Effects of Disgust on Relational Memory

Natalie Arch
Abstract

The purpose of the current study was to determine whether memory for associations between parts of an event that is negative depends on which negative emotion it is, particularly disgust. Participants were instructed that they would see pictures of locations, revealed one by one. Participants were told that they would be presented with one of three scenarios in each of the locations. There were three conditions (disgust, reward and neutral) and after viewing location pictures, participants were handed a clear plastic bag with a piece of candy in it. In the neutral condition the was candy alone, in the reward condition the candy was with a ten dollar bill and in the disgust condition the candy was with a feminine pantyliner stained with fake blood from a costume store. Memory for location picture/candy combination was assessed with an associative recognition test. Participants had to indicate whether the pairs seen were intact or rearranged. Recall was also assessed; participants were asked to indicate what treatment went with each candy. Brief questionnaires (DPSS-R and VOCI) were used to assess disgust sensitivity. Disgust did not prove to increase participant associative recognition of location picture/candy pairs. Those higher in disgust were less likely to recall pairs in the disgust treatment. Effect of emotion on recall for what appeared in the bag with the candy was not significant overall. The current study illustrates that personality factors and individual differences are important factors when analyzing effects of disgust on memory. How sensitive someone is to disgust may impact memory.

Keywords: Disgust; Associative Memory; Location
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EFFECTS OF DISGUST ON RELATIONAL MEMORY

By

NATALIE E. ARCH

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Dr. Colleen Kelley  
Thesis Director

Dr. Mike Kaschak  
Committee Member

Mr. Mark Zeigler  
Outside Committee Member
From an evolutionary perspective, emotions are seen as adaptations that help to synchronize bodily functions (Nesse and Ellsworth 2009). These physiological, cognitive, motivational, behavioral and subjective response patterns aid in the ability to meet and overcome specific situations. A diverse range of information is necessary in order to remember complex events (Chalfonte & Johnson 1996). Information necessary includes the particulars of time and/or setting of the event and other details that were important to the participant or observer, such as associated emotion, parameters of items, etc. Complex memories are dependent upon recollection of the particular components of stimuli and cognitive processes that bind the features together. The current study seeks to further examine the linking of memory with the emotion of disgust and whether explicit associative memory for disgusting events can be enhanced.

In comparison to the Zimmerman and Kelley (2010) study where word pairs were used, we will use a more naturalistic disgust situation by manipulating food items in the lab using the concepts of contagion and contamination. To demonstrate the power of disgust and how linking arousal of this emotion may lend itself to better recollection of a particular item in contrast to a neutral group, we intend to stimulate disgust in the participants and then have them engage in an associative memory task. Making participants attend to specific scenarios involving locations and food items, we predict that there will be better memory for location/food combinations that were intact in the memory task. After viewing the combinations, a feeling of familiarity should work together with the ability to recall certain types of information (disgust vs. neutral), resulting in more memory for intact items than rearranged where familiarity alone is not sufficient.
Specific emotions aid our ability to deal with different situations. Paying more attention to a disgusting or negative event so that similar situations can be avoided in the future is advantageous to a species’ survival. Heath, Bell and Sternberg (2001) outline seven different domains that commonly elicit disgust: unusual sexual activity, contact with bodily substances, violations of hygiene, ingestion of inappropriate food/bodily substances, death, envelope violations in which the body is cut or pierced, and contact with animals. Rozin, Millman and Nemeroff (1986) define disgust as revulsion at the possibility or expectation of ingesting a repugnant substance. Although the source of disgust can vary inter-culturally, reactions to feces and other body products tend to be universal as well as certain parts of most animal species. The discrete emotion of disgust has not been exhaustively studied, but relatively recent findings show it has a powerful effect on human behavior and memory. Are there specific memorial consequences of emotionally evocative stimuli, specifically disgust?

Investigating the way emotion affects memory, predictions have been made that emotional stimuli are better remembered in general. What is the mechanism by which memory for emotional events is enhanced? The amygdala (a component of the limbic system also linked to emotion) plays a vital role in encoding event details. Its specific role, though, is dependent on the particular type of detail that is appraised. Negative arousing items are more often remembered correctly than neutral items (for a review, see Kensinger & Schacter, 2008). They found that processing of emotional information in the amygdala or orbitofrontal cortex (domain-specific processes) actually increase the probability that memory for emotional items would be accurate. Although they note these processes in the amygdala during encoding of negative arousing items, they also
comment that the hippocampus was highly correlated with this activity. The hippocampus is known to have a major function in binding items and their context together. Why, therefore, would it be involved in encoding negative arousing information? Kensinger and Schacter suggest that limbic modulation of the same processes, such as hippocampal-binding mechanisms, are usually employed to remember the details of non-emotional information. Recording memory for details of an emotional event does not necessarily involve bringing “on-line” a completely separate set of processes in order to aid recollection. Instead, the areas of the brain working together seem to produce better recollection of items associated with negative arousal.

Recent research conducted by Zimmerman and Kelley (2010) tested the emotionality of word pairs and using cued recall for positive, negative or neutral words to assess how they relate to memory monitoring during encoding. Positive word pairs, such as perfume-bunny, were recalled more than both neutral and negative word pairs, contrary to prediction that emotional words in general are better remembered. In free recall, words representing discrete emotions of fear, anger, sadness, and disgust were better recalled than neutral words. This fits with general research on the effects of emotional stimuli on memory (Kensinger & Schacter 2008). However, when discrete negative emotions were studied in a cued recall study (Zimmerman and Kelley, unpublished), participants were better able to recall targets of disgust words paired with disgust cue words, compared to neutral cues and targets. Cued recall from anger pairs was lower than neutral pairs and cued recall from sadness and fear pairs were not different from neutral. Word pairs arousing disgust, for example vomit-maggot, were recalled more than word pairs such as pest-blackmail that aroused anger. These results
suggest special memory consequences when disgust is provoked. What is this special link between disgust and memory?

When creating episodic memory for a particular event, different elements come together in a bound memory for components (Pierce & Kensinger, 2011). An episodic memory for a given event might include general, contextual information (temperature, smells, emotions about the event, etc.), as well as specific information about the event itself, such as what happened, who was there, etc. Researchers have speculated on how emotion affects binding in memory. On one hand it has been suggested that the presence of emotionally arousing information should facilitate associative binding. Alternatively, it has also been suggested that emotion may facilitate the binding of features within the item, to the detriment of binding the items. Therefore, emotional information would prove to be distracting because attention would be focused on the arousing item rather than the information that did not have emotional significance, leading to worse memory.

For example, when analyzing the effects of negative emotion on the elements of memory, Kensinger, Garoff-Eaton, and Schacter (2007) presented participants with scenes with different kinds of objects and backgrounds. Some pictures had negative objects and neutral backgrounds while other images had a neutral object and a neutral background. Details of the negative objects were better remembered than neutral items when they were with neutral backgrounds. Conversely, the details of the neutral background were not remembered as well when there was a negative object in front of it, indicating that the type of detail that is evaluated can influence the effects of emotion on memory for details.

Disgust is conceptualized as a defensive emotion. Charash, McKay and Dipaolo (2006) studied attention bias and the recall of disgusting words, finding a significant bias
for disgusting information when presented in an implicit format as words on a Stroop Test. Interestingly, the bias was only significant when fear was primed initially. The attention bias states that all emotional disorders share hypersensitivity to significant or particularly relevant environmental stimuli. This early detection system would be to our advantage as a species, taking away energy from certain nonessential systems in order to prepare for action. Participants were given a Stroop Test where words were presented on a computer screen and were then replaced by a series of X’s of the same character length and color. Charash et al. found that a significantly greater number of words associated with disgust and fear were recalled compared to neutral words after participants were primed with either a disgusting, fear inducing or neutral story. Also, the higher the participant’s sensitivity to disgust, the greater their bias towards recall for disgusting words. This shows that there is heightened environmental monitoring for information pertaining to disgust.

To further emphasize the importance of linking contamination to memory, Oaten, Stevenson and Case (2009) state that the emotion of disgust is one of the most important responses for humans as a disease avoidance mechanism. Explicit knowledge of the contamination of an object by something that elicits disgust is necessary. They hypothesize that densely amnesic participants should not experience contamination. People must know the history of the event of contamination and if they cannot explicitly recall what it is or where the contaminant has been, they should not be able to have a disgusted reaction. Rather than simply knowing that something is contaminated, the person needs to be aware of the contaminant and with what it has come into contact.
Rozin, Millman and Nemeroff (1986) conducted a disgust study to test the law of contagion and how it plays a part in American culture. The law of contagion states that once things come in contact, they have the power to influence each other through the transfer of some of their properties. Even after the objects are no longer touching, the influence still remains and continues. In their study, Rozin et al. tested the effects of contact between juice and a sterilized, dead cockroach. Participants were asked which type of juice (apple or grape) they would prefer. They were then asked to rate how much they would like to drink more of it. The cockroach was then dipped into a sample of their preferred juice and removed with a clean plastic spoon. Results demonstrated that negative properties were perceived when participants were presented with a new, clean sample of juice, therefore decreasing their overall rating of the juice.

The concept of contagion was also studied in a marketing research study that aimed to test whether or not participants would remember a specific product that was touched, or “contaminated” by a product they deemed disgusting in nature. Morales and Fitzsimons (2007) suggest that consumers believe products perceived as “disgusting” are able to contaminate other products by transferring their offensive properties on contact (even through packaging) and these contaminating effects persist even after the products are no longer in contact. Thus, everyday consumers believe disgusting products can contaminate non-disgusting products, thereby making them less appealing. Participants in a classroom setting were shown four products on a table: feminine napkins, chocolate chip cookies, breakfast cereal and facial tissue. The feminine products were touching the chocolate chip cookies as the students briefly walked by. After they returned to their seats, class resumed. At the very end of class students were asked to rate the quality of
the chocolate chip cookies and how much they wanted to try them. The results exhibited that even after the full class length, contagion persisted and the students were less likely to want to try the cookies or describe them as a quality product compared with control condition where none of the products were touching. Whether or not a participant would have a persisting negative attitude toward disgusting products was also tested. The cognitive capacity of participants was manipulated by utilizing a digit rehearsal task. Consistent with their prediction, participants still wanted to try the cookies more when they were not in contact with the “disgusting” product. The results of their experiment exhibited that even after a lapse of time and constrained cognitive capacity, the concept of contagion and contamination persisted and the participants were less likely to want to try the target product. This link of contamination was memorable, indicating there is something about disgust that endures in memory after visualizing the contamination.

Is memory for disgusting events especially good? Bell and Buchner (2010) tested participants’ source memory along with old-new discrimination after viewing pictures of people who were supposedly cheaters. Negative information, especially threatening information, attracts attention more readily than does neutral and positive information and their recent study sought to test whether a source memory advantage would generalize to faces associated with negative (disgusting) contexts. Disgusting behaviors were chosen because it is a powerful emotion tied to threatening contexts. Participants were shown photographs of people that had descriptions underneath conveying negative (disgusting), positive (pleasant) or neutral information about the person pictured. First, they were asked to rate the likeability of the person. Afterwards, participants were shown a random sequence of faces (half of which were new) and were asked again how likeable
they found this person and if the face was old or new. If the participants indicated that they had seen the face before, they were then asked to remember if the person was disgusting, pleasant, or neither. The results indicated that source memory for faces encountered in negative contexts was higher than source memory for faces encountered in positive contexts and they were also rated as less likeable. In their following experiment they tested whether inter-individual differences in disgust sensitivity would alter the results from the initial experiment. Their findings demonstrated that when disgust sensitivity was compared, the disgust advantage was about 40 percent higher in the high versus low sensitivity group. This correlation between disgust sensitivity and the encoding phase and test phase likeability ratings suggest that the emotional reaction to the behavior descriptions underneath the photograph was mediated by disgust sensitivity (Bell & Buchner 2010). Another function of enhanced binding and associative memory for disgusting things is that it would be an evolutionary advantage to remember people who are associated with disgusting behaviors and stimuli, or are associated with disgusting things. Situations that could lead to ones’ survival and reproductive capabilities being at risk could be avoided if the face of the disgusting individual was encoded to source memory. A source memory task could also be due to affective conditioning, as demonstrated in patients who have Korsakoff syndrome (Johnson, Kim & Risse 1985).

Amnesia in patients who have Korsakoff syndrome results from a deficit in the ability to construct patterns and relationships between ongoing, past, and anticipated events (Johnson, Kim & Risse 1985). This reflection system gives specific memories a sense of “belonging to the self” as things are put into perspective subjectively. Memory
capacity in amnesic individuals draws upon perceptual and stimulus-driven processes and despite lacking the capacity for the reflection subsystem, Korsakoff patients still have the ability to develop affective reactions. Participants would see faces and names and read behavioral descriptions about the person pictured that were positive or negative. Ratings of Korsakoff patients reflected more the influence of feelings and attitudes rather than the influence of specific detailed information. This indicates that reactions based on affect are not necessarily due to recall of information closely tied with the event or information recognition processes. Some items have more room for reflection functions to operate. For example, although their cognitive processing does not go beyond a relatively immediate perceptual event, Korsakoff patients had about the same development of preference for repeatedly heard melodies over a period of time as a control group. On the other hand, when comparing preferences for people over a period of time, they had below normal development of affect in comparison to the control group. In the Bell and Buchner study, good source memory for whether a face had been associated with disgust may have been based on affective conditioned responses, as in amnesiacs, or could have been based on explicit memory for the association between the face and disgusting behavior.

**Experiment 1**

Experiment 1 sought to investigate the emotional modulation of relational memory for different emotions. Does disgust lead to linking between items and objects or pictures associated with the item? Chalfonte and Johnson (1996) note that binding between an item and source features (color, size etc.) is required for memory of complex
events. If feature information (such as location) is available, then judgments about the source of knowledge are more likely to be accurate. The current study placed a special emphasis on whether disgust enhances relational memory. Disgust was induced by presenting a candy in a bag containing what appeared to be a stained feminine napkin. Control pieces of candy were presented alone and positive objects were presented with a ten dollar bill. Each candy was presented with a photograph of a famous location (see Appendix C) because remembering the location of a specific disgust inducing food items would be advantageous. We hypothesize that disgusting stimuli will enhance associative memory for the specific candy-location combination.

Method

Participants. The sample consisted of 30 Florida State University students who participated in exchange for partial course credit. Subjects consisted of 7 men, and 23 women.

Materials. The stimuli for the experiment were 12 pictures of famous locations (e.g., Eiffel Tower, Coliseum, etc.). Pictures were approximately 4x4 inches in size that fit underneath each opaque plastic bowl. 12 different types of candy were chosen that were distinctively different from each other (e.g., Tootsie Roll versus peppermint). At the beginning of each session, a 6x2 grid on a black poster board was set up on a table with the 12 pictures of famous locations, each of which was covered by a bowl, facing the participant. Clear plastic bags were also used to contain candies associated with each of the three conditions. The candies were kept in a plastic bag out of view next to the experimenter.
**Design.** The experiment had three conditions (contamination, reward, and neutral), which was varied between subjects. The experiment assessed people’s memory for objects (pieces of candy) and pictures of famous locations (Eiffel Tower, Stonehenge etc.), when that candy has touched something that looks disgusting but it’s not, i.e. a clean feminine panty liner that has been rubbed with fake blood from a costume store versus a ten dollar bill, or has been untouched. The placement of location pictures was rotated for every board order and a different piece of candy was paired with each picture. There were three board orders, created and rotated to ensure that participants would encounter different treatment/location picture combinations.

There were three different conditions (A, B, and C) with a pre-established randomized placement of pictures on the grid, ten participants were tested with each version so that each candy was tested equally in the disgust, positive, and neutral conditions (totaling 30 participants). Numbers on the back of the bowls corresponded with numbers on each of the bags. This indicated to the experimenter which treatment (neutral, positive, or disgust) went with each location.

**Procedure.** Participants were told that they would see famous locations and were asked to imagine that they were visiting those locations. They were also told that they were both hungry and ran out of money. Participants were then informed that they would be presented with candy each time a location was revealed and the experimenter would uncover each of the locations one-by-one. They were told a clear plastic bag with candy would be handed to them and they would be asked to say out loud what the candy was. The experimenter described that there were three possible scenarios with the history of the candy. In the neutral condition, participants were handed a clear plastic bag
containing only candy. They were told to imagine that they bought the candy from a convenience store in that specific location. For reward items, the bag contained a ten dollar bill. They were told that they found the money on the floor on the way out of a convenience store. In the disgust condition, the presented candy was in a clear plastic bag with a panty liner stained with fake blood from a costume store. They were told to imagine that the bag was a janitor’s trash bag, used to pick up trash and waste receptacles in bathrooms. When location pictures were revealed participants were instructed to pick up the location picture and were asked to say out loud where they traveled to ensure that they attended to the picture. They were then asked to rate on a scale of one to seven (one being not at all and seven being very much) how much they would like to travel to that specific location. After the experimenter recorded participant ratings for the current location, the candies in clear plastic bags were handed to the participants, and after they said out loud what it was, they were asked to rate how much they would like to eat that piece of candy in the location pictured on a scale of one to seven. Ratings were recorded. After they rated both the candy and the location, the experimenter collected the plastic bag and picture, covered it up, and moved onto the next one. A tone went off every 30 seconds in order to keep a standard amount of time per location and candy. This part of the experiment took approximately six minutes.

After all the locations were revealed to the participant, they were given the associative memory test. The associative recognition test was administered via a Power Point presentation. They were told to read the instructions on the screen which detailed that they would see a picture of a location and a picture of a piece of candy together on the screen. They were told to say out loud where the location was, what kind of candy it
was, and if the pair was the same (intact) or not the same (rearranged) as presented in the experiment. Participants were then asked to indicate if the candy was presented alone, with money, or with the feminine panty liner. The experimenter recorded their answers on the assessment form.

Each board order had two different versions of the associative recognition assessment and each version was used on half of the participants for that board order (five participants tested with version A1, five participants tested with version A2, etc.). The associative recognition test was given using a PowerPoint presentation that included twelve different pairs of location pictures and candy pictures. Half of the location/candy picture combinations shown were intact, meaning they were presented together during the experiment, and half of the location/candy pictures were rearranged (not presented together during the experiment). Participants had seen all of the location pictures and candies during the experiment and none of them were new. Of the twelve test pairs, four were associated with the disgust treatment, four with the neutral condition, and four with the reward condition. Two of the four pairs for each condition were intact and two were rearranged. Participants viewed test items individually, and reported whether they were intact or rearranged, and then said what had happened to the candy—presented alone, with the panty liner, or with the ten dollar bill. The experimenter circled participant answers on an assessment sheet, not shown to the participant.

Following the memory test, participants were asked to fill out two brief questionnaires (The Disgust Propensity and Sensitivity Scale-Revised and the VOCI, see Appendix A) (van Overveld et al. (2006) (Thordarson et al. 2004). After they filled out
these personality assessments, they were debriefed, thanked and given credit for participation.

**Results**

Participants’ memory responses to the intact versus rearranged test pairs of candy and location as a function of emotional treatment are shown in Table 1. An analysis of the response “intact” was analyzed using a two (intact versus rearranged) by three (Disgust, Positive, Control) repeated measures ANOVA showed a main effect of whether the item truly was intact or rearranged, \( F(2, 58) = 62.62, p < .001, \) partial eta squared = .68, indicating that participants could generally discriminate candy and location pairings that had occurred from rearranged pairings. There was no overall effect of emotion in the tendency to say “intact” \( (F < 1) \). Importantly, there was a significant interaction of emotion by item type, indicating differences in the ability to distinguish intact versus rearranged pairings of candy and location across the different emotion conditions. \( F(2, 58) = 3.20, p < .05, \) partial eta squared = .10 As shown in Table 1, participants had the best ability to distinguish intact from rearranged pairs for the items in the Control condition, rather than the Disgust or Positive condition.

Next, a one way repeated measures ANOVA was used to analyze the effect of emotion on the ability to recall whether a candy had been presented alone in the control condition, with the feminine napkin in the disgust condition, or with the ten dollar bill in the positive condition. There were no differences across emotion \( F(2, 58) = 2.05, p = .14 \). Participants correctly recalled the treatment for .74 of the disgust candies, .70 of the positive (paired with money) candies, and .80 of the control candies.
Individual difference analyses. To explore the effects of individual differences in sensitivity to disgust on memory for the candy-location pairings, I combined the VOCI and the two scales of the DSSR-revised (disgust propensity and disgust sensitivity to form an overall disgust score. Then, participants were split into high and low scores on how sensitive they were to disgust, with $N = 15$ in each group. The mean scores for disgust propensity, disgust sensitivity, and VOCI for the high and low group are in Table 2. Two (intact-rearranged pairs) by three (emotion: disgust, positive, control) repeated measures ANOVA were conducted on the memory for the association between candy and locations for each group separately. Table 3 presents participants response of “intact” separately for participants high and low in disgust, by intact versus rearranged pairs, and by emotion condition.

For participants in the high disgust sensitivity group, there was no overall emotion effect on the likelihood of saying “intact”, $F < 1$. There was robust memory for intact versus rearranged pairs, $F (1,14) = 21.85, p < .001$, partial eta squared $= .61$, qualified by an interaction between emotion and whether pairs were intact versus rearranged, $F = 5.09, p = .013$, partial eta squared $= .267$. Follow-up paired t tests of memory within each emotion condition (intact versus rearranged) showed good memory for pairs that were in the control condition $t (14) = 4.68, p < .001$, and pairs in the positive (money) condition $t (14) = 3.60, p < .003$. However, participants could not tell intact (.67) from rearranged (.53) candy-location pairs in the disgust condition, $t (14) = 1.47, p = .16$, showing worse memory in the disgust condition.

A similar analysis for the participants who were low in disgust sensitivity showed a main effect of emotion, which represented a bias or tendency to respond “intact” more
often for intact and rearranged items in the control condition, $F(2, 28) = 4.27, p < .024$, partial eta squared $= .23$. There was robust memory for whether candy-location pairings on the test were intact versus rearranged, $F(1, 14) = 18.70, p < .001$, partial eta squared $= .57$, and importantly, unlike the participants high in disgust sensitivity, there was no interaction between emotion and whether items had been truly intact or rearranged at test, $F < 1$. Thus, for participants low in disgust sensitivity, memory was not affected by whether items had been presented alone, with a feminine napkin, or with a $10 bill.

Participant’s ability to remember the treatment of a particular candy received was also computed, and split into high and low disgust sensitivity participants. A one way repeated measures ANOVA revealed that condition (disgust, positive, control) affected low disgust sensitivity participants memory for the treatment each candy received, $F(2, 28) = 3.75, p = .036$, with worse memory for the disgust and positive candies than the control candies (Control M = .85, Disgust M = .75, and Positive M = .68). In contrast, participants high in disgust sensitivity, were equally likely to remember that a candy had undergone the Disgust (M = .73) as the positive (M = .72) or control (M = .75) treatment, $F < 1$.

**Discussion**

Contrary to predictions, the emotional manipulation reduced associative memory for the candy-location pairings. Memory was actually better for the neutral treatment rather than disgust or reward. The effect of emotion on recall of what appeared in the bag with the candy was not significant overall, but out of the four things participants could remember for each treatment, they average 2.9 for disgust, 2.8 for money, and 3.1 for
alone. It seems that both emotional treatments did not increase memory for the association between location and candy. Instead, it made it worse.

In the comparison of participants high and low sensitivity to disgust, the effects of emotion on associative memory found were present only for participants high in sensitivity to disgust. In particular, those high sensitivity participants showed poor associative memory for candy-location parings in the disgust condition. In contrast to Bell and Buchner (2010), found better source memory for faces paired with disgusting behaviors, particularly for people high in disgust sensitivity. One source of the difference may be the particularly strong manipulation of disgust used in the experiment - the use of a very realistic-looking used panty liner touching the candy. This may have induced such high arousal that those people highly sensitive to disgust were overwhelmed and focused only on the contents of the bag, to the neglect of the location. For those who were less sensitive to disgust, the worst memory was shown for the money condition.

Similarly, when Pierce and Kensinger (2011) studied whether binding distinct items benefits from the presence of negative compared to positive valence, they found in their first experiment that negative valence actually impairs the capacity to identify rearranged versus intact pairs. Although negative valence impaired the ability to recognize rearranged word pairs, it did not hinder the recognition of intact word pairs. These results demonstrate that there may be interference between negative valence and the ability to associate items in memory.

In their subsequent experiment Pierce and Kensinger (2011) used the same paradigm of testing of associative recognition of pairs of positive, neutral, or negative words, but waited one week to give participants the associative recognition test.
Interestingly, results indicated that memory was better for negative as well as positive pairs, compared to neutral pairs after one week. This improvement was shown only for negative arousal items and not for positive arousal items, which may indicate that emotional arousal may have an effect on consolidating negative associative information. These results demonstrate that when analyzing the effects of emotions on relational memory, the length of the delay between a task and assessment needs to be evaluated because there seems to be a difference in the effects of emotions when memories are stored for the short term and consolidated for the long term.

Although my experiment did not show an increase in associative recognition for positive emotion, it is important to note the difference between thought-action repertoires for negative and positive valence. Fredrickson and Branigan (2005) studied the scope of attention and thought-action repertoires, comparing positive, negative and neutral states. Thought-action repertoires, as described by Fredrickson (1998), are changes in physical activity following cognitive changes. Their results showed that positive emotions broaden the scope of attention when compared to a neutral state. Participants were shown either a film associated with positive emotion (e.g. Penguins and Nature), a film associated with negative emotion (e.g. a prolonged mountain climbing accident), or a neutral film. Following the film, participants were told to concentrate on the strongest emotion they felt while watching the film. An open-ended Twenty Statements Test was used to assess the breadth of momentary thought-action repertoires, which entailed that participants list all the things they would like to do right then. There were 20 blank lines that began with “I would like to ____.” When comparing the difference in the content of participant responses, it was found that their thought-action repertoires became smaller after
watching the two negative emotion films. Participants showed a decreased urge to consume, contemplate and work and an increased urge to be antisocial or connect with others. Where negative emotions support specific action, Fredrickson’s (1998, 2001) broaden-and-build theory suggests that positive emotions broaden a person’s thought-action repertoires in the moment. This would enable them to access a wide range of thoughts and actions, an adaptive advantage over the long run by promoting the recognition of strengths and resources.

As Nesse and Ellsworth (2009) point out even in the absence of real threat or opportunity, our adaptive ability is to react emotionally. With disgust, for example, this emotion serves as an alarm to bring attention to a potentially harmful situation therefore protecting the organism from contamination and possible harm. That is, the potential cost of an inappropriate reaction could be far less damaging than not reacting at all, enhancing our ability to survive.

In summary, disgust did not prove to increase participant associative recognition of location picture/candy pairs. On the contrary, pairs in the disgust treatment were less likely to be recalled for those who have higher disgust sensitivity. Elicited disgust may have interfered with the participant’s capacity to recall the pairs and therefore, they had decreased memory. Additional research might consider testing valence and delay periods to distinguish the effect of disgust on associative memory. Furthermore, in Pierce and Kensinger’s (2011) experiment participants were told their memory for the pairs would be tested later and were given instructions to help link the words in each pair. In contrast, participants in our study were not instructed to link items together and although they were told that there would be a short memory test following the first task, they did not know
the memory test would be assessing their ability to bind the candy and location pictures together. Subsequent studies might also want to examine whether or not informing the participants about the memory test would have an effect.

This study also suggests that personality factors and individual differences are important factors when analyzing effects of disgust on memory. There could be different dimensions of negative emotion and how sensitive someone is to disgust may impact his or her resulting memory. Future studies would need to include more participants because a range of disgust sensitivities may not have been achieved in the 30 participants tested.
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<th>STD. ERROR</th>
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<td>.06</td>
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<td></td>
<td>.37</td>
<td>.06</td>
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Table 1. Memory responses to the intact versus rearranged test pairs of candy and location as a function of emotional treatment.
Table II. The mean scores for disgust propensity, disgust sensitivity, and VOCI for the high and low group are in Table 2.
Table III. Table 3 presents participants response of “intact” separately for participants high and low in disgust, by intact versus rearranged pairs, and by emotion condition.
Appendix A

The Disgust Propensity and Sensitivity Scale-Revised and the VOCI

**The Disgust Propensity and Sensitivity Scale - Revised (DPSS-R)**

Instructions: this questionnaire consists of 12 statements about disgust. Please read each statement and think how often it is true for you, then place an 'x' in the box that is closest to this.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
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</thead>
<tbody>
<tr>
<td>1 I avoid disgusting things.</td>
<td></td>
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<tr>
<td>2 When I feel disgusted, I worry that I might pass out.</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>3 It scares me when I feel nauseous.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4 I feel repulsed.</td>
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<tr>
<td>5 Disgusting things make my stomach turn.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 I screw up my face in disgust.</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>7 When I notice that I feel nauseous, I worry about vomiting</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8 I experience disgust.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9 It scares me when I feel faint.</td>
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<td></td>
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<tr>
<td>10 I find something disgusting.</td>
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<td></td>
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<td></td>
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<tr>
<td>11 It embarrasses me when I feel disgusted.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 I think feeling disgust is bad for me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix A

**VOCI**

Please rate each statement by putting a circle around the number that best describes how much the statement is true of you. Please answer every item, without spending too much time on any particular item.

<table>
<thead>
<tr>
<th>How much is each of the following statements true of you?</th>
<th>Not at all</th>
<th>A little</th>
<th>Some Much</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel very dirty after touching money.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. I use an excessive amount of disinfectants to keep my home or myself safe from germs.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. I spend far too much time washing my hands.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. Touching the bottom of my shoes makes me very anxious.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. I find it very difficult to touch garbage or garbage bins.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. I am excessively concerned about germs and disease.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7. I avoid using public telephones because of possible contamination.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8. I feel very contaminated if I touch an animal.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9. I am very afraid of having even slight contact with bodily secretions (blood, urine, sweat, etc.).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10. One of my major problems is that I am excessively concerned about cleanliness.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11. I often experience upsetting and unwanted thoughts about illness.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12. I am afraid to use even well-kept public toilets because I am so concerned about germs.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix B
Consent Form

FSU Behavioral Consent Form
Emotional Reactions and Memory
You are invited to be in a research study of emotional reactions and memory. We ask that you read this form and ask any questions you may have before agreeing to be in the study.
This study is being conducted by Dr. Colleen Kelley, Department of Psychology, Florida State University.

Background Information:
The purpose of this study is to investigate people’s emotional reaction to events such as reading about people who have had bad things happen to them or reading about people who have done good or bad things, or people’s emotional reactions to mini-events such as finding a small prize or seeing something disgusting. Emotional reactions include subjective experience and changes in cognition and behavior.

Procedures:
If you agree to be in this study, we would ask you to do some of the following things: view photographs of people and read behavioral descriptions and rate your emotional reaction to them, or view pictures of various locations and rate how much you would like to visit there, or see an experimenter touch pieces of candy with either a neutral object or an object that appears disgusting, and then rate how much you like the object. We will also test your memory. Finally, we will ask you to rate your personality in terms of how much you are bothered by the emotion of disgust. The total time for the experiment will be approximately 30 to 40 minutes.

Risks and benefits of being in the Study:
The study has several risks. First, some of the things you read about or see may be emotionally arousing, including sadness, anger, disgust. However, the emotional reaction will be relatively short-lived, and will be considerably less provocative than what you might see on a television reality show or drama. Second, the assessment of your memory will take about 10 minutes and require you to think, but should be no more demanding than a short quiz.
There are no benefits to you for being in the study, beyond the educational nature of the debriefing.

Compensation:
You will receive research credit for General Psychology or extra-credit for any upper level psychology course you might be taking that offers extra credit for research. The FSU Human Subjects Committee Approved 2/7/11. Void after 2/6/12 HSC# 2011.5671rate is that you will receive 1/2 credit for any time up to 30 minutes, and an additional 1/2 credit if the experiment lasts between 30 minutes and an hour. If you chose to end the experiment early for any reason, credit will be pro-rated.

Confidentiality:
The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely in this laboratory and only researchers will have access to the records. The results for your participation will not be associated with your name, but only with a research participation number.

**Voluntary Nature of the Study:**
Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

**Contacts and Questions:**
The researchers conducting this study are Kyndra Lewis and Natalie Arch.. You may ask the experimenter any question you have now. If you have a question later, you are encouraged to contact Dr. Colleen Kelley at 850-644-3816, or Kelley@psy.fsu.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact the FSU IRB at 2010 Levy Street, Research Building B, Suite 276, Tallahassee, FL 32306-2742, or 850-644-8633, or by email at humansubjects@magnet.fsu.edu.
You will be given a copy of this information to keep for your records.

**Statement of Consent:**
I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

_________________________ _____________________________
Signature Date Print Name

FSU Human Subjects Committee Approved 2/7/11. Void after 2/6/12 HSC# 2011.5671
Appendix C

Location Pictures
Appendix C
References


