratory setting. Some of these techniques include leading participants to believe that no one selected them to be included in a group (Maner, DeWall, Baumeister, & Schaller, 2007) or having virtual confederates exclude participants from a ball tossing game, a manipulation known as Cyberball (Williams et al., 2000). Cyberball is widely used across ostracism research and involves a participant interacting with two confederates in a virtual ball tossing game. The conditions of Cyberball can be experimentally controlled, with the ostracism manipulation beginning when the participant is suddenly excluded and no longer receives the ball from the confederates. Zadro, Williams, & Richardson (2003) report that once a participant is excluded by the virtual confederates, it only takes four minutes for them to appear physically dejected. Cyberball elicits the social pain of ostracism in

participants, evidenced by reduced feelings of belonging, control, self-esteem, and meaningful existence in addition to experiencing more anger and enjoying the Cyberball paradigm less than a control group (Zadro et al., 2003).

Neurological Overlap between Social Pain and Physical Pain

Overlap between central social and physical pain systems is theorized to have been caused by advantageous conditions in our evolutionary ancestors (DeWall & Bushman, 2011). In the early years of life, human infants completely rely on others for all basic needs, such as protection and nourishment. Without a social connection, infants would not survive and therefore a need for social acceptance is critical to survival. In evolutionary terms, social connections were necessary for the survival of early humans who lived together in small groups where being rejected from one of these communities could result in death (DeWall & Bushman, 2011). Similarly to experiencing physical pain, social pain may have occurred to alert the individual of danger and cause them to seek a way to repair social structure or to seek new areas of social support (Chester, DeWall, & Pond, in press; Sturgeon & Zautra, 2016).

Dating back to ancient Greece, social pain has been considered a punishment equivalent to that of physical pain. In Greek society, the sentences of exile and death were considered equal (DeWall & Bushman, 2011). Throughout history and across multiple languages, social pain has been described using adjectives that are common signifiers of physical pain (DeWall et al., 2010). The phrases “hurt feelings” and “broken hearts” demonstrate how people perceive social pain to actually cause feelings of harm to the body (DeWall & Bushman, 2011).

As evidenced by neuroimaging, social distress causes activation of the same neuroanatomical structures associated with the unpleasant perception of physical pain including the dorsal anterior cingulate cortex (dACC) and the anterior insula (Eisenberger et al., 2003; Chester et al., in press; Kross, Egner, Oschner, Hirsch, & Downey, 2007; Masten et al., 2009). The dACC acts as a neural alarm system and conflict monitor that dictates when automatic bodily responses are in direct competition with current goals (Eisenberger et al., 2003). In particular, the dACC has been associated with the unpleasant perception to painful stimuli rather than the sensory component of pain (Eisenberger et al., 2003). In animal lesion studies, primates that were separated from their caregivers and had a lesion to the dACC, did not have any distress vocalization (Hadland, Rushworth, Gaffan, & Passingham, 2003; MacLean & Newman, 1988). This is in contrast with studies of electrical stimulation of the dACC in primates causing distress vocalization (Robinson, 1967; Smith, 1945). It has also been found, in humans, that a disapproving facial expression directed at a participant, an indication of a negative evaluation, or viewing a photo of a loved one who had passed away, caused heightened activation of the dACC (Burklund, Eisenberger, & Lieberman, 2007; O'Connor et al., 2008).

As a whole, the dACC, anterior insula, and the somatosensory cortex are the primary components of the cortical pain network, which is responsible for the perception of physical pain (Lieberman & Eisenberger, 2009). The anterior insula is the other piece of the network that has been implicated for its role in the neurological perception of social pain. It is suggested that the anterior insula partially regulates the ACC due to its efferent connections with regions of the ACC, causing the activation due to social pain

(Eisenberger et al., 2003). Recently it has been proposed (DeWall et al., 2010) that due to the shared neurologic mechanisms (Eisenberger et al., 2003; Panksepp, Herman, Conner, Bishop, & Scott, 1978), social pain should be relieved in the same manners that physical pain can be.

Acetaminophen and Psychology

Acetaminophen, the active ingredient in Tylenol®, acts as a well-known and widely used physical pain reliever. While some aspects of the mechanisms and pathways by which acetaminophen works are still unknown, it has been widely accepted that acetaminophen is a nonopiate analgesic and antipyretic drug that works through central mechanisms in the brain (Anderson, 2008; Ghanem, Perez, & Manautou, in press; Prior, Podispoti, & Fu, 2010;). Acetaminophen appears to work in the central nervous system through peroxide-mediated inhibition of cyclooxygenase enzyme activity causing inhibition of prostaglandin synthesis (Anderson, 2008; Ghanem et al., in press). Additionally, the analgesic effects of acetaminophen have also been linked to maintenance of the serotonin and endogenous cannabinoid systems (Ghanem et al., in press; Graham, Davies, Day, Mohamudally, & Scott, 2013). Acetaminophen is the most widely used over the counter medication in the United States, with 79% of the population reporting regular use and 19% reporting use in a given week (Wilcox, Cryer & Triadafilopoulos, 2005; Wolf et al., 2012).

In addition to treating physical pains and ailments, acetaminophen has been shown to reduce psychological pains and responses. DeWall, Chester, & White (2015) found that an acute 1000-mg dose of acetaminophen reduced the pain of decision making through decreasing feelings of loss aversion and cognitive dissonance.

Participants in an acetaminophen group were exposed to a standard cognitive dissonance paradigm and showed decreased cognitive dissonance by rating an unchosen task as more favorable than their counterparts in a placebo condition (DeWall et al., 2015). Furthermore, other participants received either placebo or 1000-mg of acetaminophen and then were handed a mug and exposed to a standard endowment effect manipulation before they were asked to set a price for selling the mug (DeWall et al., 2015). Participants in the acetaminophen condition set lower prices for their mug and had lessened pain from decision making through the lessened effects of loss aversion (DeWall et al., 2015).

Durso, Luttrell, & Way (2015) also demonstrated how acetaminophen could produce psychological effects. Participants received a 1000-mg dose of acetaminophen and subsequently were randomly shown 40 International Affective Picture System (IAPS) pictures which had previously been rated and categorized as extremely unpleasant, moderately unpleasant, neutral, moderately pleasant, and extremely pleasant. Participants were asked to evaluate each picture stimulus on the basis of how positive or negative it was and the level of emotional reaction elicited by the picture. Participants in the acetaminophen group showed a blunted evaluation to positive stimuli and negative stimuli alike, ranking the stimuli as less extreme in terms of positivity and negativity compared to a placebo group (Durso et al., 2015). Additionally, participants in the acetaminophen condition reported being less emotionally affected by the stimuli (Durso et al., 2015).

After three weeks of 1000-mg of acetaminophen each day, DeWall et al. (2010) found that compared to placebo, participants reported less daily social pain as

measured by a state adaptation of the Hurt Feelings Scale (Leary & Springer, 2001) and a daily measure of positive emotion (Mayer & Gaschke, 1988). Also DeWall et al. (2010) demonstrated, through fMRI imaging, reduced activation of the dACC and anterior insula after a Cyberball social distress task in participants who consumed 2000-mg of acetaminophen daily for three weeks compared to the placebo condition. The findings that acetaminophen acts as a reducing agent of physical pain and social pain was groundbreaking and lends more support to the shared neurological connections between the two types of pain. The evidence from these studies suggests the neurochemical alterations that result from acetaminophen consumption impact psychological evaluative processes and that the benefits and consequences of consumption of the pain reliever may be broader than expected (Durso et al., 2015).

Present study

The time course and dosage necessary to observe a measurable reduction in social pain is poorly understood since only DeWall et al. (2010) have examined this phenomenon. Acetaminophen has a half-life of four hours, meaning that accumulation of the drug in the body is impossible and culmination effects will not be present and account for any reduction of pain (DeWall et al., 2010; Pappas et al., 1991).

The present study aimed to better understand if a single, typical, 650-mg dosage of acetaminophen will have similar efficacy of a reduction in social pain created in the laboratory. In this study, participants received a 650-mg dose of acetaminophen or a matched placebo and then completed the Cyberball social distress task. It was hypothesized that due to the shared brain networks between physical and social pain, that acetaminophen, a physical pain reliever, would also diminish social pain caused by

the distressing task, compared to an inactive placebo, resulting in increased scores on the Need Threat Scale (van Beest & Williams, 2006). It was also hypothesized that 650-mg of acetaminophen would decrease physical pain as evidenced by lower scores on the McGill Pain Questionnaire (Malzack, 1975).

Method

Participants

Undergraduate students (*N*=119) were recruited by using a SONA experiment manager from a small liberal arts college in the Northeastern United States. Of those, 47 participants (77% female, 89% Caucasian, *M* = 19.64, *SD* = 1.36) met inclusion criteria and were invited back to participate in the laboratory portion of the study. Participants were restricted to being non-smokers since smokers show increased pain sensitivity (Kanarek & Carrington, 2004). Also, a positive individual or family medical history of liver damage, allergy to acetaminophen, current use of individual or combination medication including acetaminophen, current pregnancy, or use of the blood thinner Warfarin were exclusion criteria. Lastly, participants were also not able to participate if they drank in excess, defined ≥ 3 drinks a day, due to the potential but unlikely damaging effects of acetaminophen on the liver (FDA, 2009).

Acetaminophen is a safe and effective pain relieving drug when used at therapeutic levels, however disregard of dosage recommendations and other pertinent drug information can result in liver damage ranging from minimal to acute liver failure or, very rarely, even death (FDA, 2009; Jaeschke & Bajt, 2006). Participants were asked to not consume any pain medication twenty-four hours prior to participation and fast the

hour prior to their scheduled laboratory appointment. Participants may have received psychology class credit for participating in the study, at the discretion of their professor, and were entered into a drawing for a gift card to a local restaurant. Written consent was obtained in accordance with the Institutional Review Board's approved procedures.

Measures

Pre-test.

At the time of sign up using the SONA experiment manager, participants completed a demographics questionnaire (Appendix A) that asked for vital information including: gender, age, class, ethnicity, chance of pregnancy, smoking history, alcohol consumption, family and individual medical history of liver damage, medication allergies, current prescription drug use, and comprehensive pain and fever reliever history.

Paradigm.

Once in the laboratory, participants completed a virtual ball-tossing game called Cyberball (Williams et al., 2000). In accordance with prior use of the task, participants were informed that they were completing the task with other students, when in fact, the program was controlled and manipulated using a computer program (Williams & Jarvis, 2006; Zadro et al., 2004). Participants completed the task on a computer screen that displayed two figures in the upper right and left hand corners of the screen and the participant's "hand" on the bottom of the screen. The participant's identification number was displayed beneath the hand of the participant on the screen. After a varying amount of time, between .5 and 3.0 seconds, the computer players tossed the ball to

the participant who then chose which computer player to toss the ball to by pressing a key on the keyboard; 60 throws was the preset amount for number of tosses per task. The direction of the toss from a computer player to the participant was scripted and controlled.

Post-test.

Immediately following the manipulation, participants completed the Need Threat Scale (Appendix B) to measure social distress due to social rejection (van Beest & Williams, 2006). The Need Threat Scale has categories including: self-esteem ("I felt liked"), belonginess ("I felt rejected"), meaningful existence ("I felt invisible"), and control ("I felt powerful"). Each item asked participants to rank how they felt during the task on a 7-point scale, from 1 *(do not agree)* and 7 *(agree)*. There are 20 items on the scale, five from each of the four categories listed above. The higher the score, the less distressed the participant was from the rejection task.

All participants also completed the McGill Pain Questionnaire (Appendix C) after the Cyberball task (Malzack, 1975). The McGill Pain Questionnaire consists of pain descriptors that are placed into four major categories: sensory ("pulsing"), affective ("fearful"), evaluative ("unbearable"), and miscellaneous ("tight"). Participants were asked to select all the descriptors that matched their current pain and then also completed the present pain intensity, PPI, portion of the questionnaire and ranked their pain on a scale of 0 *(no pain)* to 5 *(excruciating)*. Three different types of measures were obtained from the MPQ: a pain rating index, determined by scoring the number and order of words selected in each set, the number of words selected in total, and the PPI.

Procedure

Participants were brought into the laboratory and asked to take a 650-mg dose (two 325-mg pills) of acetaminophen or a matched placebo after signing an informed consent (Appendix C). By random assignment, completed through the use of a random number generator, approximately half of the participants were assigned to take the acetaminophen pills (n = 22) and the other half (n= 25) consumed the same dose of placebo. After 45 minutes, participants were told they would participate with other students over the internet in a virtual ball-tossing game, Cyberball. This 45 minutes was necessary due to research findings that the median pain relieving effects of acetaminophen are not experienced until the 45 minute mark (Moller et al., 2000) and that it takes acetaminophen approximately 45 minutes to reach peak plasma concentration (Gibbs & Anderson, 2008). During the 45 minute window, participants were asked to not have contact with other people, in person or through technology. Participants were also asked to stay in the laboratory and complete questionnaires that link current research and pertain to the mental visualization cover story. Participants were asked to complete The Center for Epidemiologic Studies Depression Scale-Revised (Eaton, Smith, Ybarra, Munaner, & Tien, 2004);(Appendix D), Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989); (Appendix E), Rosenberg Self Esteem Scale (Rosenberg, 1965);(Appendix F), The Ability to Rotate Mental Images (Campos, 2012);(Appendix G), and The National Eye Institute Visual Functioning Questionnaire (Mangione et al., 2001);(Appendix H). The participants were led to believe that the Cyberball task was a measure of mental visualization, rather than ostracism.

There are two rounds to the Cyberball task. In the first round, participants were included for the entire duration of the game. In round two, participants were included for the first few tosses of the game and then were not tossed the ball for the duration of the throws, excluding the participant. Following the Cyberball task, participants completed the Need Threat Scale (Crowley, Wu, Molfese, & Mayes, 2010; van beest & Williams, 2006; Welker, Oberleitner, Cain, & Carre, 2013) and the McGill Pain Questionnaire to measure their current amount of pain (Riva et al., 2011). Following the completion of the questionnaires, participants were interviewed and asked if they had ever heard of the Cyberball task. Once completed, each participant then received a written document of the full debriefing form that discloses the cover story (Appendix I).

Design

The study utilized a between-subjects design with an independent samples T-test analysis to test the primary and secondary hypotheses. There were two conditions of the independent variable, the acetaminophen group and the placebo group. Participants were assigned to the experimental or placebo group by random assignment via use of a random number generator, and it was double-blinded. The hypothesis that those assigned to the acetaminophen condition will show higher scores on the Need Threat Scale was tested with an independent samples T-test with group assignment as the independent variable and the Need Threat Scale total and sub-scores as the dependent variables. Additionally, the hypothesis that acetaminophen would result in decreased physical pain was also measured with an independent samples T-test with group assignment as the independent variable and the scores from the McGill Pain Questionnaire as the dependent variables. Differences between groups in regards to

demographic characteristics was accessed using chi-square tests for independence to study differences in race and gender, and an independent samples T-test examined differences in age between the conditions with condition assignment as the independent variable and age as the dependent variable. All independent sample T-tests utilized an alpha level set at .05.

Results

Demographic Characteristics between Conditions

As can be predicted, there were no differences in demographic characteristics between the participants in the acetaminophen group compared to the placebo group (see Table 1). Chi-square tests for independence were used to test for differences between conditions for race (χ^2= 0.91, p= .824) and gender (χ^2= 2.20, p =.138). An independent samples T-test demonstrated that there was no difference in age between the two conditions (t(45)= 0.63, p= .530, d= .19).

Need Threat Scale

The current study hypothesized that compared to participants who consumed placebo, participants who were assigned to the acetaminophen condition would report higher scores on the Need Threat Scale, thus feeling less social pain as measured by feelings of belonging, control, meaningful existence, and self-esteem. Due to non-compliance, one participant's total score and the belonging sub-scale score was not calculated due to failure to indicate a single response, and two additional participants failed to complete the back page of the survey resulting in their total scores and self-esteem and meaningful existence sub-scales not being calculated. An independent samples T-test analysis did not support the primary study hypothesis and showed that

650-mg of acetaminophen did not decrease social pain overall ($t(42)= 0.30$, $p= .763$, $d= .09$) or through belonging ($t(44)= 0.33$, $p= .741$, $d= .10$), control ($t(45)= 1.06$, $p= .295$, $d= .32$), meaningful existence ($t(43)= 0.97$, $p= .339$, $d= .30$), or self-esteem ($t(43)= 0.35$, $p= .730$, $d =.12$) (see Table 1).

McGill Pain Questionnaire

Furthermore, it was hypothesized that participants in the acetaminophen condition would report less physical pain on the McGill Pain Questionnaire. Once again, analyses did not support the hypothesis. Only five participants in the acetaminophen condition (22.70%) and five from the placebo condition (20.00%) reported feeling any pain >0 on the Present Pain Inventory. An independent samples T-test showed that there were no differences between conditional means for the Present Pain Inventory ($t(44)= 0.14$, $p= .887$, $d= .04$), number of words chosen ($t(44)= 0.99$, $p= .328$, $d= .32$), or pain rating index ($t(44)= 0.60$, $p= .551$, $d= .18$) (see Table 1).

Discussion

The current investigation sought to determine if a single, 650-mg, dose of acetaminophen would decrease social pain through feelings of belonging, control, self-esteem, and meaningful existence. It was hypothesized that acetaminophen consumption would cause participants to report higher scores on the Need Threat Scale (van Beest &Williams, 2006) compared to a placebo group; indicating that their basic needs for belonging, control, self-esteem, and meaningful existence were not harmed and threatened as much due to the social pain of ostracism. Furthermore, it was also hypothesized that 650-mg of acetaminophen would decrease physical pain as measured by the McGill Pain Questionnaire (Melzack, 1975). Neither hypothesis was

supported and it was found that a single 650-mg dose of acetaminophen did not decrease social pain.

These findings add to the building body of literature concerning acetaminophen and its psychological effects. DeWall et al. (2010) was the first to study the possible psychological impacts of acetaminophen while demonstrating that a 21-day course of 2000-mg (two 1000-mg doses) of acetaminophen taken daily decreased activation of the dACC and anterior insula in response to social exclusion. The findings were ground breaking but called into question what dosage of the medication was required to view the decrease in social pain due to the fact that acetaminophen only has a half-life of four hours (DeWall et al., 2010; Pappas et al., 1991). Recently, research has been focused on other psychological phenomena that could share the same neural underpinnings as social pain and studying the impact of acetaminophen on these principles.

Randles, Heine, & Santos (2013) looked to examine if acetaminophen could decrease the pain of meaning threats—the pain of the uncomfortable feelings associated with something being in direct odds with one's expectations and values. Consumption of a single 1000-mg dose of acetaminophen resulted in less compensatory affirmation, a response to a meaning threat that causes affirmations of unrelated schema to which people are committed, than the placebo condition (Randles et al., 2013). From these results, it was suggested that the reason why the dACC, one brain region that responds to both physical and social pain, may react similarly to both of these types of pains is because of the uncertainty and violation of expectations that is associated with pain (Randles et al., 2013). There is evidence that the dACC reacts to all conflicts (Botvinick, Cohen, & Carter, 2004), and Randles et al. (2013) argued that

pain is brought upon by a conflict between behaviors and actions and the consequences associated with them. These findings added a new dimension and question to the social and physical pain overlap and once again demonstrated the breadth that acetaminophen has on psychological principles.

Acetaminophen was also shown to decrease the pain of decision making (DeWall et al., 2015). When describing social pain, people often times describe the feelings with common physical pain descriptors; for example, someone saying they have a “broken” heart. Similarly, people describe the pain of decision making in this manner (DeWall et al., 2015). For example, they can say things like they were “pained” when they decided to quit a job, or that they were “crushed” when they had to withdraw money from a bank account (DeWall et al., 2015). Participants who consumed 1000-mg of acetaminophen showed signs of decreased cognitive dissonance and loss aversion (DeWall et al., 2015). Once again, the association between conflict and the activation of the dACC is the proposed linkage with the social and physical pain network. The psychological discomfort of decision making is created by an attempt of people to manage their cognitive conflict and this effect is referred to as spreading of alternatives (DeWall et al., 2015). Spreading of alternatives activates the dACC and anterior insula, both structures that of which are associated with physical and social pain (Kitayama, Chua, Tompson, & Han, 2013). DeWall et al. (2015) showed that pain is a component of the decision making process and that acetaminophen can decrease this type of pain as well.

Durso et al. (2015) demonstrated that the consequences of 1000-mg of acetaminophen were much greater than expected. In addition to decreasing physical

pain, social pain, loss aversion, cognitive dissonance, and compensatory affirmations following meaning threats, acetaminophen also causes blunted evaluation sensitivity to both negative and positive stimuli. Research completed prior to Durso et al. (2015) only showed the efficacy of acetaminophen when being used to reduce feelings associated with negative stimuli, the addition of the blunted reaction to positive stimuli introduced a whole new area of study in regards to the underpinnings of the physical and social pain overlap and the associated impact of acetaminophen. Literature indicates that negative and positive evaluations are both processed with the same neural structures (Berntson et al., 2011), and it was hypothesized that acetaminophen worked through an overarching blunting of all evaluations caused through an unknown neurochemical process (Durso et al., 2015). Durso et al. (2015) suggests that acetaminophen alters neurochemical reactions that impact one or more psychological evaluative processes and this is the reason that acetaminophen has been showing psychological benefits in other literature (DeWall et al., 2010; DeWall et al., 2015; Randles et al., 2013). Potentially, acetaminophen serotonin pathway modulation (Ghanem et al., in press) or the impact of the medication on the inflammatory system (Graham et al., 2013) can be implicated as the neurochemical change responsible (Durso et al., 2015). Future research must be completed to determine what exactly this neurochemical change is that is responsible for the altering of evaluative processing. The finding of Durso et al. (2015) suggest that acetaminophen should not be classified as a pain reliever, but more broadly as an “all-purpose emotion reliever” (Durso et al., 2015).

One major difference between these studies and the current study is the dosage of acetaminophen. Acetaminophen is readily available over-the-counter in two forms, a

regular strength and an extra strength formula. The only difference in active ingredients between the two formulas is the recommended dosage of acetaminophen; regular strength calls for two 325-mg tablets for 650-mg every 4-6 hours whereas extra strength acetaminophen is two 500-mg tablets for 1000-mg every 6 hours in a dose (www.Tylenol.com). This difference in dosing could account for the lack of decrease in social pain after acetaminophen use in the current study. Past research all found their impacts of acetaminophen at the 1000-mg dosage mark using extra strength acetaminophen compared to the regular strength 650-mg dose used currently (DeWall et al., 2015; Durso et al., 2015; Randles et al.,2013).

In a large, double-blind, placebo-controlled study, it was found that 1000-mg of acetaminophen had a clinically significant greater efficacy in treating acute pain following a dental procedure compared to 650-mg and was 24% more effective in treating physical pain compared to 650-mg (Qi, May, Zimmerman, Peng, Atillasoy, Brown, & Cooper, 2012). The 1000-mg dosage of acetaminophen is regarded as the most clinically typical dose but studies have established an efficacy for doses from 325-mg to 1000-mg (Toms, McQuay, Derry, & Moore, 2008). Literature supports the physical pain relieving efficacy of the 650-mg dose of acetaminophen that was used in the current study (Bhonsule, Nevreker, Agshikar, Pal, & Dhume, 1990; Forbes, Barkaszi, Ragland, & Hankle, 1984; Jain, Ryan, McMahon, & Smith, 1986), but the social pain relieving efficacy of this minimal dose must be questioned.

The time period between consumption of acetaminophen and subsequent administration of the psychological paradigms has not been held constant throughout the literature. The current study had participants complete filler questionnaires for a 45

minute wait period to allow for the onset of the analgesic properties of the medication and is in accordance with the DeWall et al. (2015) study. This period of time was decided upon due to the findings that the median pain relieving effects of acetaminophen are viewed around the 45 minute window (Moller et al., 2000) and that it takes this amount of time to reach the peak plasma concentration of the drug (Gibbs & Anderson, 2008). Other studies have cited a necessity for a greater amount of time; a 55 minute window (Randles et al., 2013) and a 60 minute wait time (Durso et al., 2015) have also been utilized. The shorter time window may be one component as to why social pain relieving effects were not viewed in the current study, although DeWall et al. (2015) did find significant results at this time period.

Research Limitations

A limitation of the current study is the lack of participants reporting physical pain. A measure of physical pain was included to examine the expected physical pain relieving benefits of acetaminophen. Overall, only 10 participants (21%) reported feeling any physical pain, contradictory to expectations. Lack of physical pain in the sample makes it difficult to draw any inferences or make any generalizations about acetaminophen's ability to reduce physical pain which could then be used to examine linkages with social pain. Additionally, it could have been beneficial to have the measure access participant's baseline pain prior to the administration of acetaminophen as well as after the manipulation. In studies examining efficacy of analgesic medications, a baseline pain measurement can be useful to determine the overall sensitivity of the study (Breivik et al., 2008). A baseline pain measurement could also show if the medication works differently for different levels of pain (Breivik et al.,

2008)—for example, does it relieve pain for people with severe complaints better than other people experiencing mild pain?

Another limitation of the study is a failure to perform a manipulation check and question participants' response to the Cyberball manipulation. While having a manipulation check in place is desirable, the Cyberball paradigm is widely used and has a large effect size for the ostracism (Hartgerinnk et al., 2015). Hartgerink et al. (2015) found that the large effect size of ostracism remained constant across a variety of variables including: number of "participants" in the ball tossing game, country study was conducted in, age and gender of participants, and the number of ball tosses in the game. A manipulation check can be built into the questionnaires accessing social pain following the task and include items measuring perceived extent of exclusion by others or an estimate of percentage of throws received, (Liu, Mulick, & Chee, 2014; Riva et al., 2011; Zadro et al., 2004).

A final limitation of the study is a relatively small and very homogeneous sample. Findings from a sample of healthy, undergraduate college students may not be generalizable to a much more diverse population. In particular, Cyberball studies as a whole have not been completed across multiple age ranges. In a meta-analysis of 120 studies, Hartgerink, van Beest, Wicherts, & Kipling (2015) note that more research should be completed to study multiple age ranges of participants completing the Cyberball paradigm. This suggestion was implicated after observing a mean age range in their sample between 10 and 32.5 years old, with the mean age being 20.5 years.

Future Research

Future research must be completed to more specifically understand the exact dose of acetaminophen necessary to reduce social pain. With literature citing efficacy of acetaminophen from minimum doses including as low as 325-mg (Winters, 1979) to as high as the maximum recommended dose of 1000-mg (Moller et al., 2005; Qi et al., 2012), more research is warranted to understand where in that range the social pain relieving benefits of acetaminophen are located. Additionally, the study should be replicated to increase the sample size. With a relatively small sample of 47 participants, the current study risks the possibility of committing a type II error. Future research will allow better understanding of the current findings as well as the relationship between acetaminophen dosage and social pain relief.

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Table 1

Demographic Characteristics, Need Threat Scale Total and Sub-Categories, and McGill Pain Questionnaire Sub-Scores by Sample and Conditions

	Overall (*n* = 47)	Placebo (*n* = 25)	Acetaminophen (*n* = 22)
Demographics			
Age	19.64 (1.36)	19.52 (1.33)	19.77 (1.41)
Gender	76.60%	68.00%	86.36%
Race	89.36%	88.00%	90.91%
Need Threat Scale			
Total	3.71 (1.04)	3.80 (0.98)	3.65 (1.20)
Belonging	3.56 (1.07)	3.51 (0.99)	3.62 (1.19)
Control	2.97 (1.34)	3.16 (1.31)	2.75 (1.37)
Meaningful Existence	3.56 (1.26)	3.72 (1.13)	3.36 (1.38)
Self-Esteem	4.65 (1.22)	4.59 (0.96)	4.72 (1.49)
McGill Pain Questionnaire			
N Reporting Pain > 0	10	5	5
PPI	0.26 (0.54)	0.25 (0.53)	0.27 (0.55)
Words	0.91 (1.55)	1.13 (1.85)	0.68 (1.13)
Pain Rating	1.52 (2.67)	1.75 (3.14)	1.27 (2.10)

Note. Gender reported is percent female. Race reported is percent Caucasian. Scores from the McGill Pain Questionnaire are divided into three components. PPI represents the Present Pain Intensity, Words indicates number of words selected, and Pain Rating represents the numerical assignment of the pain words. All *p* values between conditional means are ≥ .05.

Appendix A

Demographic Questionnaire

I. Personal Information

Age: _____

Class:
- ☐ First- year
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

Gender:
- ☐ Male
- ☐ Female
- ☐ Prefer not to answer

Ethnic Identity:
- ☐ White
- ☐ Black or African American
- ☐ Native Hawaiian or other Pacific Islander
- ☐ Latino
- ☐ Asian
- ☐ More than one race
- ☐ Unknown or not reported

II. Study Information

Do you have any personal history of liver damage?
- ☐ Yes
- ☐ No

Do you have any family history of liver damage?
- ☐ Yes
- ☐ No

Do you smoke (smokers are people who have smoked 100 or more cigarettes in a lifetime)?
- ☐ Yes
- ☐ No

Do you drink 3 or more alcoholic drinks daily?
- ☐ Yes

☐ No

Is there any chance you might be pregnant?
☐ Yes
☐ No

Are you currently taking any medications for pain relief that include acetaminophen (Tylenol), alone or in combination with other drugs?
☐ Yes
☐ No

Are you currently taking any medications for cold/fever relief that include acetaminophen (Tylenol), alone or in combination with other drugs?
☐ Yes
☐ No

Do you have an allergy to acetaminophen (Tylenol)?
☐ Yes
☐ No

Are you currently taking the blood thinner, Warfarin?
☐ Yes
☐ No

Have you taken Psychology 162: Human Social Behavior?
☐ Yes
☐ No

Appendix B

Need Threat Scale Items (van Beest & Williams, 2006)

Rate the items using the following scale:
1= strongly disagree ***7= strongly agree***

1. I felt as one with the other players.
   1 2 3 4 5 6 7

2. I had the feeling that I belonged to the group during the game.
   1 2 3 4 5 6 7

3. I did not feel accepted by the other players.
   1 2 3 4 5 6 7

4. During the game I felt connected with one or more of the other players.
   1 2 3 4 5 6 7

5. I felt like an outsider during the game.
   1 2 3 4 5 6 7

6. I had the feeling that I could throw as often as I wanted to the other players.
   1 2 3 4 5 6 7

7. I felt in control over the game.
   1 2 3 4 5 6 7

8. I had the idea that I affected the course of the game.
   1 2 3 4 5 6 7

9. I had the feeling that I could influence the direction of the game.
   1 2 3 4 5 6 7

10. I had the feeling that the other players decided everything.
    1 2 3 4 5 6 7

11. Playing the game made me feel insecure.
1 2 3 4 5 6 7

12. I had the feeling that I failed during the game.
1 2 3 4 5 6 7

13. I had the idea that I had the same value as the other players.
1 2 3 4 5 6 7

14. I was concerned about what the other players thought about me during the game.
1 2 3 4 5 6 7

15. I had the feeling that the other players did not like me.
1 2 3 4 5 6 7

16. During the game it felt as if my presence was not meaningful.
1 2 3 4 5 6 7

17. I think it was useless that I participated in the game.
1 2 3 4 5 6 7

18. I had the feeling that my presence during the game was unimportant.
1 2 3 4 5 6 7

19. I think that my participation in the game was useful.
1 2 3 4 5 6 7

20. I believed that my contribution to the game did not matter.
1 2 3 4 5 6 7

Appendix C

Informed Consent

Allegheny College Psychology Department
Informed Consent Statement
Acute Effects of Acetaminophen on Mental Visualization Skills

Kaitlyn Fromknecht
fromknechtk@allegheny.edu

Dr. Sarah Conklin
sconklin@allegheny.edu

Description of Experiment: The current study will examine the acute effect of one dose of acetaminophen on participants' mental visualization skills. Participants will be randomly assigned to take one 650-mg dose (two 325-mg tablets) of Acetaminophen or the same dosage of a placebo. Neither you, the participant, nor the researcher will be aware of which of the groups the participant has been assigned to. Following a 45 minute wait period, participants will then complete an online Cyberball task where they will play a game of catch with participants over the internet. The task will last approximately 15 minutes followed by the completion of a questionnaire, accessing mental visualization skills, which requires an additional 15 minutes.

In order to participate in this research study, it is necessary that you give your informed consent. By signing this informed consent statement you are indicating that you understand the nature of the research study and your role in that research and that you agree to participate in the research. Please consider the following points before signing:

- I understand that I am participating in a study that could require consumption of the medication acetaminophen (Tylenol).
- I understand that although the risk is minimal, there is a risk to consuming any pain medication. The FDA states that acetaminophen is a generally safe drug if consumed following label instructions, but if directions are not followed liver damage could be possible. My risk is lessened due to the protocols of the study and the screening process of participants after completion of the demographics questionnaire.
- I understand that I should refrain from taking any acetaminophen-containing medications for at least 4 hours after completing my participation in this study.
- I understand that I am participating in psychological research.
- I understand that my identity will not be linked with my data, and that all information I provide will remain confidential.

- I understand that my participation in this study is voluntary and there is no consequence for failure to participate or termination of participation once the study has begun.
- I understand that for my participation I may receive Psychology course credit and will have the option to be entered into a drawing for a $20 gift card to the Market House.
- I understand that the risks and discomfort associated with participation will be no greater than daily stressors. Any stress will be temporary and is meant to emulate everyday life situations.
- By signing this form I am stating that I am over 18 years of age, and that I understand the above information and consent to participate in this study being conducted at Allegheny College.

If you have any questions or concerns, feel free to contact me by email (fromknechtk@allegheny.edu) or phone (814-5282059). You may also choose to contact my faculty advisor, Dr. Sarah Conklin (sconklin@allegheny.edu), or the chair of the Allegheny College Ethics Committee, Professor Searle-White (jsearle@allegheny.edu).

Signature: _____Today's Date:_____
Print your First Name: _____Last Name:_____

Appendix D

McGill Pain Questionnaire (Melzack, 1975)

McGILL PAIN QUESTIONNAIRE

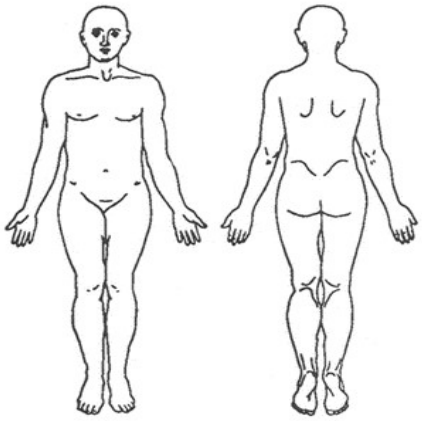
RONALD MELZACK

Patient's Name _____ Date _____ Time _____ am/pm

PRI: S _____ (1-10) A _____ (11-15) E _____ (16) M _____ (17-20) PRI(T) _____ (1-20) PPI _____

1 FLICKERING QUIVERING PULSING THROBBING BEATING POUNDING	11 TIRING EXHAUSTING	
2 JUMPING FLASHING SHOOTING	12 SICKENING SUFFOCATING	
3 PRICKING BORING DRILLING STABBING LANCINATING	13 FEARFUL FRIGHTFUL TERRIFYING	
4 SHARP CUTTING LACERATING	14 PUNISHING GRUELLING CRUEL VICIOUS KILLING	
5 PINCHING PRESSING GNAWING CRAMPING CRUSHING	15 WRETCHED BLINDING	
6 TUGGING PULLING WRENCHING	16 ANNOYING TROUBLESOME MISERABLE INTENSE UNBEARABLE	
7 HOT BURNING SCALDING SEARING	17 SPREADING RADIATING PENETRATING PIERCING	
8 TINGLING ITCHY SMARTING STINGING	18 TIGHT NUMB DRAWING SQUEEZING TEARING	
9 DULL SORE HURTING ACHING HEAVY	19 COOL COLD FREEZING	
10 TENDER TAUT RASPING SPLITTING	20 NAGGING NAUSEATING AGONIZING DREADFUL TORTURING	
	PPI 0 NO PAIN 1 MILD 2 DISCOMFORTING 3 DISTRESSING 4 HORRIBLE 5 EXCRUCIATING	

BRIEF MOMENTARY TRANSIENT	RHYTHMIC PERIODIC INTERMITTENT	CONTINUOUS STEADY CONSTANT



E = EXTERNAL
I = INTERNAL

COMMENTS:

© R. MELZACK, 1975

Appendix E

CESD-R (Eaton et al., 2004)

Choose the option that you most agree with:

1. My appetite was poor.
   _____ Not at all or less than 1 day last week.
   _____ One or two days last week.
   _____ Three to four days last week.
   _____ Five to seven days last week.
   _____ Nearly every day for two weeks.

2. I could not shake off the blues.
   _____ Not at all or less than 1 day last week.
   _____ One or two days last week.
   _____ Three to four days last week.
   _____ Five to seven days last week.
   _____ Nearly every day for two weeks.

3. I had trouble keeping my mind on what I was doing.
   _____ Not at all or less than 1 day last week.
   _____ One or two days last week.
   _____ Three to four days last week.
   _____ Five to seven days last week.
   _____ Nearly every day for two weeks.

4. I felt depressed.
   _____ Not at all or less than 1 day last week.
   _____ One or two days last week.
   _____ Three to four days last week.
   _____ Five to seven days last week.
   _____ Nearly every day for two weeks.

5. My sleep was restless.
   _____ Not at all or less than 1 day last week.
   _____ One or two days last week.
   _____ Three to four days last week.
   _____ Five to seven days last week.
   _____ Nearly every day for two weeks.

6. I felt sad.
   _____ Not at all or less than 1 day last week.
   _____ One or two days last week.
   _____ Three to four days last week.
   _____ Five to seven days last week.

____ Nearly every day for two weeks.

7. I could not get going.
   ____ Not at all or less than 1 day last week.
   ____ One or two days last week.
   ____ Three to four days last week.
   ____ Five to seven days last week.
   ____ Nearly every day for two weeks.

8. Nothing made me happy.
   ____ Not at all or less than 1 day last week.
   ____ One or two days last week.
   ____ Three to four days last week.
   ____ Five to seven days last week.
   ____ Nearly every day for two weeks.

9. I felt like a bad person.
   ____ Not at all or less than 1 day last week.
   ____ One or two days last week.
   ____ Three to four days last week.
   ____ Five to seven days last week.
   ____ Nearly every day for two weeks.

10. I lost interest in my usual activities.
    ____ Not at all or less than 1 day last week.
    ____ One or two days last week.
    ____ Three to four days last week.
    ____ Five to seven days last week.
    ____ Nearly every day for two weeks.

11. I slept much more than usual.
    ____ Not at all or less than 1 day last week.
    ____ One or two days last week.
    ____ Three to four days last week.
    ____ Five to seven days last week.
    ____ Nearly every day for two weeks.

12. I felt like I was moving too slowly.
    ____ Not at all or less than 1 day last week.
    ____ One or two days last week.
    ____ Three to four days last week.
    ____ Five to seven days last week.
    ____ Nearly every day for two weeks.

13. I felt fidgety.
    ____ Not at all or less than 1 day last week.

____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

14. I wished I was dead.
____ Not at all or less than 1 day last week.
____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

15. I wanted to hurt myself.
____ Not at all or less than 1 day last week.
____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

16. I was tired all the time.
____ Not at all or less than 1 day last week.
____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

17. I did not like myself.
____ Not at all or less than 1 day last week.
____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

18. I lost a lot of weight without trying to.
____ Not at all or less than 1 day last week.
____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

19. I had a lot of trouble getting to sleep.
____ Not at all or less than 1 day last week.
____ One or two days last week.
____ Three to four days last week.
____ Five to seven days last week.
____ Nearly every day for two weeks.

20. I could not focus on the important things.
    ____ Not at all or less than 1 day last week.
    ____ One or two days last week.
    ____ Three to four days last week.
    ____ Five to seven days last week.
    ____ Nearly every day for two weeks.

Appendix F

PSQI (Buysse et al., 1989)

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?
BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

a) Cannot get to sleep within 30 minutes

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

b) Wake up in the middle of the night or early morning

Not during the past month _____

Less than once a week _____
Once or twice a week _____
Three of more times a week_____

c) Have to get up to use the bathroom

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

d) Cannot breathe comfortably

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

e) Cough or snore loudly

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

f) Feel too cold

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

g) Feel too hot

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

h) Had bad dreams

Not during the past month _____
Less than once a week _____
Once or twice a week _____

Three of more times a week_____

i) Have pain

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

j) Other reason(s), please describe_____

_____

How often during the past month have you had trouble sleeping because of this?

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month _____
Less than once a week _____
Once or twice a week _____
Three of more times a week_____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____
Only a very slight problem _____
Somewhat of a problem _____
A very big problem _____

10. Do you have a bed partner or room mate?

No bed partner or room mate _____
Partner/room mate in other room _____
Partner in same room, but not same bed _____
Partner in same bed _____

Appendix G

Rosenberg Self-Esteem Scale (Rosenberg, 1965)

Rate the items using the following scale:

1= strongly agree 2= agree 3= disagree 4= strongly disagree

_____1. I feel that I am a person of worth, at least on an equal basis with others.

_____2. I feel that I have a number of good qualities.

_____3. All in all, I am inclined to feel that I am a failure.

_____4. I am able to do things as well as most other people.

_____5. I feel I do not have much to be proud of.

_____6. I take a positive attitude toward myself.

_____7. On the whole, I am satisfied with myself.

_____8. I wish I could have more respect for myself.

_____9. I certainly feel useless at times.

_____10. At times I think I am no good at all.

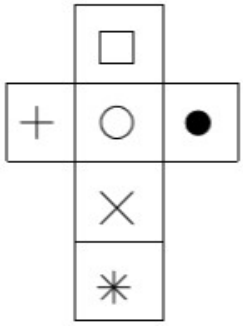
Appendix H

Measure of the Ability to Rotate Mental Images (Campos, 2012)

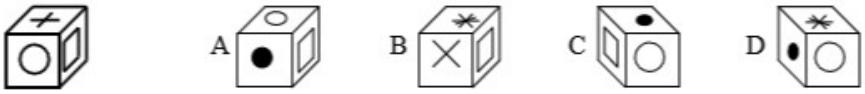
This test consists of a printed model of an unfolded cube. The first step is to reassemble the cube mentally, that is, to reassemble the cube in your mind in such a way that the cube appears identical to the cube shown to the left of each question.

The second step involves rotating the cube in your mind until you find the correct answers for each question. Each question has four options, 2 are correct, and 2 are incorrect. The first two options (A and B) are obtained by rotating the cube on the right from back to front and from front to back. The remaining options (C and D) are obtained by rotating the cube from left to right and from right to left.

Unfolded cube with its corresponding sides:



Question.- Which figures on the right marked with the letters (A, B, C, D), can be obtained by rotating the cube on the left?



The first two figures (A and B) illustrate the rotation of the cube from back to front and from front to back, respectively. The last two figures (C and D) illustrate the rotation of the cube from left to right and from right to left, respectively. No figure exhibited two movements simultaneously i.e., from back to front and from left to right.

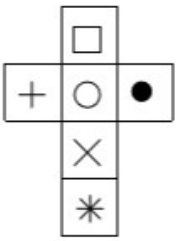
In this example, the correct options are letters A and C so you must mark with an "X" the letters A and C. Each question has four options: two are correct and two incorrect. Your total score is calculated by adding your correct scores and subtracting your incorrect scores. Therefore, do not mark an option unless you are reasonably sure it is correct.

This has been a practice test, you are now ready to begin the real test. Do not turn the page over until you have been told to turn the page. You only have 10 minutes to answer all of the questions on the test.

If you are uncertain about a question, leave it and go on to the next question. When you have finished answering the questions, try again to answer the questions you found difficult.

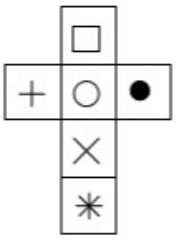
All of the questions refer to the same type of unfolded cube

DO NOT TURN THE PAGE OVER UNTIL YOU HAVE BEEN INSTRUCTED TO DO SO



		A	B	C	D
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

GO TO THE NEXT PAGE




12
A
B
C
D
13
A
B
C
D
14
A
B
C
D
15
A
B
C
D
16
A
B
C
D
17
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D
18
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D
19
A
B
C
D
20
A
B
C
D
21
A
B
C
D
22
A
B
C
D
23
A
B
C
D

STOP

Appendix I

National Eye Institute Visual Functioning Questionnaire (Rand, 1996)

Please circle one answer under each statement.

PART 1: GENERAL HEALTH AND VISION

1. In general, would you say your overall health is:

   Excellent……1
   Very Good…….2
   Good……..3
   Fair ……4
   Poor…….....5

2. At the present time, would you say your eyesight using both eyes (with glasses or contact lenses, if you wear them) is excellent, good, fair, poor, or very poor or are you completely blind?

   Excellent……1
   Good……..2
   Fair…….3
   Poor……...4
   Very Poor…….....5
   Completely Blind…..6

3. How much of the time do you worry about your eyesight?

   None of the time…...1
   A little of the time….2
   Some of the time.....3
   Most of the time…....4
   All of the time……...5

4. How much pain or discomfort have you had in and around your eyes (for example, burning, itching, or aching)? Would you say it is:

   None……1
   Mild……...2
   Moderate……..….3
   Severe……..….4
   Very Severe……..…5

PART 2: DIFFICULTY WITH ACTIVITIES

5. How much difficulty do you have reading ordinary print in newspapers? Would you say you have:

   No difficulty at all……....1
   A little difficulty…..……....2
   Moderate difficulty……..3
   Extreme difficulty……....4
   Stopped doing this because of your eyesight.....5
   Stopped doing this for other reasons or not
   Interested in doing this……6

6. How much difficulty do you have doing work or hobbies that require you to see well up close, such as cooking, sewing, fixing things around the house, or using hand tools? Would you say?

   No difficulty at all……..1
   A little difficulty…..……..2
   Moderate difficulty……3
   Extreme difficulty……..4
   Stopped doing this because of your eyesight…...5
   Stopped doing this for other reasons or not
   Interested in doing this……..……6

7. Because of your eyesight, how much difficulty do you have finding something on a crowded shelf?

   No difficulty at all……..1
   A little difficulty..……..2
   Moderate difficulty……3
   Extreme difficulty……..4
   Stopped doing this because of your eyesight…..5
   Stopped doing this for other reasons or not
   Interested in doing this……..……6

8. How much difficulty do you have reading signs or the names of stores?

   No difficulty at all……..1
   A little difficulty..……..2
   Moderate difficulty……3
   Extreme difficulty……..4
   Stopped doing this because of your eyesight…...5
   Stopped doing this for other reasons or not
   Interested in doing this……..……6

9. Because of your eyesight, how much difficulty do you have going down steps, stairs, or curbs in dim light or at night?

No difficulty at all……..1
A little difficulty...……..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight.....5
Stopped doing this for other reasons or not
Interested in doing this……...…6

10. Because of your eyesight, how much difficulty do you have noticing objects off to the side while you are walking along?

No difficulty at all……..1
A little difficulty..;……..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight…..5
Stopped doing this for other reasons or not
Interested in doing this……..……6

11. Because of your eyesight, how much difficulty do you have seeing how people react to thing you say?

No difficulty at all……..1
A little difficulty..……..…..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight.....5
Stopped doing this for other reasons or not
Interested in doing this……..……6

12. Because of your eyesight, how much difficulty do you have picking out and matching your own clothes?

No difficulty at all……..1
A little difficulty…..……..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight….5
Stopped doing this for other reasons or not
Interested in doing this……6

13. Because of your eyesight, how much difficulty do you have visiting with people in their homes, at parties, or in restaurants?

No difficulty at all……..1
A little difficulty…..……..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight…..5
Stopped doing this for other reasons or not
Interested in doing this……..……6

14. Because of your eyesight, how much difficulty do you have going out to see movies, plays, or sports events?

No difficulty at all……..1
A little difficulty…..……..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight…....5
Stopped doing this for other reasons or not
Interested in doing this……..……6

15. Are you currently driving at least once in a while?

Yes……1 Skip to Question 15c
No…….2

15a. IF NO: Have you never driven a car or have you given up driving?

Never drove……1 Skip to question 17
Gave up……..2

15b. IF YOU GAVE UP DRIVING: Was that mainly because of your eyesight, Mainly for some other reason, or because of both your eyesight and Other reasons?

Mainly eyesight……1 Skip to question 17
Mainly other reasons……..…..2 Skip to question 17
Both eyesight and other reasons……...3 Skip to question 17

15c. IF CURRENTLY DRIVING: How much difficulty do you have driving During the daytime in framiliar places? Would you say you have:

No difficulty at all……..1
A little difficulty……..2
Moderate difficulty……3
Extreme difficulty……..4

16. How much difficulty do you have driving at night? Would you say you have:

No difficulty at all……..1
A little difficulty..……..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight.....5
Stopped doing this for other reasons or not
Interested in doing this……...…6

16A. How much difficulty do you have driving in difficult conditions, such as in bad weather,
During rush hour, on the freeway, or in city traffic? Would you say you have?

No difficulty at all……..1
A little difficulty……...…..2
Moderate difficulty……3
Extreme difficulty……..4
Stopped doing this because of your eyesight.....5
Stopped doing this for other reasons or not
Interested in doing this……...…6

PART 3: RESPONSES TO VISION PROBLEMS

The next questions are about how things you do may be affected by your vision. For each one, please circle the number to indicate whether for you the statement is true for you all, most, some, a little, or none of the time.

	All of the time	Most	Some	A little	None
17. Do you accomplish less than 5 You would like because of Your vision?	1		2	3	4
18. Are you limited in how long You can work or do other Activities because of your Vision?	1	2	3	4	5

19. How much does pain or Discomfort in or around Your eyes, for example, Burning, itching, or aching Keep you from what you'd Like to be doing?	1	2	3	4	5

For each of the following statements, please circle the number to indicate whether for you the statement is definitely true, mostly true, mostly false, or definitely false for you or you are not sure.

	Def. True	Mostly True	Not Sure	Mostly False	Def. False
20. I stay home most of The time because of My eyesight	1	2	3	4	5
21. I feel frustrates a lot Of the time because Of my eyesight	1	2	3	4	5
22. I have much less Control over what I Do because of my Eyesight	1	2	3	4	5
23. Because of my Eyesight, I have to Rely too much on What other people Tell me	1	2	3	4	5
24. I need a lot of help From other because Of my eyesight	1	2	3	4	5
25. I worry about doing Things that will Embarrass myself or Others because of my eyesight	1	2	3	4	5

Appendix J

Debriefing Form

Allegheny College Psychology Department Debriefing Form
Acute Effects of Acetaminophen for Relief from Social Pain

Kaitlyn Fromknecht
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Dr. Sarah Conklin
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Thank you for participating in this study!

The general purpose of this research is to examine the acute effects of one dose of acetaminophen on a participant's ability to cope with social pain as measured by feelings of belonging, control, meaningful existence, and self-esteem. Past literature has shown that there are neural connections in the brain between structures that are responsible for the perception of physical pain and the feeling of social pain. It was found that a 21- day course of acetaminophen resulted in decreased activation of the neurological structures mentioned above. This finding showed that acetaminophen, a physical pain reliever, also relieved social pain when taken on a long term scale. The hypothesis of the current study is that acetaminophen will have acute effects and decrease social pain after a single dose.

We invited people who are non-smokers and have no medical history of liver damage to participate in the study. The experimenter did not know whether you were randomly assigned to the placebo-controlled group or the acetaminophen group. In this study, you were asked to take a single 650-mg dose of either acetaminophen or placebo depending on your random assignment and then complete a Cyberball task. The Cyberball task is scripted and controlled by the researcher and is designed to elicit feelings of ostracism. The questionnaire that followed the Cyberball task is designed to measure social pain that was created by the task.

The full debriefing form and explanation of deception was only made available to you now as to control any outside influences on feelings of social pain reported. We ask that you please not disclose any elements of this study, including the mental visualization cover story, to anyone as to not compromise the integrity of the Cyberball task for future participants.

Results from this study will be made available by email and a copy will be placed in your campus box, if you desire and provide me with your current contact information.

If you feel concerned, or have any questions about the study, please contact me by email (fromknechtk@allegheny.edu) or phone (814-528-2059), my faculty mentor, Dr. Sarah Conklin (sconklin@allegheny.edu), the chair of the Allegheny College Ethics

Committee, Professor Searle-White (jsearle@allegheny.edu), or the chair of the IRB, Professor Streeter (jstreeter@allegheny.edu). In addition, the Allegheny College Health Center is available to you as a resource for any health concerns, appointments can be made by phone at (814)332- 4355.
For additional information on the topics of social pain, physical pain, and acetaminophen, please regard the following articles:

Eisenberger, N., Lieberman, M., Williams, K. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*, 302, 290292.

DeWall, N., MacDonald, G., Webster, G., Masten, C., Baumesister, R., Powell, C., Combs, D., Schurtz, Stillman, T., Tice, D., Eisenberger, N. (2010). Acetaminophen reduces social pain: behavioral and neural evidence. *Psychological Science*, 21, 931-937.