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Effects of Tylenol and Social Rejection on Memory

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Abstract

Individuals tend to describe physical pain and social pain with the same terminology (DeWall & Baumeister, 2006; Eisenberger, et al., 2003; Way, et al., 2009). There is a neurobiological overlap between the systems that control physical pain and social pain. During both physical pain and social rejection, the same brain areas (insulae in the central cortical fissure) are active. DeWall (2011) found that individuals who received a dose of acetaminophen had less activity in the bilateral anterior insula and bilateral posterior insula during a social rejection stimulation. Because social rejection also increases memory (Pajkos, et al., 2011), subjects given acetaminophen during social rejection may not benefit from this memory enhancement effect. In study one, students (n=55) participated in a two-week study for extra credit. Participants were randomly assigned to one of four conditions, either Tylenol or no Tylenol, and a rejection of either a polite or harsh nature. Participants viewed introduction and rejection videos, which were followed by a memory task, and, one week later, the same memory task. They also completed a protocol about a prior break-up they had endured. Overall, Tylenol had no effect on memory for a prior break-up suggesting that Tylenol's effects on memory is only seen at encoding. In study two, students (n=77) completed the same experiment with the exclusion of the break-up protocol. Tylenol enhanced detail memory in the female participants only. These studies indicate that Tylenol does have an impact on memory during social rejection.

The Effects of Tylenol and Social Rejection on Memory

Humans and animals alike have the desire to be in the company of others. This need to belong is similar to one's needs for food and shelter, and has been long engrained in the evolutionary past (Silk, Alberts, & Altmann, 2033; Kling, Lancaster & Benitone, 1970). When one experiences social exclusion, their feelings of belonging are hindered, creating feelings of dejection. Current research shows that the feelings of social rejection parallel those of physical pain, suggesting that the same mechanisms are responsible for their functioning (Panksepp, 1989, MacDonald & Leary, 2005).

Evolutionary Memory Mechanisms

While many scientists agree that memory is adaptive (Narine et al., 2007; Narine et al., 2008), the mechanisms involved are unclear. It appears as though human memory systems have developed to help us remember certain essential information better than other stimuli (Narine et al., 2007; Andrews et al., 2002). From an evolutionary standpoint, memory for one's predators is vital (Narine et al., 2007; Narine et al., 2008). Hence, all stimuli are not equal.

Although there is not much research on the correlation between memory mechanisms and social survival, Narine et al. (2007, 2008) present some of the mechanisms relating to memory adaptions. Participants were asked to remember word lists that were either related (i.e. juice, catfish) or unrelated to survival (i.e. soccer, teacher). Survival words were remembered significantly more often than nonsurvival words in both free recall and recognition tasks. The researchers controlled for pleasantness of the words and saw no significant difference indicating that there was no difference in arousal between survival words or nonsurvival words. Therefore,

remembering words related to one's ultimate survival increases later retention and recall suggesting memory as an evolutionary mechanism.

Additional research by Narine et al. (2008) assigned participants to one of six conditions: rate the word for survival relatedness, pleasantness, the ease with which the word could be visualized, the ease at which the word brought up an important personal experience, unscramble words and then rate their pleasantness, or to remember word lists. The survival condition was remembered significantly more often than any other condition. It appears as though one's survival is dependent upon memory retention and recall.

Arousal and Memory

In 1977, Brown and Kulik discovered flashbulb memories (FBM). These memories are the vivid recollection of details surrounding one's discovery of a sudden traumatic event (Brown & Kulik, 1977). Although Brown and Kulik (1977) originally indicated that high arousal was necessary for flashbulb memories to occur, there is much discrepancy in the role that emotion plays in memory formation and retention. There are conflicting views regarding flashbulb memory mechanisms. Some individuals believe that the emotions at encoding are instrumental factors (Bohannon, Julian & Aue, 2008), whereas others believe flashbulb memories are inaccurately reconstructed at retrieval (Neisser & Harsch, 1992, Talarico & Rubin, 2003).

Researchers have varying beliefs as to the effects of emotional arousal on memory. Some researchers suggest that emotionally stressful events hinder one's ability to produce accurate flashbulb memories (Christianson, 1992; Kassin, Ellsworth, & Smith, 1989). For example, Elizabeth Loftus (1980) proposes that high emotional arousal is

detrimental to one's memory. Additionally, research by Kuehn (1974) examined the memories of homicide, rape, assault, and robbery victims. The results concluded that those in the least stressful event (robbery) reported fuller and more extensive memories than those in the most emotionally stressful events (rape or assault). Further, if the victim was injured in the event, they tended to report less than uninjured victims. Some cognitive researchers (Bohannon, 1992; Brown & Kulik, 1977; Colgrove, 1899; Winograd & Killenger, 1983; Bohannon, 1988; Julian et al., 2009) indicate that high emotional arousal assists in the retention of memories over time.

Yuille and colleagues (Yuille & Cutshall, 1986, 1989; Yuille & Tollestrup, 1992) proposed that high stress did not negatively impact the memory of a murder witness over time; the emotion was in fact beneficial for the accuracy of the memory. Those who reported feelings of high distress while witnessing a murder had an average memory accuracy of 93%. At a four-month delay, the average accuracy of the memory in highly distressed individuals was 88%. The highly aroused participants included more details than those who were less aroused. Similarly, Christianson and Hubinette (1993) asked both bank tellers and witnesses of bank robberies to complete memory tasks. The results indicated that the tellers held at gunpoint had more accurate memories of the robbery rather than bystanders. However, arousal among both bystanders and tellers was equivalent; therefore, arousal was not a key factor in the retention or accuracy of memory at recall. It does appear, however, that detail retention is highly correlated with arousal during the event.

In 1990, a vital piece of information was discovered in Christianson and Loftus' experiment on traumatic memories. When participants were asked to recount their most

traumatic memory, a relationship was found between those with a high degree of emotion and the central details of their memories. Peripheral details were unaffected. This indicates that highly distressing events may correlate with central details of the memory, such as the color of the robber's clothing. Additionally, emotionally neutral events do not appear to elicit detailed memories. The literature, despite its scarcity, still has its dichotomy.

Robinson (1980) indicated that intense emotionality in a personal event provoked more accessible memory; therefore, there are faster reaction times to recall. Although some studies have shown a memory decrease at immediate time of retrieval when associated with highly arousing photos, after a delay, the memory reduction is no longer present (Christianson & Nilsson, 1984; Christianson & Larsson 1990).

The Yerkes-Dodson Law suggests that arousal has an inverted-U relationship with performance or cognitive efficacy (1908; See Figure 1). According to this law, individuals experiencing extremely low or extremely high levels of arousal are likely to exhibit decreased cognitive functioning than those experiencing an average arousal level. This would indicate that individuals in extremely low or extremely highly arousing events would produce less enduring and accurate memories than those in moderately arousing events. Many individuals agree with this theory (e.g. Deffenbacher, 1983; Loftus, 1979); however, some researchers (Christianson, 1992) suggest that this model no longer has accurate empirical evidence to support it.

Physical Pain and Social Pain

Physical pain is defined as: unpleasant sensory and emotional experience associated with actual or potential tissue damage (International Association for the Study

of Pain Task Force on Taxonomy, 1994). Social pain, on the other hand, refers to distressing experiences arising from the perception of actual or potential psychological distance from close others or a social group, (Bowlby, 1969).

Recent studies suggest that physical pain and social pain seem to be more alike that was once thought (Panksepp, 1989, MacDonald & Leary, 2005; DeWall & Baumeister, 2006). Just as physical pain causes a threat to one's evolutionary fitness, social exclusion can pose a potential threat to one's survival. This has been true for hundreds of years, dating back to the earliest mammals (MacDonald & Leary, 2005). Many studies on non-human animal species, such as baboons and monkeys, have shown that socially excluded or less socially integrated animals were less likely to survive than their social counterparts (Silk, Alberts, & Altmann, 2003; Kling, Lancaster & Benitone, 1970). This suggests that the more socially adept one is, the more likely one is to be evolutionarily successful. For these mammals, being socially inept was death. The same phenomenon occurs in the human species.

From the time we are born, humans are a part of a social group, the basis of which is the mother-child relationship. This mother-child dependence that includes protection from potential physical and social threats, has laid the foundation for the social attachment system seen in humans today. Over time, social animals have created more advanced social structures that have proved to be vital (Gilbert, 1992; MacLean, 1993; Whiten & Byrne, 1989). It has been suggested that one's social attachment system is used to detect and prevent social separation (Panksepp, 1998). Further, MacDonald and Leary (2005) suggest that social beings require a system that castigates those who embrace exclusion. This system encourages the animal to respond quickly to the first signs of

exclusion. According to MacDonald and Leary (2005) and Panksepp (1989), the evolutionarily formed mechanism of physical pain is the foundation for the system of social exclusion. Feelings of exclusion led to the activation of threat- defense mechanisms frequently associated with threats, physical and social, to one's survival (MacDonald & Leary, 2005). Therefore, the threat of social exclusion elicited the same reactions a physical threat would have.

It appears as though the pain mechanism would be highly compatible in detecting and managing social inclusion (Panksepp, 1998; MacDonald & Leary, 2005). Pain, however, has two separate circuitries – pain sensation and pain affect (Melzack & Wall, 1996; Price, 1999; Rainville, 2002). Pain sensation includes the body's involvement with pain receptors and tissue damage that are associated with pain (Craig, K.D., 1999; Melzack & Wall, 1965). Pain sensation does not play a role in the regulation of social pain. Pain affect, however, includes the distressing feelings associated with painful situations; it also encourages the individual to alleviate pain by escaping the presented danger (Melzack & Casey, 1968; Price, 1999). It appears as though pain affect is key in understanding how physical pain mechanisms can regulate social exclusion. Because painful situations can occur without the pain sensation circuitry activated, it seems that social exclusion may still initiate pain affect, which would allow an emotionally painful experience to be sensed just as a physically painful experience would (MacDonald & Leary, 2005).

Additionally, both physical pain and social pain use a learning effective approach (MacDonald & Leary, 2005). Just as a child who has been bitten by a snake would avoid snakes in the future, a child who is socially excluded may avoid social situations or the

specific person who ostracized them in the future. Stressful emotions may then be associated with social situations in which the individual may experience rejection. Infants also learn that a gentle touch is a sensory experience that reduces the negative affect from both physical and social pain (MacDonald & Leary, 2005). Harlow (1958) suggests that physical touch is vital in attachment. When young experience physical discomfort, the parents ease the pain with physical touch (Bowlby, 1973). Therefore, children rely on social support in distressing situations, both physically and socially (MacDonald & Leary, 2005). Hence, this theory suggests that the same system involved in physical pain is affected by social separation.

Studies also indicate that individuals describe physical pain and social pain with the same terminology (DeWall & Baumeister, 2006; Eisenberger, et al., 2003; MacDonald & Leary, 2005; Way, et al., 2009). These studies concluded that people use the terms, "I'm hurt" to describe both physical ailments and social rejection. Additionally, individuals may refer to a social rejection as "a slap in the face" or that they were "crushed". Interestingly enough, the English language does not provide any synonyms for "hurt feelings" (Leary & Springer, 2001); therefore, English speakers have no other way to indicate feelings of dejection but pain terminology. This finding further supports the potential overlap between the systems, as the both types of pain elicit the same verbal reaction.

The research done on the neurobiological overlap between physical pain and social pain has led to research on the brain areas affected in the two systems. According to Eisenberger, Lieberman, and Williams (2003), physical pain and social exclusion were associated with similar brain activations, suggesting a shared neuroanatomical basis.

Participants played a virtual ball toss while inside an fMRI machine. At the beginning of the ball toss, participants were equally included by the other two virtual players. However, as the game progressed, the virtual players discontinued their participation with the participants in the study. The researchers then examined which areas of the brain were affected while the participant was excluded. Results indicated that the anterior cingulate cortex was more active during exclusion than inclusion. This was also positively correlated with the participants' self-reported distress. Additionally, the right ventral prefrontal cortex was active during exclusion. The activity in the right ventral prefrontal cortex was negatively correlated with the participants' self-reported distress. The anterior cingulate cortex, which is activated during physical pain, was activated during social pain (Eisenberger, Lieberman, Williams, 2003). These results suggest that the right ventral prefrontal cortex regulates the distress of social exclusion by interrupting anterior cingulate cortex activity. Further research by numerous psychologists (Lieberman, 2004; Rainville, 1997; Tolle, 1999; Peyron, 2000), has examined the dorsal anterior cingulate cortex's roles in physical pain, namely its impact on the disagreeable feelings from physical pain. In addition to playing a significant role in physical pain, the dorsal anterior cingulate cortex has played a large role in the effects of social pain in humans and other mammals (Eisenberger & Lieberman, 2004).

Because of the involvement of the anterior cingulate cortex in physical pain, neurosurgeons have often performed cingulotomies to treat chronic physical pain; these patients help explain the anterior cingulate cortex's role in physical pain as opposed to sensory pain. These patients indicated that the pain was still felt after the cingulotomy was performed, but it no longer bothered them (Foltz & White, 1968). Because the

anterior cingulate cortex is involved in the sensory aspect of pain, it is not a coincidence that social pain may share the same mechanisms. Furthermore, research by Kross et al. (2011) supports that the sensory components of physical pain become active during rejection. Individuals were exposed to a photograph of an ex-partner who had previously rejected them, while thinking about the rejection. The results suggested that the same areas that support the sensory components of physical pain, the operculo-insular region, thalamus, dorsal anterior cingulate cortex, and anterior insula, became active during the rejection activity. This study provides further evidence that the sensory components of physical pain and social pain are similar; therefore, sharing the same mechanisms.

Additional research by Williams et al. (in press) showed that individuals who experienced social pain experienced significantly more pain than those in physically painful situations. In this study, participants were asked to re-live both socially painful situation and a physical injury situation. After recalling the event, the participants were asked to rate the intensity of their pain as well as how many times they recounted their painful experience to others. Participants were also asked how difficult it was to re-live their physical and social pain situations and to choose which situation was harder to re-live. Every questionnaire completed by the participants indicated that the betrayal situation appeared to be statistically signifgantly more painful than the physical injury. Therefore, social rejection elicited harsher, more painful feelings than a physical injury.

As social exclusion and physical pain seem to be highly correlated, DeWall and Baumeister (2006) examined whether or not social exclusion resulted in insensitivity to physical and/or emotional pain. Their examination included five experiments in which the participants reported a reduced sensitivity to physical pain when experiencing social

rejection. Feelings of social rejection elicited emotional sensitivity. The first and second experiments examined whether or not social exclusion reduced sensitivity to physical pain. The participants in these experiments took a personality test and were then given feedback that the test indicated they would end up alone in life (social exclusion). Other groups were told they would experience a life full of meaningful relationships, while another group was given no feedback. An additional group was added in experiment two, which received feedback that in their life would experience many accidents (physical pain). In experiments one and two, social exclusion increased pain threshold and tolerance. This supported the original hypothesis that social exclusion would reduce the sensitivity of physical pain. Study three examined the implications of social exclusion on affective forecasting. In this version, the methods remained consistent with the addition of mood and affective measuring. The results of this experiment indicated that responses to social exclusion use a shared psychological system related to both physical and social pain. The fourth experiment examined whether social exclusion had an effect on one's empathy towards others. In this experiment, participants were asked to empathize with someone who was recently broken up with. The results indicated that following social exclusion, the emotion system stops functioning normally. When the emotion system temporarily stops functioning normally, socially excluded participants are less emotionally responsive towards others who are distressed. Participants who were socially excluded were far from empathetic towards the individual who had recently been broken up with. The final experiment asked participants to empathize with someone experiencing physical pain: a broken leg. Again, those participants who were socially rejected were less empathetic towards the individual with the broken leg. Therefore, the

emotional system seems to stop functioning normally during painful situations. These studies concluded that physical pain and emotion are highly intercorrelated (DeWall & Baumeister, 2006).

Numerous implications have been suggested due to the overlap between physical and social pain. It has been suggested that if children endure physical pain at a young age, they will deal with social pain more efficiently (Bowlby, 1969). Individuals who have a solid support system not only see a decline in negative feelings of social pain but also experience a decrease in physical pain, in medical situations including: cancer, heart surgery, and childbirth (Hoogendoorn, 2000; Zaza & Baine, 2002; King, 1993; Kennell, 1991). Lastly, opiate-based drugs, meant for alleviating physical pain, have been successful in reducing social pain (Panksepp, 1998). Similarly, antidepressants, for relieving social pain, have been used to treat chronic physical pain (Nemoto, 2003). Because the opioid receptors seem to be affected in both physical and social pain, the social attachment system may have coevolved with the opioid substrates of the physical pain system, suggesting that a neurobiological overlap is present (Eisenberger, 2011). Because of this proposed overlap, Way, Taylor, and Eisenberger (2009) studied morphine's effects on social rejection situations. Because morphine is used as a painkiller, the researchers proposed it might alleviate the aversive feelings associated with social separation. Because morphine affects the mu-opioid receptor associated with physical pain, the researchers wanted to investigate whether a gene mutation might affect one's rejection sensitivity. Results indicated that certain alleles, G in particular, denoted individuals with a greater reaction to both social rejection and physical pain (Way, Taylor & Eisenberger, 2009). The brain areas affected in this research again indicated the role

of the anterior cingulate cortex and the anterior insula. Therefore, this indicates the neurobiological overlap is indeed present. It also suggests, however, that certain genes and receptors affected in physical pain are also affected by social rejection.

As the overlap suggests, other painkillers may be beneficial in alleviating both physical and social pain. DeWall et al. (2010) used the knowledge of the neurobiological overlap in order to determine whether or not social pain could be reduced by a common physical pain suppressant: Tylenol. In this study, participants were assigned to take either a dose of Tylenol or a placebo daily for three weeks. In the first study, participants were asked to report their hurt feelings on a daily basis. In the second study, participants also took either a dose of Tylenol or a placebo daily for three weeks. They then completed the same social exclusion task seen in Eisenberger, Lieberman, and Williams' 2003 study while undergoing functional magnetic resonance imaging (fMRI). The first study indicated that the Tylenol reduced the feelings of social pain on a daily basis. Participants reported a significant decline in the number of hurt feelings over time if they were taking Tylenol. Those taking the placebo experienced no difference over time in the number of hurt feelings. The two groups did not show any differences in their positive emotions; therefore, Tylenol only reduced feelings of social pain and did not affect positive emotions felt by the participants. The second study showed that participants taking Tylenol had significantly less activity in their dorsal anterior cingulate cortex during the social exclusion task. Additionally, the second experiment showed that Tylenol reduced the brain's neural responses to social rejection. The areas that saw a reduction in activity were those often associated with feelings of physical pain.

Therefore, the results of the experiments displayed the extensive overlap between physical and social pain both behaviorally and neurally (DeWall et al., 2010).

Pain and Tylenol

In the late 19th century, acetaminophen was discovered and used as a painkiller. It was first discovered when an amateur pharmacist incorrectly filled a prescription for naphthalene with acetanilide. The prescription was being used to treat a patient with intestinal parasites. The acetanilide reduced the fever of the patient. In 1899, it was noted that acetaminophen was the metabolized form of acetanilide. Although its effects seemed promising, acetaminophen was not further studied until 1949. While many individuals feared the negative consequences of aspirin, pharmaceutical companies began experimenting with other ingredients to produce safer painkillers. Soon after, in 1955, McNeil laboratories introduced the first aspirin-free pain reliever, Tylenol Elixir for children using acetaminophen as one of its active ingredients ("McNeil Consumer Healthcare Company Worldwide Consumer Pharmaceutical Intranet Site Content", n.d.) At this time, Tylenol was available by prescription only and was to be used as a central acting painkiller. In 1959, Tylenol was approved for sale without a prescription ("McNeil Consumer Healthcare Company Worldwide Consumer Pharmaceutical Intranet Site Content", n.d.). Tylenol products became extremely successful due to their safety and effectiveness. McNeil Laboratories began producing additional products using acetaminophen as their active ingredient. Since then, Tylenol has been one of the top five best-selling brands of analgesics in the United States ("McNeil Consumer Healthcare Company Worldwide Consumer Pharmaceutical Intranet Site Content", n.d.).

Although Tylenol has been used for years to relieve physical pain, little research has been conducted on the effects of Tylenol on social rejection situations. Since 1989, it has been suggested that painkillers may alleviate not only physical pain but also social pain (Panskepp, 1989). Because of the neurobiological overlap seen in numerous studies, it has been suggested that opioids used to relieve physical pain may also alleviate separation anxiety (Panksepp, 1989). In 2011, DeWall used Tylenol coupled with a social rejection simulation to determine whether or not the Tylenol seemed to alleviate the brain activity and feelings of dejection. DeWall (2011) found that individuals who received a dose of acetaminophen had less activity in the bilateral anterior insula and bilateral posterior insula during a social rejection stimulation. This stimulation included undergraduates to engage in a social exclusion experiment of a ball tossing game with two same sex participants. The participants experienced one round in which they participated the entire time, followed by a second round in which they were excluded from the ball toss after receiving the ball a few times. Participants who were given acetaminophen prior to the exclusion task experienced less activity in the bilateral anterior insula than those in the placebo group. Additional work by DeWall (2010) showed that a central acting pain killer such as acetaminophen has been found to reduce the effects of social pain. In this study, participants were given either a daily dose of acetaminophen or a placebo over a three-week period. Those in the acetaminophen group reported a decrease in the level of their hurt feelings over the three-week period. Those participants in the placebo group experienced no change in their level of hurt feelings. These experiments suggest that pain medication may curb the pain felt by social rejection

(DeWall, 2010). Further, harsh social rejection has a strong agonistic memory effect (Pajkos et al., 2011).

Pain and Memory

Although physically and emotionally painful situations are equally stressful, the effect of these events on memories has been unclear. Further research, however, indicates that highly painful or emotionally taxing events may produce more enduring memories. In 2010, Sauer suggested that physical pain and threat to oneself could create more enduring memories. This study, which looked at individual's memories for first kisses, first sexual experiences, and first car accidents, indicated that people were more likely to possess enduring memories if physical threat was involved. Individuals who were in car accidents remembered significantly more details than those who were tested on their first kiss or first sexual experience. It is unclear, however, if this is a result of a direct link between specific events (such as reproduction or physical threat) to memory, or an indirect link between memory and the arousal mechanism (Julian, et al., 2009). Atkinson (2011) also indicates that physical pain could provide a memory advantage in regards to a study on childhood injury. Parents who were present at the time of their child's injury tended to have a memory advantage over those parents who were not present at the time. This effect is attributed to the visual image of seeing their child's injury as opposed to just hearing about it.

Threats to one's evolutionary fitness also seem to create enduring memories. Pajkos (2011) suggested that individuals who received a harsh social rejection remembered more than those who received a nice rejection. In her study, participants were introduced to a potential romantic interest (PRI). After asking the PRI on a date, the

participants were rejected harshly or circumstantially. The harsh rejection was directed at the participant's appearance and abilities, whereas the circumstantial rejection was in regards to already having plans that day. Those who were rejected harshly experienced a threat to their fitness. Therefore, from an evolutionary standpoint, the participants were not only social rejected but also felt as though their future chances at reproduction were denied. This study further supports the claim that threat to one can create more enduring memories. Because of the purposed overlap between physical pain and social pain, perhaps a painkiller may relieve the negative feelings of social exclusion. If this were the case, the memory enhancement effect of a harsh social rejection should disappear.

The Current Study

The current study aims to determine whether or not Tylenol will effect the memory of participants who experience a romantic rejection. If participants experience social rejection in a laboratory simulation (encoding), and a previous memory (retrieval), then the effects of acetaminophen on emotional memory can be determined at both encoding and retrieval. For the purpose of efficency, an autobiographical memory of a break-up was employed to see if Tylenol had an effect at retrieval on an emotional memory. 1. Because social rejection also increases memory (Pajkos, et al., 2011), if subjects are given acetaminophen during social rejection then the memory enhancement effect should disappear if the pain-memory circuit is in series. 2. If an individual receives a harsh rejection but also receive a dose of Tylenol, then they should have less of a memory than those individuals who receive a rejection but ingest a placebo.

Study 1

Methods

Participants

55 Butler University undergraduate students participated in this study for extra credit in a psychology course. 46 participants were female and 9 participants were male. 12 participants were in the Tylenol group, nice rejection; 11 participants were in the Tylenol group, harsh rejection; 16 participants were in the no Tylenol group, harsh rejection; 16 participants were in the no Tylenol group, nice rejection.

Design

The design of the study is a mixed 2 (Tylenol vs. placebo) x 2(polite vs. harsh social rejection) x 2(immediate vs. week delay memory test). The delay variable is within-subjects, as all participants took place in both the immediate and delayed test.

Table 1: Design of Study I

Time of Test	Tylenol Treatment	Type of Social Rejection
Immediate	***Tylenol***	***Harsh***
One week delay		
Immediate	***Placebo***	
One week delay		
Immediate	***Tylenol***	***Nice***
One week delay		
Immediate	***Placebo***	
One week delay		

Materials

Videos. The actors in the videos were friends of the researcher. The actors did not attend Butler University to eliminate the possibility of knowing the participants in the study. In the rare occasion that a participant knew the actor, their data was no used. The actors memorized scripts and then performed them into a camera. All information was presented in the same way across all videos (See Appendix G for the video scripts). In the introductory video, the actor stated numerous details about themselves, such as their favorite movie, college major, and favorite restaurant. There were two separate rejection videos. The first rejection video's reason for rejection was that the person has already made plans with someone else. In the second video, the person was rejected because the actor did not see them as romantically adequate or interesting. Both the male actor and the female actor shared similar characteristics (brown hair, brown eyes) and wore identical outfits (white shirts, with a green button, and sunglasses attached at the neck). Male participants saw the female actor and female participants saw the male actor. We did not ask the participants to indicate their sexual orientation.

Major Depressive Inventory. The MDI consists of 11 questions that were to be answered on a 6-point rating scale, ranging from 0 (at no time) to 5 (all of the time) (See Appendix A).

Word Search. Participants were given two twenty-word word searches to serve as an interpolated task to ensure the Tylenol or placebo had reached their blood stream before continuing the experiment (Included in Appendix B). The word searches contained words unrelated to the task at hand. Participants received an additional word

search while the researcher was giving the potential romantic interest (PRI) the date request as well as following the rejection video to act as a distractor task.

Free Recall. The free recall consisted of writing an email to a hypothetical friend who was abroad to tell them what happened with the PRI. Responses were scored on a 0-3 scale in five of the seven canonical features most frequently used in flashbulb memory research. A 0 was given if the feature was not present. A 1 was given if the feature was implied. A 2 indicated the feature was explicitly present. A 3 was given if the feature was explicitly mentioned 2 or more times. In addition, mentions of specific details from the initial video were counted and recorded. For example, if the participant included that the PRI's favorite food was Mexican and their favorite restaurant was Recess, they received a 2 (See Appendix B for 1 protocol and Appendix D for week 2 protocol).

Probed Response. The probed response consisted of 16 probed questions regarding the PRI's interests and physical appearance. These questions were presented in both a recognition (multiple choice) option and a recall (free response) option. All probed questions were scored on a 0-1 scale. A 0 was given for an incorrect answer and a 1 for a correct response (See Appendix B for week 1 protocol and Appendix D for week 2 protocol).

Valence and Arousal Ratings. In order to measure their valence and arousal, they were asked to fill in a box on a 9 x 9 grid square that indicated both their feelings of arousal and pleasantness (Included in Appendix B and D). This grid was established by Eich et al (2007) to be used for mood research.

Break-up Protocol. A protocol included free recall and probed recall regarding a past break-up (See Appendix C).

Procedure

Students were recruited to participate through Butler courses. Testing sessions took place in the evening throughout the week. Upon arrival, participants were randomly assigned to one of four conditions: romantic rejection – nice rejection, Tylenol - harsh rejection, Tylenol – nice rejection, placebo – harsh rejection, placebo.

Table 2: Conditions Design

Tylenol treatment	Rejection type
Tylenol	***Harsh***
Placebo	
Tylenol	***Nice***
Placebo	

At the beginning of the initial session, participants were given written informed consent. To ensure the emotional stability of all participants, they were all required to complete the major depressive inventory (MDI) prior to participation. As participants were receiving a form of social rejection, we did not want to cause further harm to those suffering from a lack of emotional stability. Once the participant had completed the questionnaire, the experimenter counted up their total. Scores of over 30 indicate the possibility of depression, and those participants were politely dismissed and given

information on Butler University's counseling center, as requested by the Institutional Review Board (Olsen et. al, 2003).

The remaining participants were given a 500 mg dose of either a placebo or Tylenol that was mixed in a lemonade drink. They then completed a crossword puzzle for eighteen minutes to ensure that the Tylenol or placebo had reached their blood stream. We did not examine the last meal the participant had eaten, which may have impacted the Tylenol's ability to be absorbed in the bloodstream. The participants then rated their arousal and valence, as well as, indicated whether or not they were currently in a relationship. If they were currently seeing someone, the length of time was reported. All participants were asked how attractive they felt as though they were. The participants then watched a short video of a person of the opposite sex (a potential romantic interest or PRI) introducing themselves. Following the rejection video, participants completed two memory tasks: a free recall and probed response. First, participants filled out a short questionnaire regarding the PRI and wrote a brief letter to the PRI asking them on a date. They were asked to include a description of the person in the video, both physical and what they said. Participants were also asked to include their written invitation to the PRI, and the PRI's response to the participant. The participants also rated how attractive the PRI was, and how interested they were in dating the PRI. The participants were then given another word search as a distractor task, while the researcher took the participant's date request to the PRI. After four minutes, the participants were then shown one of two rejection videos. Following the rejection tape, the participants filled out a survey that asked them to describe the events taking place, the PRI, and their emotions. Finally, the participants completed a survey about a break-up that they had previously endured. This

survey included free recall and probed questions. Participants were debriefed. One week later the participants returned for a follow-up session and were asked to complete the same memory tasks as the week prior (See Appendix D).

Results Study I

Overall Memory

Overall memory was examined using a 2 (Tylenol treatment) x 2 (rejection type) repeated measures ANOVA. In overall memory, which included both free recall and probed recall, there was a marginal interaction between rejection type and drug type, $F(1, 40) = 3.413$, $p < .0721$, Cohen's $f^2 = .23$ (See Figure 2). We used Tukey's HSD to explain the significant result. It indicated that this effect was due to the significant effect of drug type under the harsh condition, $F(1, 19) = 7.128$, $p < .0151$, Cohen's $f^2 = .54$. The "Tylenol" participants (mean = .666) remembered significantly more than those in the placebo group (mean = .544).

Detail Memory

We used a 2 (Tylenol treatment) x 2 (rejection type) x 2 (detail type) repeated measures ANOVA to examine detail memory. In memory for details, there was a significant interaction between Tylenol group and rejection type, $F(1, 40) = 5.190$, $p < .0281$, Cohen's $f^2 = .31$. The individuals in the harsh condition with Tylenol remembered significantly more on average compared to all groups (See Figure 3).

Affect Type

Affect type was analyzed using a 2 (Tylenol treatment) x 2 (rejection type) x 2 (affect type) x 4 (test order) ANOVA. There was a significant effect of test order on rejection type, $F(1, 150) = 3.685$, $p < .0135$ (See Figure 4).

Tylenol at Encoding

We assessed memory for a previous break-up using an ANOVA. Most notably, Tylenol had no effect on memory for a prior break-up, $F(1, 51) = .229$, N.S.

Discussion Study I

Study 1 showed that harsh romantic rejection had a deferential emotional impact than polite rejections. Figure 3 shows that at the beginning of the session, arousal and valence was the same in both the nice and harsh conditions. At time two, which took place immediately following writing a date request to the PRI, arousal and valence remained fairly consistent. However, at time three, which occurred following the rejection video, those in the harsh condition saw a large plummet in arousal and valence ratings. Those in the nice condition also had lower scores for arousal and valence; however, they were not as significant as those in the harsh condition. This indicates that those in the harsh rejection condition experienced a more arousing rejection, which in turn elicited a more elaborate memory. Therefore, the first hypothesis that participants who receive a harsh romantic rejection will elicit a more elaborate memory was supported.

DeWall (2006) and Eisenberger, Lieberman, and Williamson (2003) have shown that rejection is associated with the activation of the anterior cingulate cortex and the bilateral insula. When these brain regions are activated, they elicit the pain response from the brain (DeWall, 2006; Eisenberger, Lieberman, & Williamson, 2003). Tylenol should deactivate these brain regions, which are the site of action for both pain and its prophylactic effects of Tylenol. Under Tylenol, the anterior cingulate cortex and bilateral insula are less active, such that those in the Tylenol condition would not have the

memory enhancement effect in the harsh rejection (DeWall, 2010; DeWall, 2011). Because Tylenol may reduce the feelings of pain felt by those in the harsh condition, one would expect the memory enhancement effect of a harsh rejection to disappear, or reduce the amount of activity in the anterior cingulate. However, those in the harsh rejection and Tylenol treatment condition remembered more than those in any other group. It is clear that those in the harsh rejection and the Tylenol treatment group experienced a memory enhancement effect. If only Tylenol was working, it would have dampened the activity in the anterior cingulate and removed the memory enhancement effect. It appears as though both Tylenol and the harsh rejection have some effect on the activity in the anterior cingulate. This hypothesis was not supported as those in the harsh Tylenol condition remembered more than any other group.

We conclude that Tylenol may enhance encoding memory for two reasons. The Tylenol may be reducing any pain stimuli associated with the harsh rejection, freeing cognitive resources for memory processing. The second theory is that the pain circuit and the memory circuit work parallel to one another instead of being a sequential process. If the mechanism were sequential, a participant would have needed to experience pain in order to enhance memory. According to this view, participants who received Tylenol should have experienced reduced memory when given a harsh rejection. If this had been the case, the anterior cingulate cortex and the bilateral insula would have needed pain to form a memory. Since this does not appear to be the case, our results suggest that activity due to pain in the anterior cingulate cortex and the bilateral insula is not necessary to prompt memory formation. The fact that Tylenol enhanced recall under

harsh conditions suggests the anterior cingulate is a parallel circuit to the posterior cingulated-hippocampal memory axis.

Tylenol at retrieval had no effect on recalling a past break-up that varied in emotional reaction across subjects. This suggests that the Tylenol effect is most likely during encoding and not retrieval. There were several confounding factors in this study. Namely, the rejection experienced by the participant was not highly believable. Additionally, we edited the video scripts to show a more severe harsh rejection to create a greater difference between the nice and the harsh rejection. The actor was also instructed to act in a harsher manner when delivering the harsh rejection. Further, the participant never felt personally approached by the PRI. In order to address this issue, a second study was implemented using different, more realistic videos.

Study II

Study two was conducted to replicate the results of study one. Study two saw drastic changes to the video being shown. Because many participants did not feel personally affected by the videos presented, additional phrases were added to ensure the participant felt personally involved in the rejection video. The changes in study two are further discussed in the methods section. Additionally, because the break-up data indicated no effect of Tylenol at encoding, this portion of the experiment was removed in study two.

Methods Study II

Participants

77 Butler University undergraduate students participated in this study for extra credit in a psychology course. 56 participants were female, and 21 participants were

male. 20 participants were in the Tylenol group, nice rejection; 19 participants were in the Tylenol group, harsh rejection; 19 participants were in the no Tylenol group, harsh rejection; 19 participants were in the no Tylenol group, nice rejection.

Materials

The majority of materials remained consistent from study one to study two.

Videos. The introductory video was edited to include more details than the first introduction video. The rejection videos were also changed to elicit a more significant difference between the harsh and nice rejection. The actors were students majoring in Theater, in order to produce a believable rejection. The actors wore the same color shirt as seen in the prior study; however, the background in the videos was changed. In the beginning of both rejection videos, an off-camera voice said, "What do you think of subject number 9?" The actor/actress responded with, "You're going to edit this right?" and ended the video with "S/He isn't going to see all of this, right?" in order to let the participant know the PRI was being brutally honest (See Appendix H).

Probed Recall. The sixteen questions in the probed recall were counterbalanced to ensure that half of the participants were asked to recall certain items and half of the participants were asked to recognize certain items. The questions remained the same; however, their order differed to account for counterbalancing (See Appendix E for week 1 protocol and Appendix F for week 2 protocol).

Procedure

The procedure remained consistent from study one to study two. After completing the informed consent and the MDI, all participants were told they were participant number nine. This was to ensure that the participant knew that the rejection

video as directed at them. Additionally, participants were asked to continue working on the word search for five minutes immediately after the rejection video in order to serve as a distractor tasks. Further, participants were no longer asked to recall a previous break-up, as Tylenol had no effect on the memories at retrieval.

Results Study II

Gender

There were no significant effects of rejection type and gender on the following measures: free recall $F(1, 57) = .216$, N.S., probed recall $F(1, 55) = 2.523$, N.S., audio detail memory $F(1, 56) = 2.11$, N.S., or detail type $F(1, 73) = 2.782$, N.S.

Free Memory Recall

We examined free recall memory using a 2 (Tylenol treatment) x 2 (rejection type) repeated measures ANOVA. There was a significant effect of rejection type on free recall memory in the females only, $F(1, 43) = 4.350$, $p < .043$, Cohen's $f^2 = .27$. By using Tukey's HSD test, we determined that those in the harsh condition (mean = .331) remembered significantly more than those in the nice condition (mean =.244). There was no significant effect of Tylenol on free recall memory, $F(1, 43) = 1.119$, N.S, so that those who received Tylenol (mean = .290) remembered no more than those who did not (mean = .275).

Probed Memory

A 2 (Tylenol treatment) x 2 (rejection type) repeated measures ANOVA was used to analyze probed memory. There was a significant effect of rejection type on probed memory in all subjects, $F(1, 55) = 5.065$, $p < .0284$, Cohen's $f^2 = .26$, such that those who received the harsh condition (mean =.559) remembered significantly more than those in

the nice condition (mean = .460). These differences among groups were determined by using Tukey's HSD. This significant effect was enhanced when the male subjects were removed from the analysis, $F(1, 41) = 8.643$, $p < .0054$, Cohen's $f^2 = .412$. The women in the harsh condition (mean =.605) remembered significantly more than the women in the nice condition (mean = .460). There was also an effect of delay in all participants, $F(1, 55) = 12.983$, $p < .0007$, Cohen's $f^2 = .45$, such that participants remembered significantly more at the initial testing session (mean =.548) than at a one week delay (mean =.467). There was no effect of Tylenol on probed memory, $F(1, 55) = .154$, N.S.

Detail Memory

A 2 (Tylenol treatment) x 2 (rejection type) x 2 (detail type) repeated measures ANOVA was used to analyze detail memory. There was a significant interaction of Tylenol and rejection type on detail type in females, $F(1, 52) = 4.168$, $p < .0463$, Cohen's $f^2 = .24$. Tukey's HSD revealed that those in the Tylenol group with the harsh rejection (mean = 2.286) remembered more than those in any other group. Many more audio details (mean = 2.571) were remembered than visual details (mean = .696) in female participants. In the male participants, there was a significant effect of Tylenol group on detail type, $F(1, 17) = 5.816$, $p < .0275$, Cohen's $f^2 = .48$. Those in the Tylenol group (mean = 1.273) remembered more details than those in the placebo group (mean = 1.050). The male participants remembered more audio details (mean = 2.0) than visual details (mean = .333).

Audio Details

Audio details were analyzed using a 2 (Tylenol treatment) x 2 (rejection type) repeated measures ANOVA. Anything written verbatim by the participant that the PRI

had said in the video constituted an audio detail. There was a marginally significant interaction between Tylenol group and rejection type on audio details in the female participants, $F(1, 42) = 3.306$, $p < .0761$, Cohen's $f^2 = .22$ (See Figure 5). The females in the Tylenol group with a harsh condition (mean = 2.958) remembered the most details, followed by the females in the placebo and nice condition (mean = 2.321).

Discussion Study II

Study two also supported the first hypothesis that participants who received a harsh romantic rejection remember more elaborate memories than those who receive a nice romantic rejection. This is because those in the harsh romantic rejection experienced a deferential emotional impact than those who received a harsh rejection. This further supports the adaptive aspect of memory seen in Pajkos, et al. (2011). From an evolutionary standpoint, one would want to remember someone who had rejected them harshly to avoid similar situations in the future. Those who received the nice condition, however, would not need to avoid the rejecter in the future, as this their rejection was not a threat to the participant's fitness. This suggests that memory is adaptive as seen in Narine et al. (2007, 2008).

As predicted in study one, Tylenol did have an enhancing effect on memory details in the female participants. Hence, both the Tylenol and the harsh rejection may have had some effect on the anterior cingulate, which in part may be related to more elaborate memory processing. This would explain why a more elaborate memory was seen for those in the harsh Tylenol condition (DeWall, 2006; Eisenberger, Lieberman, & Williamson, 2003). One possibility is that Tylenol appears to have deactivated the anterior cingulate and the bilateral insula in order to lessen the impact of the harsh

rejection. Because of the diminished effect of the rejection, those in the harsh condition were still able to maintain the memory enhancement effect often seen with harsh physical pain and social rejection. We maintain our conclusions from study one that indicate that this effect of Tylenol on memory is due to one of two processes. It is possible that Tylenol is reducing the pain stimuli associated with the harsh rejection, freeing cognitive resources for memory processing. The other process suggests that the pain circuit and the memory circuit are working parallel to one another rather than sequentially. We are unsure why this effect was only seen in the female participants. Perhaps the females took the study more seriously, whereas the males were more prone to being less interested in the experiment. Additionally, the small male sample could have affected these results. There was however no effect of Tylenol on memory in the probed questions.

Study two did not elicit the same degree of memory enhancement effect seen in study one. It is unclear why these effects no longer seem significant. We attribute this to numerous possibilities. Perhaps the subject pool was less affected by the rejection, or the other researchers running subjects were not trained properly. Further, the memory enhancement effect seen in study one may have been a type I error.

General Discussion

It is apparent that both social rejection and Tylenol have an effect on memory as suggested by researchers such as DeWall (2006, 2010, 2011). However, the reliability of the effect of Tylenol is unclear. Both studies demonstrated the evolutionary effect of memory during social rejection, as the harsh rejection condition was remembered more vividly than those in the nice rejection condition (Narine et al., 2007; Narine et al., 2008). This is because those in the harsh condition wanted to remember their suitor more in

order to avoid similar situations in the future (Pajkos et al., 2011). The participants want to remember the qualities of the rejecter to avoid him or her in their future endeavors as they hope to pass along their genes and the present suitor would not help them in this process. This suggests that a harsh rejection is indeed a threat to one's evolutionary fitness, and is therefore an example of adaptive memory. This finding is consistent with the work of others (Narine et al., 2007; Andrews et al., 2002), implying that our memory systems have developed to help us remember certain stimuli better than other stimuli.

This study provides further evidence for the neurobiological overlap seen by numerous other researchers (DeWall & Baumeister, 2006; Eisenberger, et al., 2003; MacDonald & Leary, 2005; Way, et al., 2009). The effect of Tylenol on memory indicates that the brain areas affected by physical pain and social exclusion are the same. The fact that one's memory is enhanced in both a physically painful situation and a harsh social rejection implies that the same brain regions, anterior cingulate and bilateral insula, are being activated in both situations. Further, this infers that painkillers, such as Tylenol, should alleviate the aversive effects of both physical and social pain.

This research also suggests that humans respond to physical pain and social pain in a similar fashion (Panksepp, 1989, MacDonald & Leary, 2005; DeWall & Baumeister, 2006). Physical pain, just like social rejection elicits emotion in the participant, provoking the participant's arousal and hence their memory. The heightened arousal seen in the rejection memory may be congruent with the arousal seen in flashbulb memories (Brown & Kulik, 1977). Brown and Kulik established flashbulb memories and their definite features such as heightened arousal, and vivid recollections over time. However, the role of emotion in flashbulb memories is highly argued. While some

individuals believe that the emotions at encoding are instrumental factors (Bohannon, Julian & Aue, 2008), others credit emotion to inaccurately reconstruct flashbulb memories at retrieval (Neisser & Harsch, 1992, Talarico & Rubin, 2003). The present study suggests that emotion assists memory construction as those experiencing highly arousing situations (the harsh romantic rejection) elicited a more elaborate memory. If emotion inhibited the creation of memory, we would expect those in the nice rejection condition to elicit a more elaborate memory. This study, while offering much insight to the neurobiological overlap between physical pain and social pain, is not without limitations.

Limitations

Study one saw a much greater memory enhancement effect with Tylenol than study two. If Tylenol enhances memory under a harsh rejection, there are explanatory candidates. Tylenol is not impacting memory as we had anticipated. Our initial hypothesis was that Tylenol would reduce the feelings of pain under the social rejection, which in turn would eliminate the memory enhancement effect frequently seen in harsh rejection situations. This has led to a few implications as far as Tylenol's effect on memory. First off, Tylenol may reduce any other aliments felt by the participant, therefore, freeing up other cognitive resources. This allows those participants in the Tylenol condition to remember more than those in the non-Tylenol condition. Second, the pain circuit and the memory circuit may work parallel to one another rather than sequentially. If the pain circuit and the memory circuit worked together, one would need the pain to create the memory, which is not the case. Participants in both the harsh condition and the nice condition are forming memories. Further, Tylenol appears to effect memory only at the time of encoding rather than retrieval. This is seen with the

insignificant effects of Tylenol on memory for a prior break-up in study one. Therefore, Tylenol has an effect on an immediate event when encoding occurs; however, Tylenol assists in more than memory retrieval. To further test the effects of Tylenol at encoding and retrieval, one may wish to give participants Tylenol only after their week delay and not during the initial testing session.

One thing to consider is we did not examine the delay between the study and the prior break-up, perhaps introducing a confound to this part of the experiment. Perhaps we found no significant effects because of the large time frame between the break-up and the time of testing. It is possible that the results may be different after a controlled one-week delay. Additionally, it is unclear whether or not the break-up being a real life situation and the experimental rejection simulation would elicit the same degree of pain. One would not expect these differences to arise as previous work by DeWall and Baumesiter (2006) examined physical pain and social exclusion in a similar fashion to this study, and did not see significant differences between the two types of pain. Reviewing the break-up data to ensure that the arousal and valence levels were consistent with those in the rejection simulation may be beneficial in answering this question.

Future Directions

Because Tylenol is a central acting painkiller and affects the anterior cingulate cortex and anterior insula, it is unclear whether or not other painkillers such as Advil would also alleviate the pain felt by social rejection. Future research may use a different painkiller to test its effects on memory and see whether the same results ensue. Because other painkillers such as Advil affect different areas of the brain, I would not expect the same results to occur.

Although the neurobiological overlap between physical pain and social pain is clear, we may need to add a condition in which participants that are under social stress also experience physical pain. In order to elicit a physical pain condition, a cold pressor stress (CPS) should be used (Andreano & Cahill, 2006; Andreano & Cahill, 2010). We could then compare how Tylenol affects those in a physical pain condition and determine if Tylenol elicits pain reduction. This would allow us to confirm that Tylenol works in a similar fashion in a physical pain situation to our social exclusion situation. Additionally, replication of this effect is necessary to ensure that the Tylenol effect is indeed present and not the effect of a Type I error. In future studies, both the effects of a harsh rejection and of Tylenol should be replicated. Further, this effect may be present with a larger sample size as many of our results were heading towards significance.

In conclusion, the present study presents some solid evidence for the neurobiological overlap seen in physical pain and social pain. The results suggest that both physical pain and social pain affect the anterior cingulate and the bilateral insula. Further, Tylenol appears to decrease the activity in these aforementioned areas to maintain the memory enhancement effect seen in a harsh rejection. We conclude that activity in the anterior cingulate cortex may be associated with more elaborate memory processing. These studies indicate that Tylenol does have an impact on memory during social rejection.

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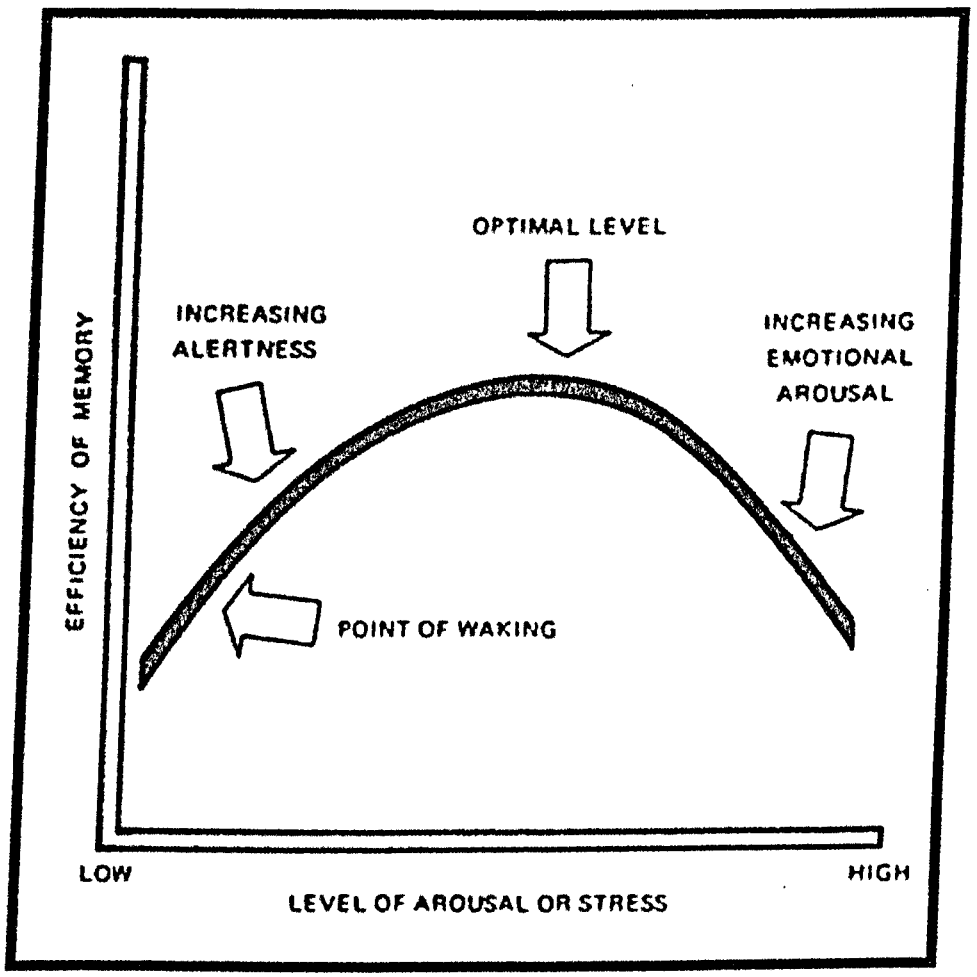


Figure 1: Yerkes-Dodson law and relationship to memory performance according to E. F. Loftus (1980).

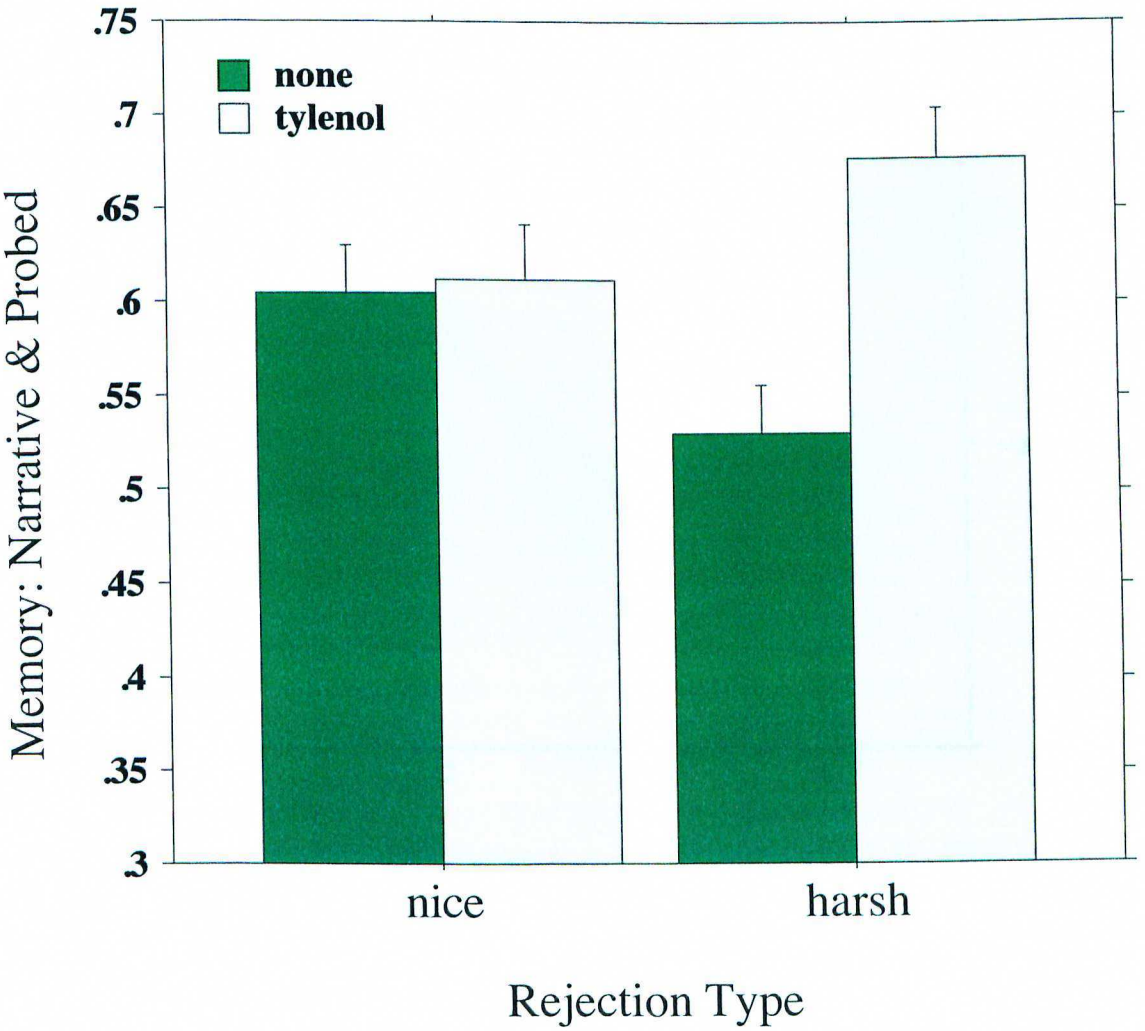


Figure 2: The overall memory by rejection type and Tylenol group, F (1,40) = 3.413, p = .072 in Study 1.

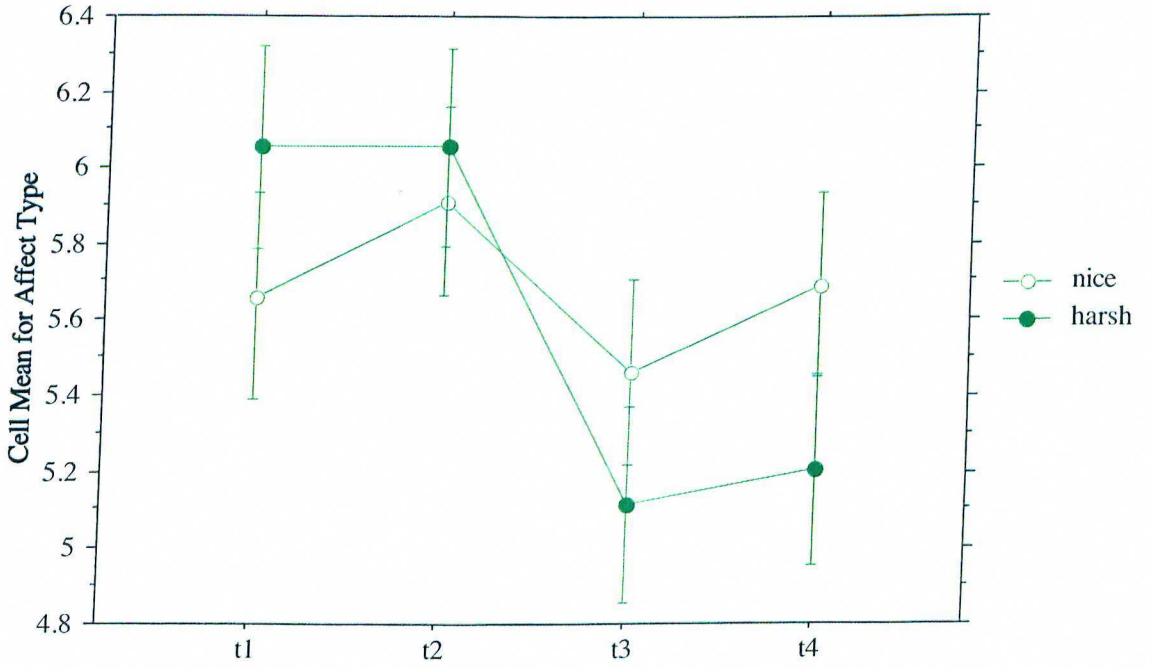


Figure 3: The affect type by rejection type by test order, $F(1, 150) = 3.685$, $p < .0135$ in Study 1.

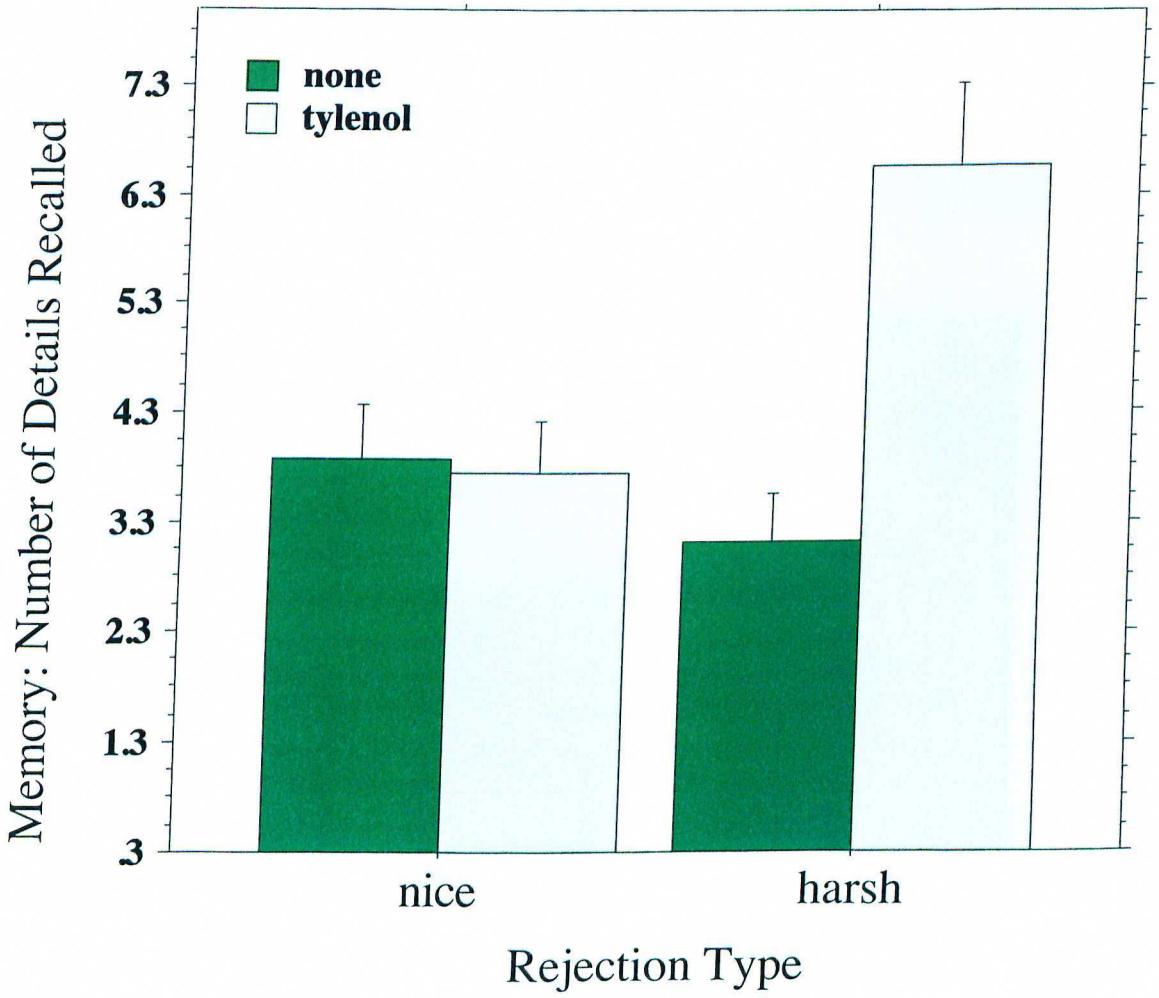


Figure 4: The detail memory by rejection type and Tylenol group, F (1, 40) = 5.190, p = .0281 in Study 1.

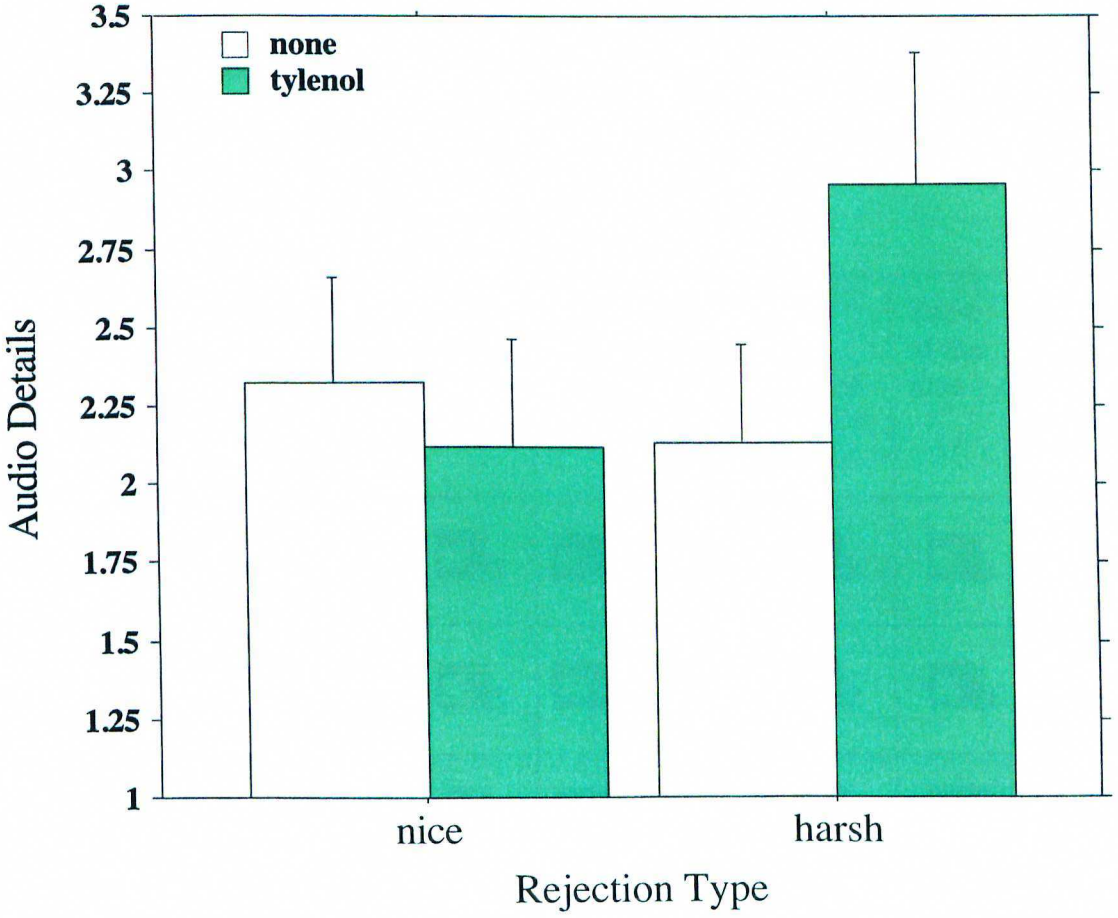


Figure 5: The audio detail memory by rejection type and Tylenol group for female participants only, $F(1, 42) = 3.306$, $p < .0761$ in Study 2.

Appendix A: MDI

The following questions ask about how you have been feeling over the last two weeks. Please put a check in the box that is closest to how you have been feeling.

Example: If you have felt in low spirits or sad slightly more than half of the time during the last two weeks put a tick in the third box from the left in the first row.

When finished add up your score and write the total at the bottom.

	How much of the time...	All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
1	Have you felt in low spirits or sad?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
2	Have you lost interest in your daily activities?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
3	Have you felt lacking in energy and strength?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
4	Have you felt less self-confident?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
5	Have you had a bad conscience or feelings of guilt?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
6	Have you felt that life wasn't worth living?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
7	Have you had difficulty in concentrating, e.g. when reading the newspaper or watching television?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0

8a	Have you felt very restless?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
8b	Have you felt subdued?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
9	Have you had trouble sleeping at night?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
10a	Have you suffered from reduced appetite?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
10b	Have you suffered from increased appetite?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0

Total:_____

Appendix B: Week one protocol (Study 1)

Subject Number: _____

I have read the below statement, understand my rights, and agree to these conditions.

Signature:_____

Name		Student ID	
Address		Telephone	
City, State		Zip Code	
Date		Class Year	
Professor		E-mail	

Tear along the above line and keep the bottom portion for your records.

This experiment looks at how people respond to interactions of varying types. All responses will be kept confidential and will only be used for the purpose of this experiment.

All participants will be asked to take a 500mg dose of either Tylenol or a placebo. Therefore, if you are currently taking any medications or are allergic to Acetenphinmen, we ask that you do not complete this study. You will be asked to view a short video clip that will be about 3 minutes in length and then answer a questionnaire that should take approximately 30 minutes. After that you will complete another questionnaire regarding a past experience. You will also be asked to return one week later to complete a second questionnaire that will take no longer than 20 minutes to complete. This experiment is completely voluntary. You may discontinue your participation at any time, and any information that you provided will not be used. If you should decide to cease your participation or withdraw from this study, you will not be penalized in any way.

Please note: Based upon your responses to the MDI, you may not be eligible to participate in this research.

Please do not discuss this study with anyone during or after the experiment. At your request, we will fully inform you as to the nature of this experiment no later than one month from your participation. Thank you.

If you have any questions, please feel free to contact:
Karina Hamamouche
317-529-3948
khamamou@butler.edu

Dr. Neil Bohannon
317-940-9240
nbohannon@butler.edu

You may go on to the next word search if you complete this one:

N Y F H X O J G A W L C C S S S B
Y N R Q O O C T E L E O Q T C T U
L C N A R L H S A F M V O R H R L
N H A D R E C B E M K K H A W A L
I R A M R B T O U R W K L L I E D
X N O T R E I N M N Z B D A T N O
U J O M K A I L E B E X R R Z I G
Y N Z S E C H A N D V X X E E F L
T T A D A C F P J I U I J B R U V
V B Q T E L W Z W I W C N I J X S
A L I L L Y H A L L M R A L W S T
M O B I V H X D R D I H I T E B K
N J W U H U J Z X T S S Q N I A I
P D J I Z Y O K N A D E I G S O C
N I A T N U O F R A T S Y I S W N
E U H A L L A G B L U E T W O R Q
L B N Z B M S G Q B V X I W R W P

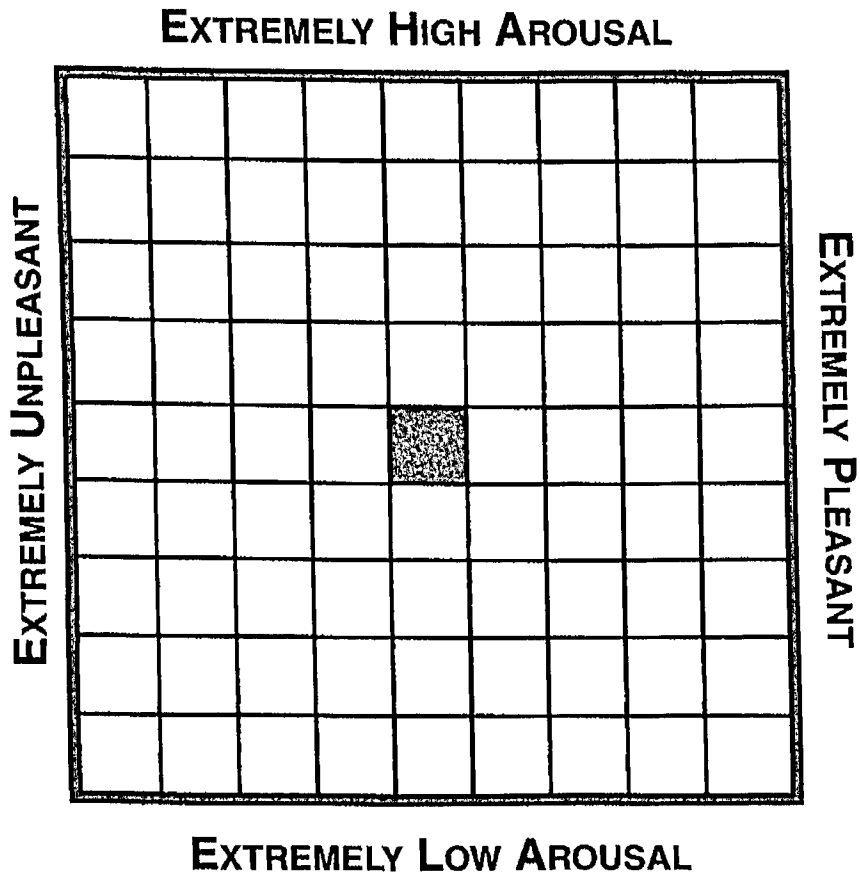
ATHERTON
BASKETBALL
FINEARTS
BLUETWO
BULLDOG
BUSINESS
COMMUNICATION
DANKO
SCHWITZER
EDUCATION
LIBERALARTS
LILLYHALL
GALLAHUE
HOLCOMB
IRWINLIBRARY
JORDAN
STARFOUNTAIN
PHARMACY
RESCO
ROSS

Please do the word search until you receive further instruction from the experimenter:

R O B S J B E O P C K O H K L E Y
D E S K N G P R N H P I H A B D F
L Z D N E M X G Y O G K P E E U N
A X J L D Y C A H H B T B R D C T
S B L Z O G K N L J O C U U S A V
Y O C X T F O I T P N P T T R T D
C T C X K T G Z W E R W L U O I R
Z D A Q E H H A J Y X Z E F S O A
C V D B T Z V T V Y N T R O S N C
S P O E Y F B I R S H D B P E M E
K O R R Q K R O W E M O H O F Q T
K K S Z R E N N A L P Y A D O R O
O U N I V E R S I T Y E V D R K N
M E E T I N G B F Q O J N E P M S
R E D N I B L R Q E G V P C T F W
U P B N H O K D E T R A B O I K Q
J E K J I B M D I H P G P V N L P

BINDER
BUTLER
COLLEGE
DAYPLANNER
DESK
EDUCATION
FOLDER
FUTURE
HIGHLIGHTER
HOMEWORK
LAPTOP
MEETING
NOTEBOOK
NOTECARD
ORGANIZATIONS
PAPER
PENCIL
PROFESSORS
TEXTBOOKS
UNIVERSITY

Please fill in the box that best describes your current state of arousal and pleasantness.



Please answer the following questions:

Are you currently in a relationship? (please circle) **Yes** **No**

If yes, then for how long? _____

If you're **not** in a relationship, how interested are you in being in a relationship, 1 being no interested at all and 7 being extremely interested:

1 2 3 4 5 6 7

On a scale from 1 to 7, how attractive do you think you are, 1 being not attractive at all and 7 being extremely attractive:

1 2 3 4 5 6 7

STOP! DO NOT CONTINUE UNTIL YOU RECEIVE FURTHER INSTRUCTION FROM THE EXPERIMENTER!

After viewing the video clip, please answer the following questions:

On a scale from 1 to 7, please rate the attractiveness of the person in the video, 1 being not attractive at all and 7 being extremely attractive:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your interest in the person in the video, 1 being not interested at all and 7 being extremely interested:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your desire to ask the person in the video on a date, 1 being no desire at all and 7 being a great desire:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your confidence in person in the video accepting your date, 1 being not confident at all and 7 being extremely confident:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your compatibility with the person in the video, 1 being not compatible at all and 7 being extremely compatible:

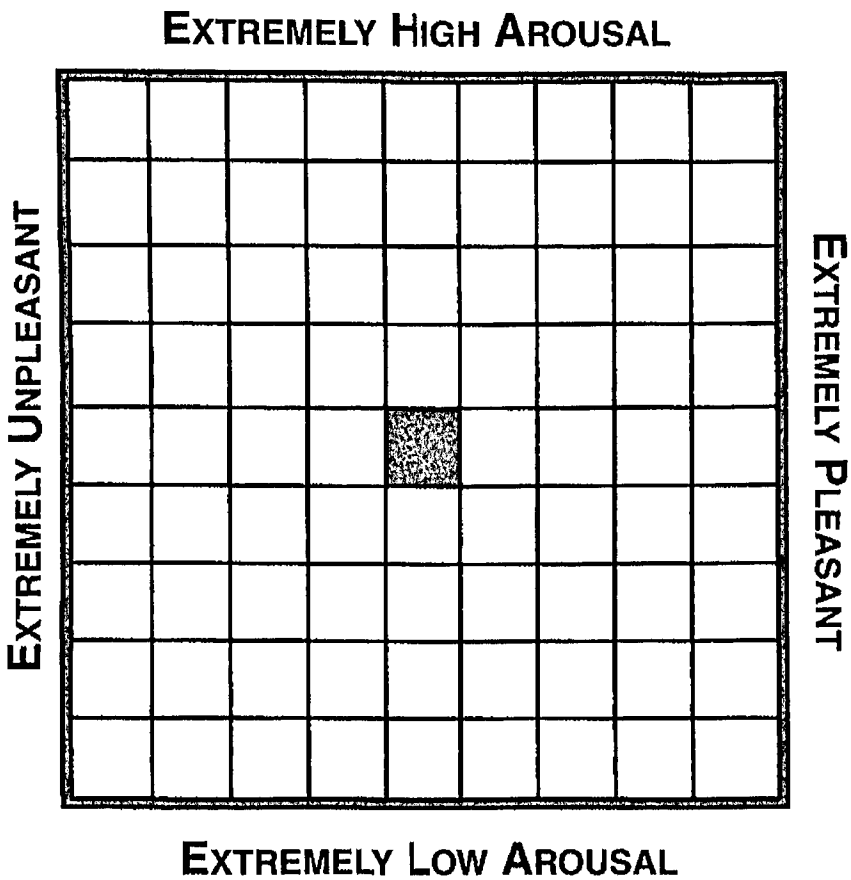
1 2 3 4 5 6 7

After watching this video, please describe in detail how you would like to ask this person on a date. Please limit to **eight sentences**.

On a scale of 1 (not confident at all) to 7 (extremely confident), how confident are you that the suitor will accept your request for a date, 1 being not confident at all and 7 being extremely confident:

1 2 3 4 5 6 7

Please fill in the box that best describes your current state of arousal and pleasantness.



STOP!

DO NOT CONTINUE UNTIL YOU RECEIVE FURTHER INSTRUCTION FROM THE EXPERIMENTER!

After viewing the video clip, please answer the following questions:
On a scale from 1 to 7, how surprised were you that the suitor turned down your invitation, 1 being not surprised at all and 7 being extremely surprised:

1 2 3 4 5 6 7

On a scale from 1 to 7, how disappointed were you that the suitor turned down your invitation, 1 being not disappointed at all and 7 being extremely disappointed:

1 2 3 4 5 6 7

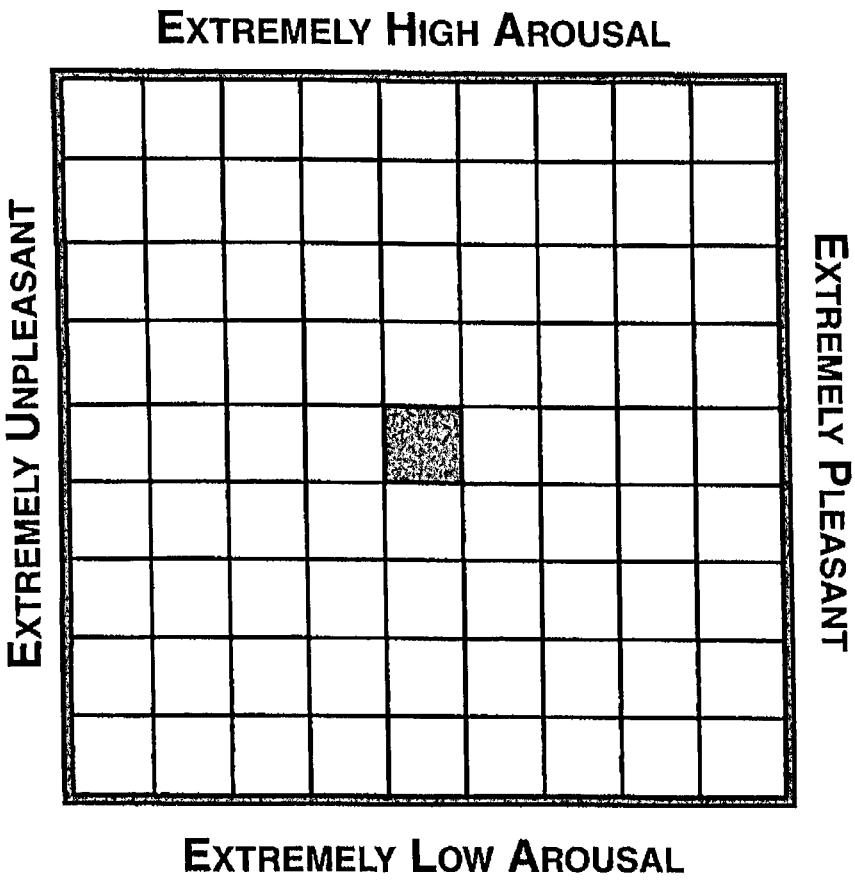
Please do the word search until you receive further instruction from the experimenter:

E N K K G D K R W L Z D V N Z R W
D D I E F N Y L T P G O Z J A F Y
T Q X M U N I I T R U G O Y L N W
D S S T R E A M E R S E P P L O L
X R X W R E P A P S W E N T E T T
K E E F Y U V T X L N U E R R U N
I T S S T Q C P A B S B T S B F A
A U Y W S A V P P J A E Q R M V P
L P G W L E I O X H S C M T U W M
B M V B E C R Y P V I T A M I N N
H O A R N K T L B C G D W K Z V S
Y C M I E K A J F C J U X Q K Z E
U M R C T C J N O I T A C U D E S
V P A R O L R A P S E L P P A Q S
E R W C C W R O Z J A G U A R B A
T S I T N E D R P A N C A K E D L
A E K S T E R E O R E P M U B V G

ALPHABET
APPLE
BUMPER
COMPUTER
DENTIST
DRESSER
EDUCATION
FUTON
GLASSES
JAGUAR
NEWSPAPER
PANCAKE
PARLOR
PRINCIPAL
QUEEN
STEREO
STREAMERS
UMBRELLA
VITAMIN
YOGURT

Unfortunately, the person in the video declined your invitation for a date. You want to tell your best friend who is abroad about what happened. Please compose an e-mail to your friend explaining what happened. Please include a description of the person in the video (both physical and what they said), your invitation, and their response to you.

Please fill in the box that best describes your current state of arousal and pleasantness.



Please answer the following questions about the video to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

1. What color are the suitor's eyes? ☐

Blue **Brown** **Green** **Hazel**

2. What did the suitor have on their head? ☐

Baseball Cap **Sunglasses** **Sports Headband** **Nothing**

3. What color was the pin on their shirt? ☐

Red **Yellow** **Green** **Blue**

4. What was their favorite movie? ☐

Field of Dreams **Midnight in Paris** **Remember the Titans** **Miracle**

5. What was their favorite food? ☐

Burritos **Enchiladas** **Gazpacho** **Gelato**

6. Where would they like to travel in the future? ☐

Turkey **Indonesia** **Egypt** **Nigeria**

7. Where did the suitor study abroad? ☐

France **Egypt** **Bulgaria** **Spain**

8. What culture is the suitor doing his Honor's Thesis on? ☐

Egyptian **Thai** **Mexican** **French**

9. What is the name of the restaurant that the suitor enjoys going to? ☐

Recess **Room 4** **Barcelona Tapas** **Imo's**

Please answer the following questions about the video to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

1. What color was the suitor's hair? ☐

_____

2. What did the suitor wear around their neck? ☐

_____

3. What color shirt was the suitor wearing? ☐

_____

4. Where did the suitor study abroad? ☐

_____

5. What type of food does the suitor enjoy eating? ☐

_____

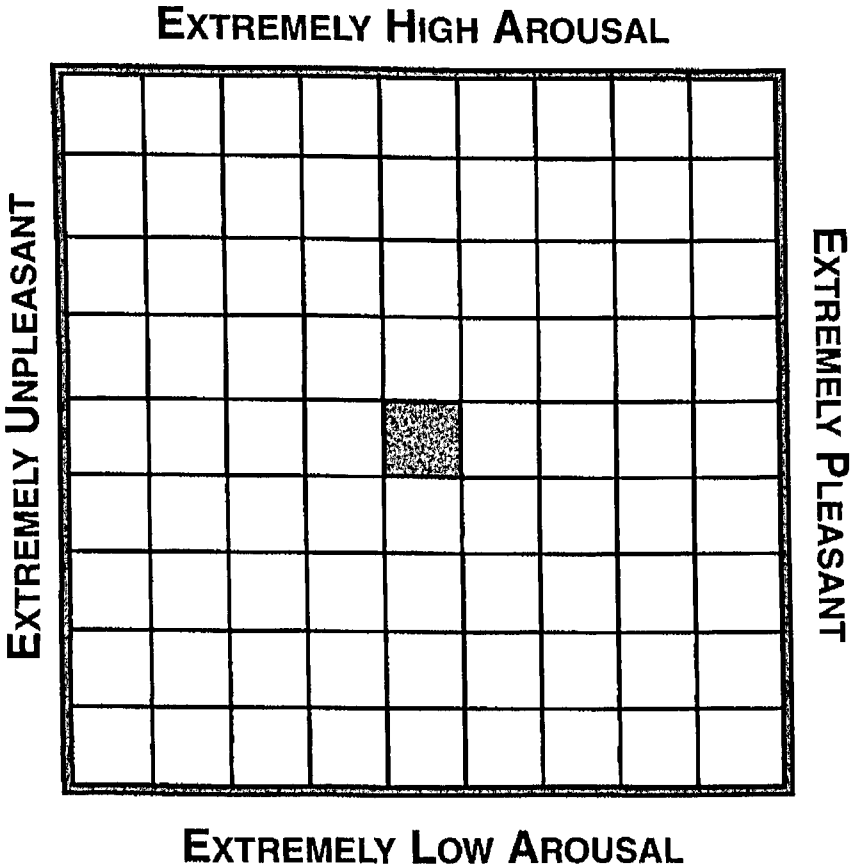
6. What is the name of the movie that just came out that the suitor enjoyed? ☐

_____

7. What is the suitor's major? ☐

_____

Please fill in the box that best describes your current state of arousal and pleasantness.



IMPORTANT: Please do not share the information of this study with any other students or friends!

Appendix C: Break-up protocol

Break-up

Please write a detailed account of your break-up with your former partner. Be as inclusive and as accurate as possible. Please detail both internal thoughts and as well as external events (ie things you saw and hear at the time).

Break-up

Not sure at All	Somewhat Confident	Moderately Confident	Very Confident	Extremely Confident
1	2	3	4	5

1. What were you wearing at the time that your break-up occurred?

   _____

   Confidence Rating:_____

2. What was your former partner wearing at the time that your break-up occurred?

   _____

   Confidence Rating:_____

3. What were the last words spoken before the break-up occurred and who said them?

   _____

   Confidence Rating:___

4. What were the first words spoken after the break-up occurred and who said them?

   _____

   Confidence Rating:_____

5. In what location did the break-up occur?_____
   Confidence Rating: _____

6. What was the exact date of the break-up? (Month/Date/Year):

   _____

   Confidence Rating: _____

7. What day of the week did the break-up occur?

   _____

   _____

   Confidence Rating: _____

8. What time did the break-up occur? (To the nearest hour, AM or PM):

   _____

   Confidence Rating: _____

9. What were you and your former partner doing prior to break-up?_____

   _____

   Confidence Rating: _____

10. Approximately how many times have you related this story of your break-up with your former partner to another person?_____

11. Approximately how many times have you thought about this story of your break-up with your former partner? _____

12. Approximately how many times have you discussed this story with your former partner? _____

Please circle your arousal level at the time of the break-up on the scale provided below.

Couldn't Have Cared Less	Somewhat Aroused/Agitated	Moderately Aroused/Agitated	Very Aroused/Agitated	Extremely Ecstatic
1	2	3	4	5

Please circle the vividness of your memory regarding the break-up on the scale provided below.

Extremely Vague	Somewhat Vague	Moderately Vivid	Very Vivid	Extremely Vivid
1	2	3	4	5

Please circle the level of surprise you experienced after the break-up on the scale provided below.

Couldn't Have Cared Less	Somewhat Surprised	Moderately Surprised	Very Shocked	Absolutely shocked/amazed
1	2	3	4	5

Appendix D: Week two protocol (Study 1)

Subject Number: _____

I have read the below statement, understand my rights, and agree to these conditions.

Signature:_____

Name		Student ID	
Address		Telephone	
City, State		Zip Code	
Date		Class Year	
Professor		E-mail	

Tear along the above line and keep the bottom portion for your records.

This experiment looks at how people respond to interactions of varying types. All responses will be kept confidential and will only be used for the purpose of this experiment.

All participants will be asked to take a 500mg dose of either Tylenol or a placebo. Therefore, if you are currently taking any medications or are allergic to Acetenphinmen, we ask that you do not complete this study. You will be asked to view a short video clip that will be about 3 minutes in length and then answer a questionnaire that should take approximately 30 minutes. After that you will complete another questionnaire regarding a past experience. You will also be asked to return one week later to complete a second questionnaire that will take no longer than 20 minutes to complete. This experiment is completely voluntary. You may discontinue your participation at any time, and any information that you provided will not be used. If you should decide to cease your participation or withdraw from this study, you will not be penalized in any way.

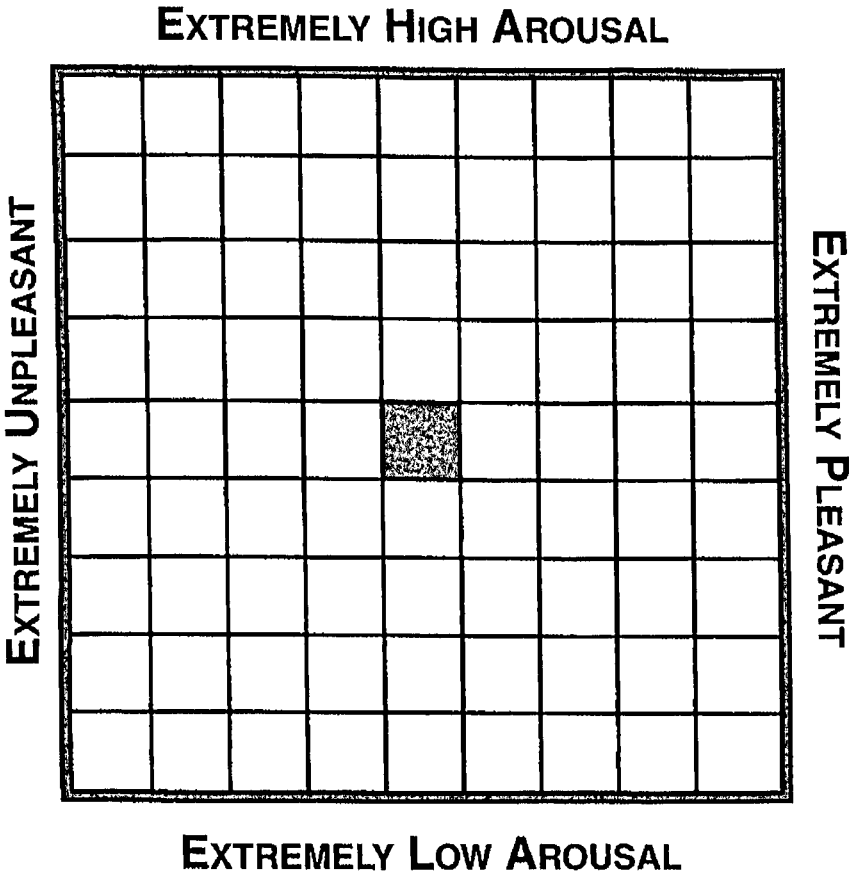
Please note: Based upon your responses to the MDI, you may not be eligible to participate in this research.

Please do not discuss this study with anyone during or after the experiment. At your request, we will fully inform you as to the nature of this experiment no later than one month from your participation. Thank you.

If you have any questions, please feel free to contact:
Karina Hamamouche
317-529-3948
khamamou@butler.edu

Dr. Neil Bohannon
317-940-9240
nbohannon@butler.edu

Please fill in the box that best describes your current state of arousal and pleasantness.



Last week, you asked a person in the video out on a date. Unfortunately, they declined your invitation. You want advice from your best friend who is abroad and you have to explain to them the situation. Please compose an e-mail to your friend explaining what happened. Please include a description of the person in the video (both physical and what they said), your invitation, and their response to you.

Please answer the following questions with regards to the video you viewed one week ago:

On a scale from 1 to 7, how attractive did you think the person in the video was, 1 being not attractive at all and 7 being extremely attractive:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your compatibility with the person in the video, 1 being not compatible at all and 7 being extremely compatible:

1 2 3 4 5 6 7

On a scale from 1 to 7, how surprised were you that the person in the video turned down your invitation, 1 being not surprised at all and 7 being extremely surprised:

1 2 3 4 5 6 7

On a scale from 1 to 7, how disappointed were you that the person in the video turned down your invitation, 1 being not disappointed at all and 7 being extremely disappointed:

1 2 3 4 5 6 7

Please answer the following questions to the best of your knowledge. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

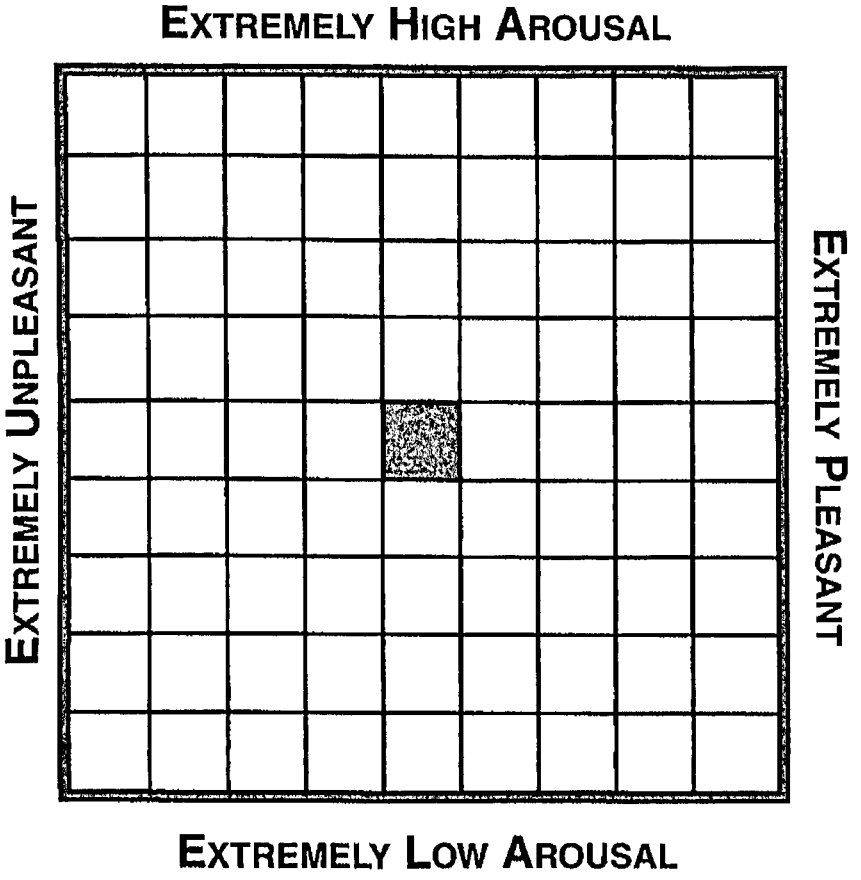
Approximately how many times have you thought about this event to yourself? ☐

_____

Approximately how many times have your elated this story to another person? ☐

_____

Please fill in the box that best describes your current state of arousal and pleasantness.



Please answer the following questions about the video you viewed one week ago to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

1. What color are the suitor's eyes?

Blue **Brown** **Green** **Hazel**

2. What did the suitor have on their head?

Baseball Cap **Sunglasses** **Sports Headband** **Nothing**

3. What color was the pin on their shirt?

Red **Yellow** **Green** **Blue**

4. What was their favorite movie?

Field of Dreams **The Rookie** **Remember the Titan** **Miracle**

5. What was their favorite food?

Cheesecake **Chocolate Pie** **Girl Scout Cookies** **Brownies**

6. Where would they like to travel in the future?

Turkey **Indonesia** **Egypt** **Nigeria**

7. What athletic event does the suitor like to play?

Tennis **Basketball** **Hockey** **Badminton**

8. Who does the suitor enjoy going to movies with?

Parents **Friends** **Brother** **Sister**

9. What is the name of the restaurant that the suitor enjoys going to?

Recess **Room 4** **Don Pablos** **Imo's**

Please answer the following questions about the video viewed one week ago to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

5. What color was the suitor's hair? ☐

6. What did the suitor wear around their neck? ☐

7. What color shirt was the suitor wearing? ☐

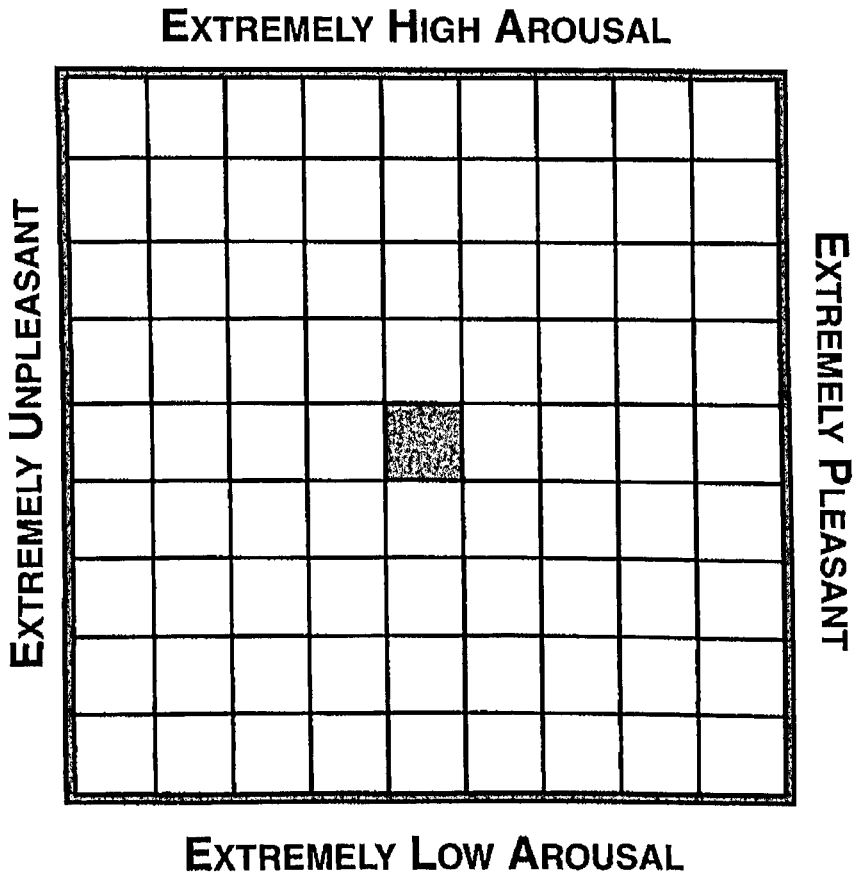
8. Where does the suitor travel every summer? ☐

9. What does the suitor enjoy eating (besides chocolate pie)? ☐

10. What is the name of the actor in the suitor's favorite movie? ☐

11. What are the names of the individuals that the suitor goes to movies with? ☐

Please fill in the box that best describes your current state of arousal and pleasantness.



Appendix E: Week one protocol (Study 2)

Subject Number: 9

I have read the below statement, understand my rights, and agree to these conditions.

Signature:_____

Name		Student ID	
Address		Telephone	
City, State		Zip Code	
Date		Class Year	
Professor		E-mail	

Tear along the above line and keep the bottom portion for your records.

This experiment looks at how people respond to interactions of varying types. All responses will be kept confidential and will only be used for the purpose of this experiment.

All participants will be asked to take a 500mg dose of either Tylenol or a placebo. Therefore, if you are currently taking any medications or are allergic to Acetenphinmen, we ask that you do not complete this study. You will be asked to view a short video clip that will be about 3 minutes in length and then answer a questionnaire that should take approximately 30 minutes. After that you will complete another questionnaire regarding a past experience. You will also be asked to return one week later to complete a second questionnaire that will take no longer than 20 minutes to complete. This experiment is completely voluntary. You may discontinue your participation at any time, and any information that you provided will not be used. If you should decide to cease your participation or withdraw from this study, you will not be penalized in any way.

Please note: Based upon your responses to the MDI, you may not be eligible to participate in this research.

Please do not discuss this study with anyone during or after the experiment. At your request, we will fully inform you as to the nature of this experiment no later than one month from your participation. Thank you.

If you have any questions, please feel free to contact:
Karina Hamamouche
317-529-3948
khamamou@butler.edu

Dr. Neil Bohannon
317-940-9240
nbohannon@butler.edu

You may go on to the next word search if you complete this one:

N Y F H X O J G A W L C C S S S B
Y N R Q O O C T E L E O Q T C T U
L C N A R L H S A F M V O R H R L
N H A D R E C B E M K K H A W A L
I R A M R B T O U R W K L L I E D
X N O T R E I N M N Z B D A T N O
U J O M K A I L E B E X R R Z I G
Y N Z S E C H A N D V X X E E F L
T T A D A C F P J I U I J B R U V
V B Q T E L W Z W I W C N I J X S
A L I L L Y H A L L M R A L W S T
M O B I V H X D R D I H I T E B K
N J W U H U J Z X T S S Q N I A I
P D J I Z Y O K N A D E I G S O C
N I A T N U O F R A T S Y I S W N
E U H A L L A G B L U E T W O R Q
L B N Z B M S G Q B V X I W R W P

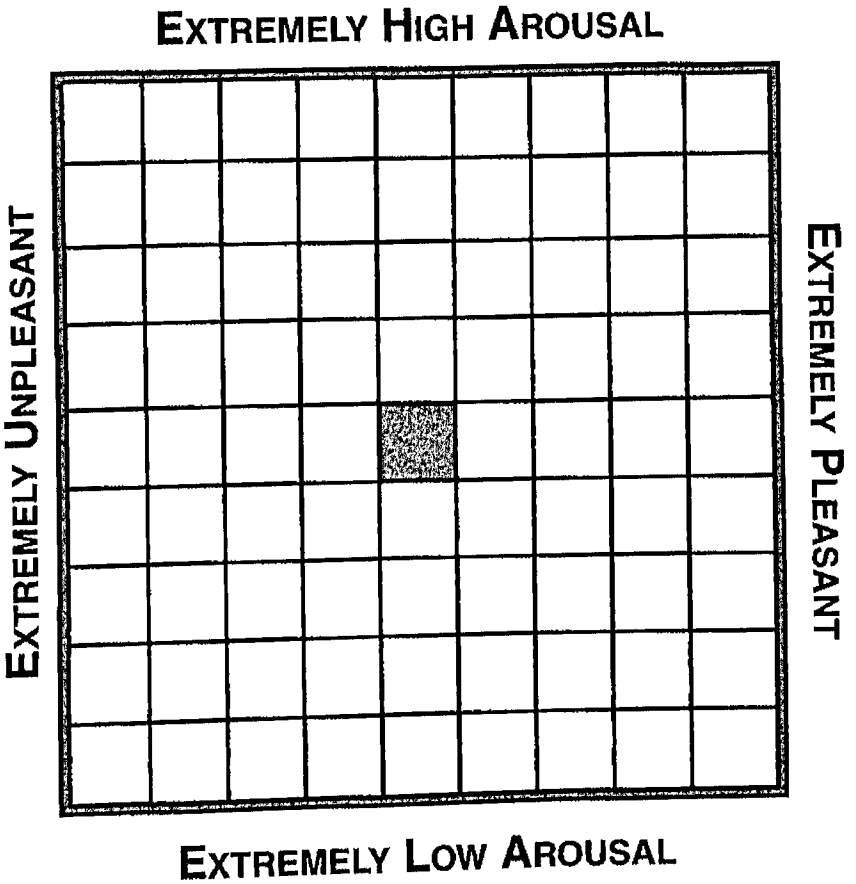
ATHERTON
BASKETBALL
BLUETWO
BULLDOG
BUSINESS
COMMUNICATION
DANKO
SCHWITZER
EDUCATION
FINEARTS
GALLAHUE
HOLCOMB
IRWINLIBRARY
JORDAN
STARFOUNTAIN
LIBERALARTS
LILLYHALL
PHARMACY
RESCO
ROSS

Please do the word search until you receive further instruction from the experimenter:

R O B S J B E O P C K O H K L E Y
D E S K N G P R N H P I H A B D F
L Z D N E M X G Y O G K P E E U N
A X J L D Y C A H H B T B R D C T
S B L Z O G K N L J O C U U S A V
Y O C X T F O I T P N P T T R T D
C T C X K T G Z W E R W L U O I R
Z D A Q E H H A J Y X Z E F S O A
C V D B T Z V T V Y N T R O S N C
S P O E Y F B I R S H D B P E M E
K O R R Q K R O W E M O H O F Q T
K K S Z R E N N A L P Y A D O R O
O U N I V E R S I T Y E V D R K N
M E E T I N G B F Q O J N E P M S
R E D N I B L R Q E G V P C T F W
U P B N H O K D E T R A B O I K Q
J E K J I B M D I H P G P V N L P

BINDER
BUTLER
COLLEGE
DAYPLANNER
DESK
EDUCATION
FOLDER
FUTURE
HIGHLIGHTER
HOMEWORK
LAPTOP
MEETING
NOTEBOOK
NOTECARD
ORGANIZATIONS
PAPER
PENCIL
PROFESSORS
TEXTBOOKS
UNIVERSITY

Please fill in the box that best describes your current state of arousal and pleasantness.



Please answer the following questions:

Are you currently in a relationship? (please circle) **Yes** **No**

If yes, then for how long? _____

If you're **not** in a relationship, how interested are you in being in a relationship, 1 being no interested at all and 7 being extremely interested:

1 **2** **3** **4** **5** **6** **7**

On a scale from 1 to 7, how attractive do you think you are, 1 being not attractive at all and 7 being extremely attractive:

1 **2** **3** **4** **5** **6** **7**

STOP! DO NOT CONTINUE UNTIL YOU RECEIVE FURTHER INSTRUCTION FROM THE EXPERIMENTER!

After viewing the video clip, please answer the following questions:

On a scale from 1 to 7, please rate the attractiveness of the person in the video, 1 being not attractive at all and 7 being extremely attractive:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your interest in the person in the video, 1 being not interested at all and 7 being extremely interested:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your desire to ask the person in the video on a date, 1 being no desire at all and 7 being a great desire:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your confidence in person in the video accepting your date, 1 being not confident at all and 7 being extremely confident:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your compatibility with the person in the video, 1 being not compatible at all and 7 being extremely compatible:

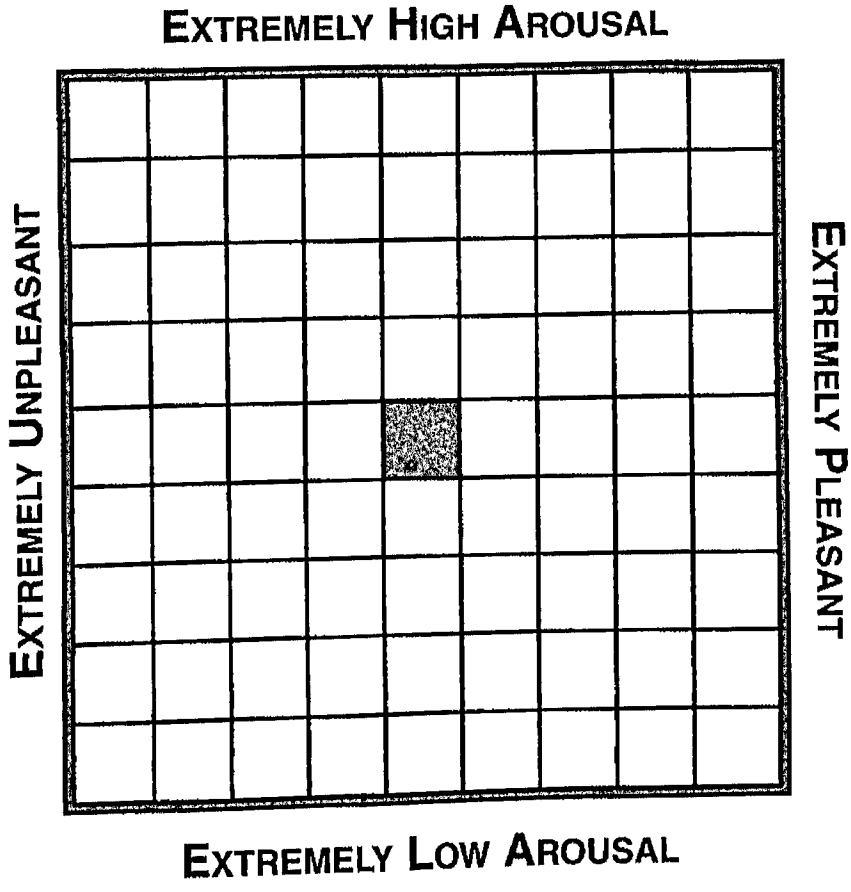
1 2 3 4 5 6 7

After watching this video, please describe in detail how you would like to ask this person on a date. Please limit to **eight sentences**.

On a scale of 1 (not confident at all) to 7 (extremely confident), how confident are you that the suitor will accept your request for a date, 1 being not confident at all and 7 being extremely confident:

1 **2** **3** **4** **5** **6** **7**

Please fill in the box that best describes your current state of arousal and pleasantness.



STOP!

DO NOT CONTINUE UNTIL YOU RECEIVE FURTHER INSTRUCTION FROM THE EXPERIMENTER!

After viewing the video clip, please answer the following questions:

On a scale from 1 to 7, how surprised were you that the suitor turned down your invitation, 1 being not surprised at all and 7 being extremely surprised:

1 2 3 4 5 6 7

On a scale from 1 to 7, how disappointed were you that the suitor turned down your invitation, 1 being not disappointed at all and 7 being extremely disappointed:

1 2 3 4 5 6 7

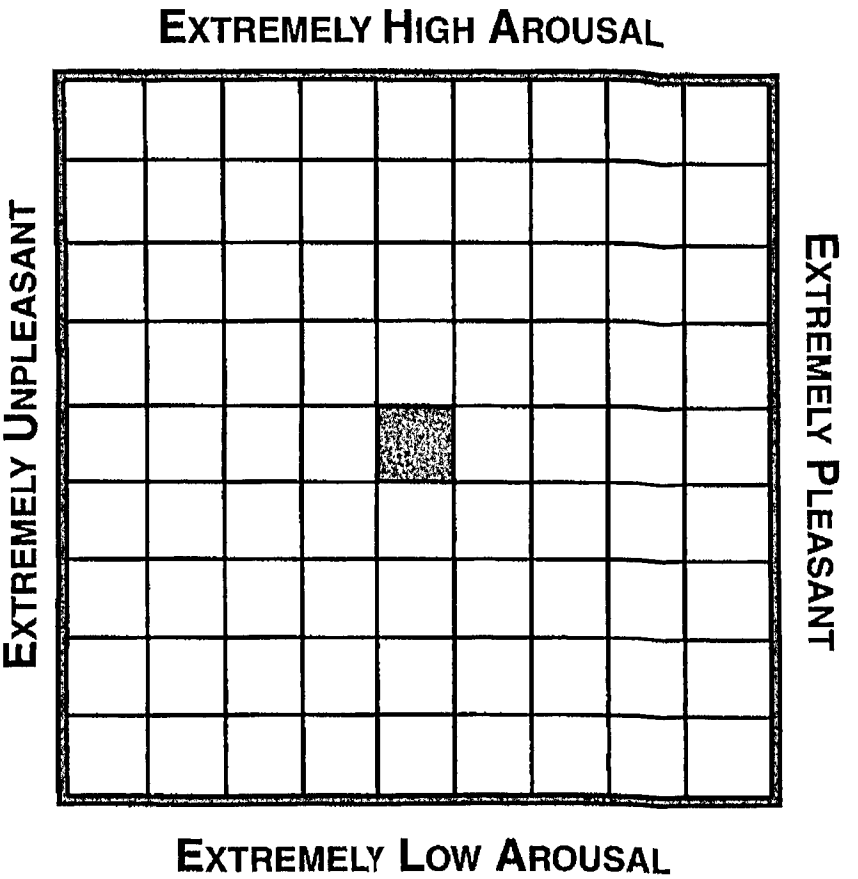
Please do the word search until you receive further instruction from the experimenter:

E N K K G D K R W L Z D V N Z R W
D D I E F N Y L T P G O Z J A F Y
T Q X M U N I I T R U G O Y L N W
D S S T R E A M E R S E P P L O L
X R X W R E P A P S W E N T E T T
K E E F Y U V T X L N U E R R U N
I T S S T Q C P A B S B T S B F A
A U Y W S A V P P J A E Q R M V P
L P G W L E I O X H S C M T U W M
B M V B E C R Y P V I T A M I N N
H O A R N K T L B C G D W K Z V S
Y C M I E K A J F C J U X Q K Z E
U M R C T C J N O I T A C U D E S
V P A R O L R A P S E L P P A Q S
E R W C C W R O Z J A G U A R B A
T S I T N E D R P A N C A K E D L
A E K S T E R E O R E P M U B V G

ALPHABET
APPLE
BUMPER
COMPUTER
DENTIST
DRESSER
EDUCATION
FUTON
GLASSES
JAGUAR
NEWSPAPER
PANCAKE
PARLOR
PRINCIPAL
QUEEN
STEREO
STREAMERS
UMBRELLA
VITAMIN
YOGURT

Unfortunately, the person in the video declined your invitation for a date. You want to tell your best friend who is abroad about what happened. Compose an e-mail to your friend explaining what happened. Describe the person in the video and their interests (as much as you can remember) your invitation, and their response to you.

Please fill in the box that best describes your current state of arousal and pleasantness.



Please answer the following questions about the video to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

1. Where did the person in the video just return from? (Circle the correct answer)

Spain **Bulgaria** **France** **Egypt** ☐

2. What is the video person's favorite food? ☐

_____

3. What is the video person's favorite restaurant? (Circle the correct answer) ☐

Recess **Room 4** **Barcelona Tapas** **Imo's**

4. What is the major of the person in the video? ☐

_____

5. What is the video person's favorite culture? (Circle the correct answer) ☐

Thai **Ethiopian** **Egyptian** **African**

6. Where would the video person like to travel? ☐

_____

7. On which culture is the video person doing their honor's thesis? (Circle the correct ☐

answer)

Thai **Ethiopian** **Egyptian** **African**

8. What movie did the video person recently see? ☐

_____

Please answer the following questions about the video to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

9. What is the video person's favorite food? (Circle the correct answer)

French **French** **Spanish** **Ethiopian** ☐

10. What prompted the video person's major? ☐

_____

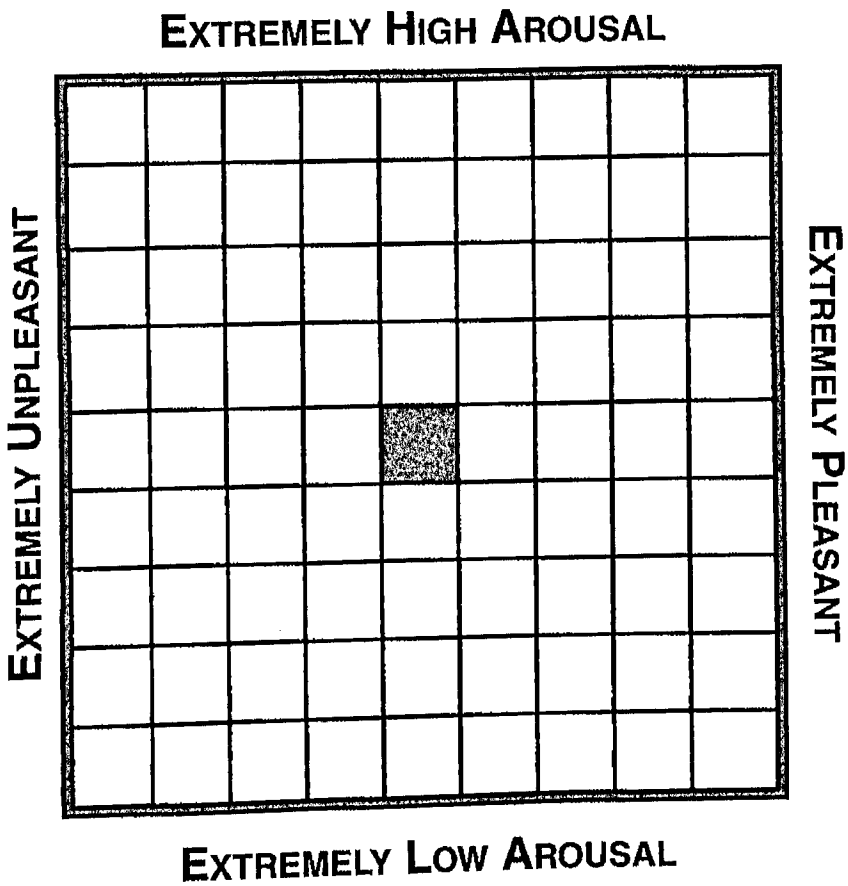
11. What is one of the video person's favorite movies? (Circle the correct answer) ☐

Midnight in Paris **Fast 5** **Titanic** **21 Jump Street**

12. Who does the video person enjoy seeing movies with? ☐

_____

Please fill in the box that best describes your current state of arousal and pleasantness.



IMPORTANT: Please do not share the information of this study with any other students or friends!

Appendix F: Week 2 protocol (Study 2)

Subject Number:____9___
I have read the below statement, understand my rights, and agree to these conditions.
Signature:_____

Name		Student ID	
Address		Telephone	
City, State		Zip Code	
Date		Class Year	
Professor		E-mail	

Tear along the above line and keep the bottom portion for your records.

This experiment looks at how people respond to interactions of varying types. All responses will be kept confidential and will only be used for the purpose of this experiment.

All participants will be asked to take a 500mg dose of either Tylenol or a placebo. Therefore, if you are currently taking any medications or are allergic to Acetenphinmen, we ask that you do not complete this study. You will be asked to view a short video clip that will be about 3 minutes in length and then answer a questionnaire that should take approximately 30 minutes. After that you will complete another questionnaire regarding a past experience. You will also be asked to return one week later to complete a second questionnaire that will take no longer than 20 minutes to complete. This experiment is completely voluntary. You may discontinue your participation at any time, and any information that you provided will not be used. If you should decide to cease your participation or withdraw from this study, you will not be penalized in any way.

Please note: Based upon your responses to the MDI, you may not be eligible to participate in this research.

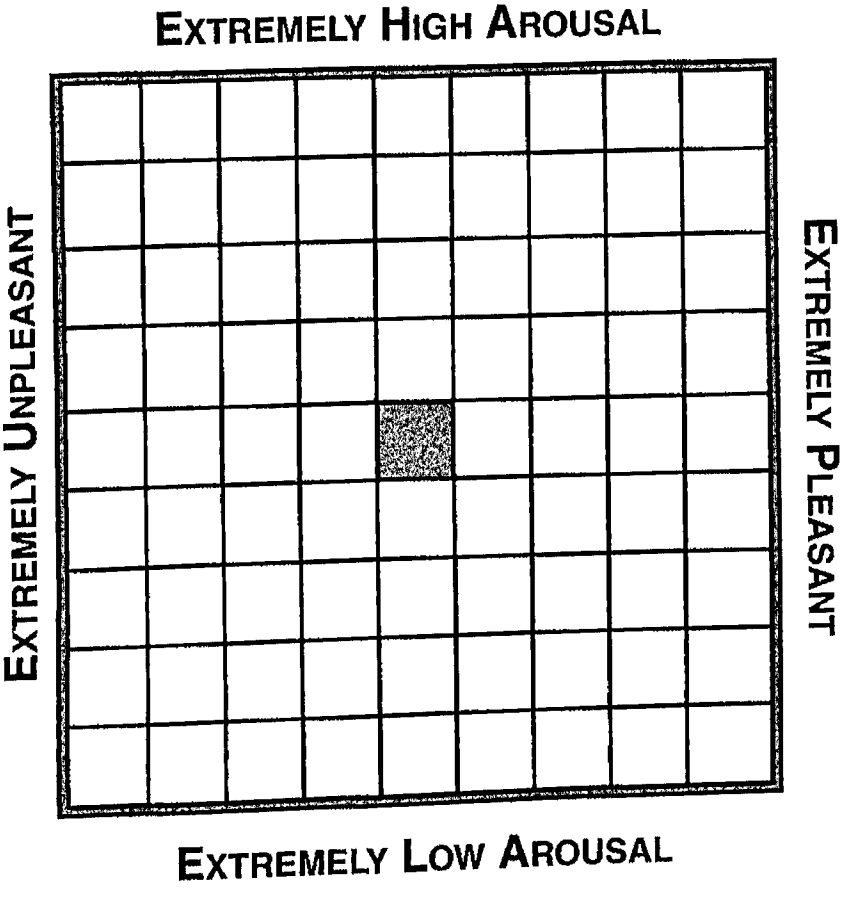
Please do not discuss this study with anyone during or after the experiment. At your request, we will fully inform you as to the nature of this experiment no later than one month from your participation. Thank you.

If you have any questions, please feel free to contact:

Karina Hamamouche
317-507-8706
khamamou@butler.edu

Dr. Neil Bohannon
317-940-9240
nbohannon@butler.edu

Please fill in the box that best describes your current state of arousal and pleasantness.



Last week, you asked a person in the video out on a date. Unfortunately, they declined your invitation. You want to tell your best friend who is abroad about what happened. Compose an e-mail to your friend explaining what happened. Describe the person in the video and their interests (as much as you remember), your invitation, and their response to you.

Please answer the following questions with regards to the video you viewed one week ago:

On a scale from 1 to 7, how attractive did you think the person in the video was, 1 being not attractive at all and 7 being extremely attractive:

1 2 3 4 5 6 7

On a scale from 1 to 7, please rate your compatibility with the person in the video, 1 being not compatible at all and 7 being extremely compatible:

1 2 3 4 5 6 7

On a scale from 1 to 7, how surprised were you that the person in the video turned down your invitation, 1 being not surprised at all and 7 being extremely surprised:

1 2 3 4 5 6 7

On a scale from 1 to 7, how disappointed were you that the person in the video turned down your invitation, 1 being not disappointed at all and 7 being extremely disappointed:

1 2 3 4 5 6 7

Please answer the following questions to the best of your knowledge. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

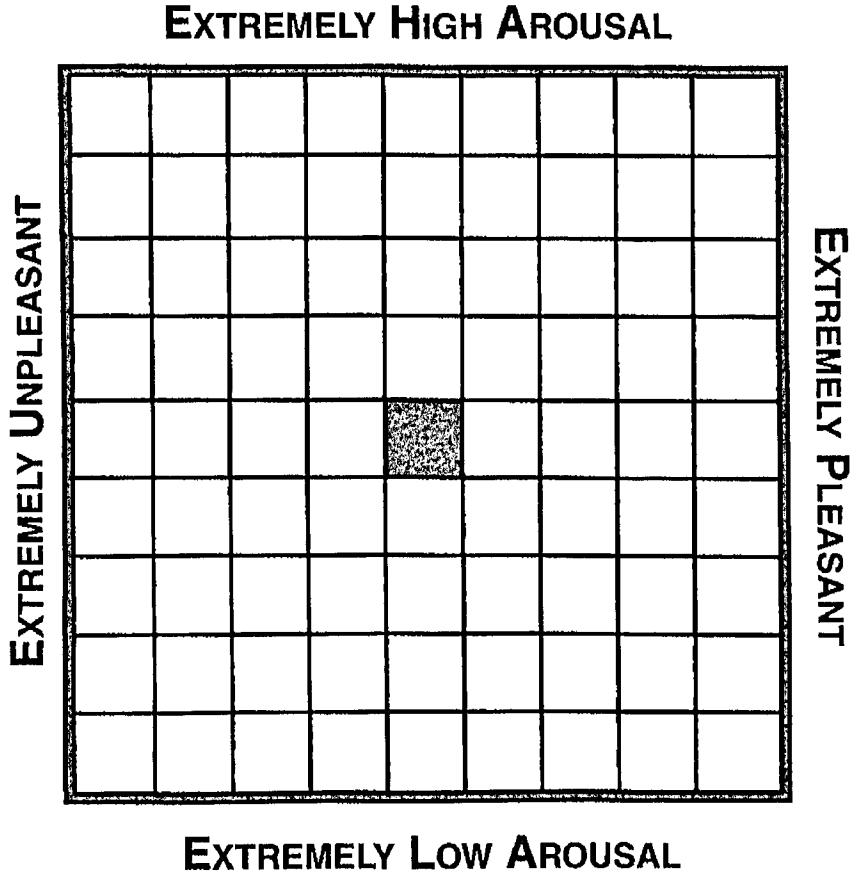
Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

Approximately how many times have you thought about this event to yourself? ☐

Approximately how many times have your elated this story to another person? ☐

Please fill in the box that best describes your current state of arousal and pleasantness.



Please answer the following questions about the video to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

1. Where did the person in the video just return from? (Circle the correct answer).

Spain **Bulgaria** **France** **Egypt** ☐

2. What is the video person's favorite food? ☐

_____

3. What is the video person's favorite restaurant? ☐

Recess **Room 4** **Barcelona Tapas** **Imo's**

4. What is the major of the person in the video? (Circle the correct answer) ☐

_____

5. What is the video person's favorite culture? ☐

Thai **Ethiopian** **Egyptian** **African**

6. Where would the video person like to travel? (Circle the correct answer) ☐

_____

7. On which culture is the video person doing their honor's thesis? ☐

Thai **Ethiopian** **Egyptian** **African**

8. What movie did the video person recently see? (Circle the correct answer) ☐

_____

Please answer the following questions about the video to the best of your recollection. Also, please rate your confidence in each answer according to the scale below. If you do not know the answer, please guess to the best of your abilities and rate your confidence as a '1':

Not sure at all	Somewhat confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

Confidence Rating

9. What is the video person's favorite food? ☐

French **French** **Spanish** **Ethiopian**

10. What prompted the video person's major? (Circle the correct answer) ☐

_____

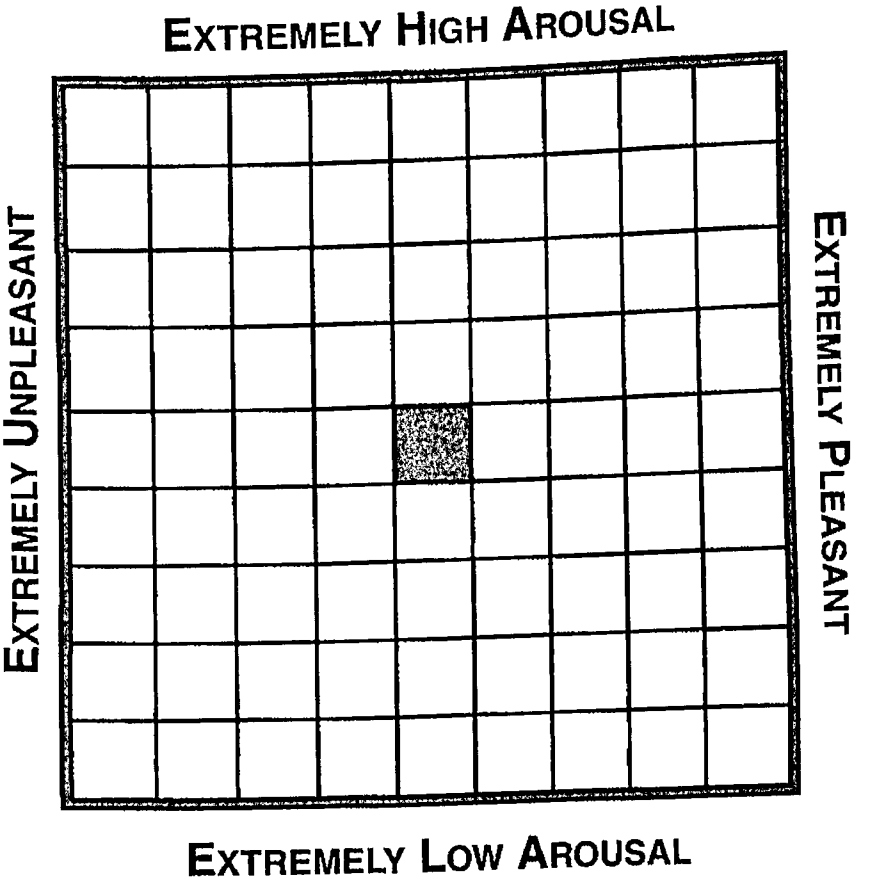
11. What is one of the video person's favorite movies? ☐

Midnight in Paris **Fast 5** **Titanic** **21 Jump Street**

12. Who does the video person enjoy seeing movies with? (Circle the correct answer) ☐

_____

Please fill in the box that best describes your current state of arousal and pleasantness.



Appendix G: Study 1 Video Scripts

Romantic Rejection: Introduction

"Hey! It's nice to meet you. Let me tell you a little about myself. I'd like to think that I am pretty athletic. This is pretty embarrassing but I LOVE to play badminton with my brother. Every weekend we set up the net and shoot around. I also love to travel. I drive up to the sand dunes in Northern Indiana every summer. I've always wanted to see the pyramids in Egypt. I also love going to the movies with my three best friends, Sam, Joe, and Alex. My favorite movie is "Field of Dreams" with Kevin Costner. I like to go to local restaurants that aren't advertised and tourists wouldn't know about like Recess on the eastside. My favorite food is chocolate pie, but I also love Mexican food....burritos in particular. I am currently single and looking for a relationship. If you're interested, I'd love to hear from you!"

Romantic Rejection: Polite (Circumstantial) Rejection

"Oh, I'm sorry. I think you're really nice and attractive but I've already made plans for that day. Even though I am starting a relationship with someone else, I'd really like to get to know you. You have such a great personality and I think we could really get along. I don't want you to be upset. Can we be friends?"

Romantic Rejection: Harsh (Fitness) Rejection

"Are you kidding?! I have standards and I'm a way out of your league. You are hideous, you write gibberish and seem basically stupid. Your children would be so handicapped, I cannot even begin to THINK about going out with you at all! You should find someone less attractive to accept your obvious flaws."

Appendix H: Study 2 Video Scripts

Romantic Rejection: Introduction (Study 2)

"Hi! It's nice to meet you, let me tell you a little about myself. I love to travel. I recently got back from a two-week trip to Sofia, Bulgaria and I've always wanted to see the pyramids in Egypt. I love to go out to eat to restaurants that aren't advertised and that tourist wouldn't really know about. Spanish food is my favorite. I especially love gazpacho and Barcelona Tapas is my favorite restaurant. My appreciation in foreign culture is what prompted International studies as my major. Ethiopian culture is my favorite, but I'm doing my honors thesis on Thai culture. I love to go out to action movies with my friends. I was so excited when the Avengers came out. But I love Midnight in Paris, too. I am currently single and looking for a relationship. So, if you are interested, I'd love to hear from you."

Romantic Rejection: Polite (Circumstantial) Rejection (Study 2)

Off camera voice: "What did you think of subject number 9?"

PRI: "You're going to edit this right? S/he seemed really nice and pretty cute. It's too bad that I recently met someone that I'm really interested in. But number 9 seems like a really great girl/guy, nothing against her, just bad timing I guess. Is s/he going to see all of this?"

Romantic Rejection: Harsh (Fitness) Rejection (Study 2)

Off camera voice: "What did you think of subject number 9?"

PRI: "You're going to edit this right? Oh her/him! Come on did you see her/him? Did you read what s/he wrote? I am way out of her/his league, mentally and physically. I

Appendix I: Debriefing Script

Thank you very much for your participation in this study. The purpose of this study is to determine whether or not there is a memory affect while using Tylenol. It is important that you know that the rejection you received was simply a video. The rejection was in no way a reflection on you as a person and everyone in this study will receive a form of rejection. There were two possible ways in which you could have been rejected and that rejection was determined randomly. Again, thank you for your participation and feel free to contact Dr. Bohannon or myself if you have any questions or concerns.