DOMAIN-SPECIFIC NARRATIVE RECALL AND EMBODIED COGNITION

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By

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ABSTRACT

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By

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Students ($n = 90$) were assigned to hold either warm or cold therapeutic pads, and then wrote an essay about a past academic experience. Analysis using Linguistic Inquiry Word Count (LIWC) revealed that participants who held warm pads used significantly more affect words ($t(47) = 2.24, p = .03$), and slightly more words indicating cognitive complexity ($t(47) = 1.74, p = .08$), than who held cold pads. Participants who subsequently chose to receive information about graduate school used more affect words in their essays ($\beta = .31, p = .08$). Thus, holding a warm pad seems to have induced participants to view their academic experiences more “warmly,” recalling them with more emotional and cognitive depth, and that depth was related to behavioral indicators of academic motivation. These findings suggest the malleability and context-sensitivity of memory for academic experiences, and also validate the use of LIWC as a predictor of behavior.
Introduction

The theory of *embodiment* argues that many psychological processes are rooted in physical experiences. For example, Parzuchowski and Sudziarska (2008) demonstrated that participants show better recall for surprising words and worse recall for neutral words while making a surprised expression. This effect of embodiment is possibly due to the role the physical body plays in learning of new concepts, emotion, and language (Niedenthal, Winkielman, Mondillon & Vermeulen, 2009).

This study investigates this embodiment effect on narrative recall, about which there is currently little extant research. Specifically, the study examined students’ memories of academic experiences and their association with physical warmth. These memories are important to examine because the way in which they are represented may be associated with academic persistence and motivation (Etten, McInerney, Liem, & Presley, 2008). Although academic motivation is typically thought to be the product of long-term and distal factors (e.g., parental involvement and education; Adams & Corville-Smith, Midgett, & Ryan 2002), the current study investigates whether it can also depend on short-term context. Cognitive mechanisms that allow the effect of embodiment to occur are also discussed.

Academic Motivation

Current research on academic motivation shows a relationship between student performance in the classroom and how the student perceives he or she can handle the work in this domain (Etten et al., 2008). Additionally, the concept of academic motivation contributes to a student’s drive to continue to pursue work in the realm of academia; because of this, it is pursued by different researchers for the purpose of
understanding ways to better this experience for students (Elliot & Bempechat, 2002). More importantly, this topic is widely researched because the way students experience motivation influences the quality of work produced (Ziegler, Schmukle, Egloff, & Buhner, 2010).

Although other factors aside from motivation contribute to student outcomes (Elliot & Bempechat, 2002; Etten et al, 2008), it has been demonstrated that academic motivation is significantly and positively related to intellectual effectiveness (Adams et al., 2002). The findings produced by Adams et al. (2002) suggest not only that motivation in this domain can be driven by intellectual effectiveness, but also that intellectual effectiveness can in turn be driven by a student’s motivation. This finding implies new ways of interpreting the driving forces and mediating factors when considering the achievements students produce in their time pursuing academia; an intervention targeting motivation could increase student achievement.

It was previously thought that these schemas of the self (performance approach; performance avoidance) were the largest predictor of success in these realms. Performance avoidance / approach addresses the mental attitude an individual has in regards to performing in any domain. Specifically these goals and the schemas used by the individuals are interpreted as approaching competence or avoiding incompetence (Law, Elliot, & Murayama, 2012). These emotions felt by students as they progress through their academic careers affect their motivation and performance (Pekrun, Elliot, & Maier, 2009). It was found that these emotions mediated the relationships that performance-approach and performance-avoidance attitudes ultimately have on performance. These emotions serve different functional roles in assessing the success of a
student; they lend to a larger picture of understanding motivation and success.

In the college atmosphere in particular, students’ academic motivation is not only affected by strictly academic factors, but also by social factors, environmental factors, and extracurricular activities (Etten et al. 2008). In a qualitative study, Etten et al. (2008) identified specific exemplars of each of these three broad categories that college seniors reported influenced their own personal motivations. Etten et al. (2008) demonstrated that the interaction between external factors (social environment, family, instructors, extracurricular activities, external internship opportunities) and internal factors (demographics of the student, metacognitive characteristics of the student) directly influenced students’ academic motivation, which in turn was related to their performance in their senior year. This analysis generated a theoretical model of all factors influencing a students’ motivation; it supports the call for contextualized, well-defined research in specific domains regarding academic motivation as a more effective means of interpreting the construct (Elliot & Bempechat, 2002).

The need for qualitative methods along with the quantitative methods that are currently more commonly applied to properly define this construct is shown by the considerable variety with which it is interpreted (Elliot & Bempechat, 2002). This contention is supported by recent findings which suggest more direct definitions of the academic motivation construct as per each research initiative that pursues it, as it is defined by social, cultural, and other contextual elements that create its unique shape to an individual (Ziegler et al., 2010). In moving forward, there is a lack of research on specific short-term contextual influences on student motivation; examining these influences can provide insight on the nature of this construct of motivation.
Automaticity

Cognition is often automatic and heuristic; background processes allow our perceptions of the world to take place (Bargh, 1994). These processes act on our judgments, actions, motivations, and developed primarily as an adaptation to moving throughout life (Bargh & Chartrand, 1999). The development of these processes into a heuristic nature served to benefit us, an adaptation making common occurrences faster, and more relevant to the environment that we are in. As noted by Bargh & Chartrand (1999), these processes can speed up learning new concepts or tasks by mechanizing the process.

Research in automaticity is touched upon by many different sub-disciplines in cognition (see: Asch, 1946; Bargh, 1994; Bargh & Chartrand, 1999; Williams & Bargh, 2008). Research in this area examines how people interact with the world and the unconscious factors that mediate these interactions. The central issue addressed by research in automaticity is the extent to which everyday cognitions are automated. For example, a better understanding of research in automaticity will evolve awareness that can help people make better decisions (Kahneman & Tversky, 1984) or work more effectively with others (Pecker & Teckan, 2009).

The foundations of research in automatic cognition are rooted in early studies on impression formation. Asch (1946) examined this basic precursor of social interaction; the forming of impressions of individuals is often automatic, and it happens at a very fast pace as we begin to interact with somebody. Asch (1946) noted the influence of global information of “warm” and “cold” personalities becoming accessible and subsequently influencing the judgments participants made about other traits of the target. It is not the
case that we judge traits of an individual separately; Asch noted an automatic influence of more global or dominant traits on our decision making process regarding other people.

In an investigation of the awareness with which people form impressions, Nisbett & Wilson (1977) investigated whether participants rated a target person as either a likeable or non-likeable after a single manipulation of mannerisms presented (as either “warm and friendly” or “cold and distant”) across conditions. More importantly, character traits such as the individual’s accent were rated less favorably, a trait that held no connection with the distant-cold mannerisms of the performer. The judgments by the participants in this case were influenced by global stimuli, which they reported being unaware of and having no influence on their opinions or decisions about the target. This automatic filter of positive and negative stimuli captured by our attention mechanisms was confirmed by Shiffrin & Schneider (1977) and developed as an adaptation of our cognitions to common occurrences. When evaluating an individual expressing either “warm” or “cold” characteristics in their mannerisms (Asch, 1946; Nisbett & Wilson, 1977) participants make judgments that are consistent with the manipulation.

Impression formation (Asch, 1946; Nisbett & Wilson, 1977) lacks what Bargh & Chartrand (1999) defined as characteristics of conscious action: that these actions are initiated by will; are intended by the individual; are controlled, and require effort. Lacking the ability to stop a process such as impression formation is a defining characteristic of a process that is automatic. Since there is no conscious intervention for this process, it is a property of our being from day to day. This definition of automaticity put forward by Bargh and Chartrand (1999) in their review as something that requires only a set of pre-existing conditions to be present for them to occur, can then in
application be interpreted as an automated perceptual process that serves as a crude and basic function of the protective self, to be able to better process attitudes, judgments, emotions, and actions of others in context serves to create a better environment for the self.

**Priming**

The automatic activation of a concept occurs outside of conscious awareness of the individual and is termed *priming*. Priming may range from everyday objects (Williams & Bargh, 2008), context such as features of an individual or the environment they are in (Nisbett & Wilson, 1977) and even subliminal primes displayed for only a few milliseconds (Suslow et. al., 2009). Priming activates a knowledge structure of an individual, which subsequently takes the form of an expressed feeling, an emotion, a thought process or influencing an action from the individual. The accessibility of categories via priming can affect many different processes, including how we judge other people (Nisbett & Wilson, 1977).

Ideas, concepts, and emotions can therefore be primed by exposing people to stimuli outside of their conscious awareness. Consider the classic research by Asch (1946) on impression formation. The manipulation of the target’s traits as “warm” or “cold” could be considered a prime that elicits a particular judgment from the participant. These two target traits served as primes due to the method of their presentation; following the processing of the information of the target, the judgment systems we operate on fixate on classifications of positive and negative affects automatically (Shiffrin & Schneider, 1977). The subsequent fixation on these traits in turn makes salient concepts related to those traits; the categorical information related to it is retrieved when the knowledge
structure of “warm” or “cold” individual is activated. The salience of this information when it becomes available leads the individual to subsequently perform a corresponding action, judgment, or perception that parallels that information (see: McClelland & Rumelhart, 1986a; McClelland & Rumelhart, 1986b).

**Embodiment of Cognition**

Theories of embodied cognition hold that concept use involves partial reactivations of the sensory motor states that occur during experience with the world (Niedenthal et al., 2009). This argument is largely based on the afferent experience of the nervous system and its interactions with the cortex in not only perceiving but also encoding information (McClelland & Rumelhart, 1986b). It follows then, that while learning information, associations are made with distal psychological concepts and the physical use of the body, facilitating better retrieval of these concepts by use of the body at a later date (Ahlse´n, 2008). These associations include a wide array of concepts in social psychology, including attitudes (Taylor, Lord, & Bond, 2009) and emotion (Niedenthal et. al., 2009).

It is argued that the role of the physical body in cognition developed as an evolutionary advantage to facilitate the ease of learning of concepts (Ahlse´n, 2008). The hypothesis of embodiment as an evolutionary adaptation to learning is defended by Ahlse´n (2008), who contends that there is a strong relationship between speech and gestures, and that the ability to understand speech is bettered by an understanding of the gestures associated with that speech. Communication then can be seen as a multifaceted perceptual experience rather than a stand-alone ability. This advantage acquired over time is made possible by mirror neurons located in the somatosensory cortex that activate not
only when a motion by the body is conducted, but also when a motion of another body is perceived. This information about the physical experience of the body is coupled with the information conveyed in speech as gestures are made creating a semantic node of reference (Collins & Quillian, 1969; McClelland & Rumelhart, 1986a).

An examination of communication disorders such as aphasia and apraxia affirms this evolution approach to the embodiment hypothesis (Ahlse´n, 2008). In children who have impaired understanding of speech such as aphasia, learning of communication is improved when it is coupled with physical gestures. Similarly, children with apraxia, a disorder of comprehending motor movements, are better able to understand others and communicate more effectively with others when these movements are coupled with speech (Ahlse´n, 2008). These findings suggest that embodiment of cognition is a natural process by which learning occurs on multiple levels; the learning of speech is facilitated by interpreting the physical movement of the speaker, and that the physical movement is coupled with the speech. This learning process attaches emotional concepts conveyed in the world to physical movements of the body.

This is further supported by studies of the learning of emotion in children who are blind (Roch-Levecq, 2006). Such children, since they cannot visually perceive the content of emotions conveyed by others, instead learn to understand emotions by focusing on the physical experience of the body. In her study blind children were compared to sighted children on false-belief tasks. Although children (whether blind or not) were able to understand and perform well on the false belief task equally by explaining the cause and effect relationships, experimenters’ ratings of the emotions displayed by the children correlated with the children’s’ ability to perform on the task
across groups. The findings of Roch-Levecq (2006) suggest that the encoding of emotional information is also a physical experience in development. The findings allude to learning these situations as imaginative, and physical in the sense that children imagine themselves in the same situation when attempting to comprehend a standard false belief task – which does not require sight. Rather, the findings suggest the physical encoding of emotions attached to the false-belief task in understanding these events.

Although the embodiment of cognition is widely researched, comparatively little research has examined its connection with memory. The embodiment of emotional concepts such as achievement, pride and disappointment can lead to a better understanding about the role of embodiment affecting memory. When exercising memory, all aspects of an event are recalled – emotion included. The retrieval of emotional information involves a partial re-experiencing of that emotion (Niedenthal et al., 2009), much like the retrieval of a memory for narration involves retrieval of a central target of the context (Koriat, Goldsmith, & Panksy, 2000), it follows then that there must be a retrieval of the kinesthetic memory related to the context at hand.

Information about emotion is thought to be stored much like other types of information, in a network of related knowledge structures to be retrieved as a semantic whole (McClelland & Rumelhart, 1986a; Collins & Quillian, 1969). This theory of spreading activation states that rather than retrieving one node, or set of neurons with all of the information in a single place, multiple areas of the brain are accessed in a parallel fashion. In line with this theory, part of what is retrieved is then said to be the physical experience of the emotion, and thusly recalling this information is facilitated by approaching a central target of the node during recall: the physical re-experience of the
emotion.

This effect of retrieval of emotion has been shown in a wide range of contexts. Participants experience somatic changes in muscle tension commonly associated with emotions such as joy, anger and disgust when evaluating whether a target word would elicit that type of emotion (Niedenthal et al., 2009). For neutral words, these somatic changes were not seen, suggesting that retrieval of emotional information in making judgments requires a small physical re-experiencing of that emotion. Parallel findings have been observed for pride and disappointment. Oosterwijk, Rotteveel, Fischer & Hess (2009) instructed participants to generate words associated with either pride or disappointment, as they measured their posture. People who generated words related to disappointment slouched more than people who generated words related to pride – a physical experience of the appropriate emotion. Additionally, participants slouched more over time in proportion to the number of disappointing words they generated. These findings support the embodiment of emotion hypothesis.

Parallel-Distributed Processing

The unconscious activation of concepts, such as the embodiment hypothesis, can be explained in part by the parallel-distributed processing approach to cognition. The parallel-distributed processing approach to automatic processes is explained by a “web” of interconnected neural networks in which information is activated at the same time rather than one at a time or in succession (McClelland & Rumelhart, 1986b). These networks of ideas are distributed information about features (i.e., individual pieces) that, when activated together, form accessible complete constructs that activate on different levels of electrical activity in the cortex based on the order in which it was accessed.
(McClelland & Rumelhart, 1986a). Constructs that are retrieved consciously approach threshold to fire the cell network most readily. The model posits that because these concepts are not whole, but are composed of features of the target construct, these features are shared across multiple similar constructs and will cause those separate networks to approach activation threshold as well. (McClelland & Rumelhart, 1986a).

Research exploring the embodiment of cognition is compatible with this model. For example, the finding that more surprising words (e.g., “shocking”) are recalled by individuals who make surprised expressions (Parzuchowski & Shudziarska, 2008) fits the model, in that the physical motions of making a surprised expression are part of the concept of “surprise”. When participants make this expression they are tapping into a model of “surprised” that is closely related to the “surprising” trait possessed by words on the list. The activation of these cells in the network facilitate the networks of features that are shared when encoding surprising words. The participant can then recall this category more readily.

**Formation and Narration of Context-Dependent Memories**

The retrieval of information from long-term memory can occur both explicitly, when we try to remember something, and implicitly, when heuristics have developed for certain tasks. The focal point of this review on the retrieval of information will then center on the interaction between short-term factors such as context that influence the explicit retrieval of information. Explicit retrieval involves recalling an event, idea, property; narration, then, is the communication of the content of recall to another person.

Context present during encoding can provide additional support in forming a more detailed memory that is more readily recalled (Connor-Greene, 2000; Davis & Hult,
When participants in their studies produced summaries of information they outperformed groups who did not employ such a tactic on a recall task. What was demonstrated in these two studies was the *self-reference effect*, in which self-relevant information facilitates recall. Rogers, Kuiper, & Kirker (1977) demonstrated this effect when recall of words on a list was greatest when the self-reference task was employed, information about the word was generated by the participant that was relevant to the self; the theory of the self-reference effect states that this production of additional information related to the self led to a deeper level of processing or encoding of the information. The context of the self is added into the encoding of the information, providing another node of reference from which it can be retrieved.

As discussed earlier, the storage of information, or in this case a memory of an event, is not stored in any one single area of the brain, but rather is stored as features across different nodes of reference (McClelland & Rumelhart, 1986b). The features referenced about the event can be any detail, such as emotions, actions, sounds, sights, or the physical experience of the event. This information is stored across multiple knowledge structures; failure to access these features during recall of events can lead to a lack of these details in narration. The activation of these knowledge structures at a later time can lead to interpretations of the event that were previously unavailable to the individual because the information was not accessed previously (Koriat et al., 2000).

Due to the storage of features of an event across multiple knowledge structures, and failure to access all of these nodes, individuals make errors in recalling events accurately (Koriat et al., 2000). This information is not lost, but rather can be retrieved properly if additional related information is accessed as well (see also McClelland & Rumelhart,
1986a; McClelland & Rumelhart, 1986b). Koriat et al. (2000) showed that participants had better recall for people’s names if they also recalled the context in which they met the people. Koriat et al. (2000) saw evidence for what McClelland & Rumelhart (1986) proposed: the information for the name of the individual was “tied” in a network with information about the context of the event, along with other related information such as facial features.

The formation of memories around a specific node of reference leads into the concept of memories that are formed as context-dependent, or memories that are only readily retrieved in the presence of particular stimuli. This effect was demonstrated when participants who were instructed to remember positive or negative traits about a target show better recall for the target when these positive or negative traits were made salient to them during the recall (Wilson, Hodges & LaFleur, 1995). The findings support the theory that recall at times can actually be constructed out of the attitudes or other short-term contexts experienced by the observer at the present time of encoding.

**The Current Study: Embodiment Effects on Narratives**

Little literature exists on the effects of embodiment on recall. However, a sizable body of research implies that these automatic properties of information networking in the cortex and shared memory systems are subject to context-dependency through the physical embodiment of a psychological stimulus (McClelland & Rumelhart, 1986b; Parzuchowski & Shudziarska, 2008; Niedenthal et al., 2009). The current study links these concepts, examining whether the embodiment of a psychological concept through physical means can affect the content of narrative recall.

The current study applies these concepts of automaticity, embodiment, and memory
narration to examine the influence of short term contextual cues posited to affect students’ motivations and achievements in the realm of academia. The theory driving this research parallels previous research on psychological warmth, which has observed participants making judgments and decisions psychologically consistent with the physical experience of warm temperature (Williams & Bargh, 2008). More specifically, experiencing physical warmth will activate the concept of psychological warmth; impacting the way in which students perceive their prior experience in the realm of academia. This effect is expected to occur despite the student’s current record of achievement and engagement; the manner in which student’s recollection of their own academic prowess is expressed is expected to be emotionally consistent with the contextual stimuli.
Method

Design and Procedure

The experiment utilized a three-group between-subjects design. All participants were told that the study concerns how different types of people evaluate products; this cover story disguised the true purpose of the study. The stimuli used (as the “products” evaluated by participants) were therapeutic packs that were either frozen or heated to produce the desired “warm” and “cold” embodiment effects. Participants thusly were exposed to a warm, cold, or control prime.

Upon arriving to the research laboratory, the participants were greeted by the experimenter and directed to sit at a computer workstation. Participants were instructed that the study concerned how different types of students evaluate a new product, and that the experimenter was interested in recording the student’s attitudes about how it functions. The participants were told they were to complete a survey that evaluated the effectiveness of the product (serving as a manipulation check), and that they were to perform a usability test that involved writing about an academic experience in some detail. This cover story was used to keep participants motivated to write emotionally about their past academic experiences without becoming aware of the embodiment hypothesis. Participants were directed to begin the survey after having the therapeutic pack strapped to their forearm. The study lasted no longer than fifteen minutes, and participants were debriefed upon exiting.

In addition, several weeks before arriving to the research laboratory, participants completed an academic engagement scale (Plunkett & Bámaca-Gómez, 2003) during a prescreening session. In addition, participants completed a set of questionnaires contained
in a larger battery of screening measures. These included measures of academic engagement, demographics such as gender and class level, and lastly an estimation of their current GPA.

**Sample Characteristics**

Ninety undergraduates (62% female) from the psychology department subject pool participated in the study and were compensated with partial course credit. The sample was predominantly composed of freshmen (53%) and sophomores (24%; mean age = 20 years). Although participants had a wide range of GPAs (range = 1.0 to 4.0) they held positive attitudes toward school in general ($M = 3.35$ recorded out of a possible 4 points).

**Measurement**

All data were collected using MediaLab software. GPA (also recorded during prescreening) was a planned a covariate in the primary analysis, due to its likely link to academic motivation.

**LIWC Text Analysis Software.** Text analysis software was used to analyze participants’ responses to the recall question. This software automatically counts individual words and combinations of words, sorting them into predetermined categories for a frequency count of the occurrences. The psychometrically validated dictionaries included in the software have been used in research in the past in efforts to discern, for example, truth from lies (Bond & Lee, 2005), and intimate from non-intimate relationships (Simmons, Chambles, & Gordon, 2008).

Custom dictionaries can be made to sort words by in addition to the dictionaries that exist within the software. A “warm” word dictionary and a “cold” word dictionary were
compiled from the existing dictionaries in the software, to be used for the primary analysis of the study. These custom dictionaries will be compiled from an earlier pilot study. It was hypothesized that the embodiment effect received in the study will influence the language used by participants in their essays. Participants in the “warm” condition were expected to utilize more “warm” language in their reflection of past academic experiences, whereas the participants in the “cold” condition are expected to use more distant and “cold” language in their writing as it pertains to academic motivation.

**Prime reception.** Participants were directed to evaluate the therapeutic pack strapped to their arm using a five-question scale consistent with the product evaluation cover story. For example, participants were asked, “How flexible is this product in your hand? (Please squeeze once).” Response choices for all items were on a four-point Likert scale. The questions are designed to direct the participant to interact with the product, ensuring that the experimental manipulation of temperature is received.

**Recall.** Participants then encountered the primary measure of the study, a question asking them to recall work they have done in school. The item is as follows:

“We would like you to write a short essay in which you remember an assignment or project at school that you put a lot of work into. It can be an assignment, test, or project for a class, or it can be something extracurricular - as long as it was done for something related to school. We are interested in how you felt while completing the assignment or project, more so than the actual procedures of completing it.

The response for this item is a text box in which the participant wrote a brief essay. Participants were instructed to write a response containing at least 200 words, or two paragraphs to this question. The minimum of 200 words is in place to provide the LIWC software a chance to operate effectively (see below).
**Academic Engagement.** Academic motivation was assessed with a five-item scale designed to measure students’ effort exerted in school, importance of grades and education, extent of finishing homework on time, and liking school. The response choices were anchored by 1 = strongly disagree, and 4 = strongly agree. The items were averaged to create a mean score for the scale with higher numbers indicating higher academic engagement. These responses are posited to correlate with other demographic variables (e.g., GPA) due to their likely association with recall in this domain.

**Projection of Future Work & Behavior.** As a secondary dependent measure, participants answered a question: “What do you think your GPA will be when you graduate?” It was hypothesized that the embodiment effects of temperature might also affect perception of the work they will accomplish in the future. In addition, a measure was employed to assess behavioral intentions related to the topic. After completing the study, participants responded to the question: “Would you be interested in receiving information about seminars at CSUN on how to get into graduate school?”
Results

The original sample (N=90) was filtered by the word count of the essays written, so that only essays that contained more than 100 words were used in the analysis (N=75). There were no notable cases of skewness or kurtosis recorded on any of the variables of the LIWC output. Among all of the students in the sample, 57% were coded as following the directions to the essay writing, with a mean word count of 158 throughout all of the essays written. There were five categories of words investigated: positive emotion language, negative emotion language, words indicating cognitive mechanisms, words related to anxiety, and general use of affect language.

The average response for academic engagement ($M = 3.36$, $SD = .47$) was very high, indicating a generally favorable attitude towards school among the sample. These responses did not correlate with the students pre-screened GPA, $r(75) = .14$, $p = .21$, but did significantly correlate with their projected GPA, $r(75) = .30$, $p = .004$.

LIWC output analysis.

Independent samples T-tests were conducted to investigate differences in types of words used in the essays, as reported by LIWC. Average use of affect words was significantly higher ($t(47) = 2.244$, $p = .03$) for students who touched warm packs ($M = 5.88$, $SD = 2.10$) than those who touched cold packs ($M = 4.69$, $SD = 1.51$). There were nonsignificant trends between use of positive emotion language ($t(47) = 1.53$, $p = .13$) and words reflecting cognitive mechanisms ($t(47) = 1.74$, $p = .08$); students who wore the warm pack used these words slightly more. Refer to table 1 for an illustration of this usage. No significant differences were found for average use of negative emotion language or language reflecting anxiety.
Differences in word use by condition.

A mixed-model ANOVA was conducted on the differences between positive emotion language and negative emotion language by condition. There was no significant difference in the use of positive and negative language (F(1,47) = .876, p = .35), nor was there an interaction by condition (F(1,47) = .17, p = .68).

Indications of future behavior.

A logistic regression was conducted to predict the likelihood of the student requesting information about graduate school, based on the use of language in their essays. Use of positive emotion language predicted whether the student requested information about graduate school, though this relation was only marginally significant (β = .306, p = .08) in predicting whether. No other category of language significantly predicted whether students requested information.
Discussion

The data indicate a relationship between the temperature experienced by students and the manner in which they recalled their academic experiences. Analysis using LIWC revealed higher use of affect language in the warm condition as compared to the cold; this implies that the participants recalled their academic experience with more emotional depth. The hypothesis that the utilization of positive emotion language would be higher in the “warm” condition was not supported, although the pattern of means suggests that a subtle effect may exist. This specific hypothesis was weakly supported at best, and further research will be required to definitively determine whether the physical warm and cold stimuli result in differential use of positive and negative emotion language.

The data also indicate a possible connection between the manner in which the students recalled their academic experiences and the possibility of engaging in future behavior related to that domain. Binary logistic regression revealed that the more students used affect language, the more likely that they were to request information about graduate school. This decision made by participants is not only one that was observed in the short term, but also a commitment to possibly engage in future behavior. It is possible that by narrating the experience with more emotional depth, students felt more connected, or more “warmly” towards the domain of academia. Thus, we see evidence of short term contextual cues influencing behavior in not only the immediate sense, but possibly directing future behavior as well.

The findings of this research project confirm previous research conducted on the theory of psychological warmth. There is indeed a psychological concept of physical warmth – attached to a variety of concepts as our mental representation of warmth
appears to be vast and encompassing (Williams & Bargh, 2008). More importantly, this study further validates this mental representation of a complex series of associations as partially rooted in a physical experience. The important aspect of the concept of embodiment of cognition is that re-experiencing the physical aspect of a concept can activate associated mental representations, which may then influence other cognitive processes such as decision making, judgment (Williams & Bargh, 2008), and memory (Parzuchowski & Sudziarska, 2008).

Mental representation can likely be extended to many different domains, academic motivation is but a single aspect or subcomponent of “warmth”. Anything experienced in a positive sense, or as generally gratifying, could be associated with the psychological representation of warm temperatures, which is posited by Williams & Bargh (2008) to have stemmed from the warmth experienced as a young child held close to a mother. If their theory is correct, the effects of the physical experience of warmth could be further applied to other domains in which a positive experience is possible, such as school and work environments.

The primary limitation to this study involves the amount written by the students. It was important that participants not feel pressured to write the text, but rather that they recalled and wrote the experience in a fluid manner. Unfortunately, this approach led many participants to ignore the instructions, and many of the responses had to be excluded because they did not meet the 100 word minimum criteria. LIWC software yields more reliable results as participants write more and more. Thus, future investigations of this type will require participants to recall their experiences in more depth. (It is important, however, to not suggest a word minimums as the validity of LIWC
is compromised when the language of the writer is “forced”.) The main concern of the current study was inducing students to write freely about their emotions as they went through a school project. Although this was successful, it appears that, for many students, writing about their experiences in depth is more difficult.

These findings emphasize the influence that short-term contextual cues can have on long term decisions and future behavior. Students’ recollections in the short term were related to decisions that could promote positive long-term academic outcomes. Thus, students should be made aware of the effects of short term cues on how they recall their academic experiences. Additionally, parents and educators may better understand how contextual factors may influence students’ perceptions of their academic experience, and better mentor them to continue to pursue education with a positive outlook. By understanding the impact of contextual influences, efforts can be made to surround students with influences that will promote adaptive decision-making.
References


*Journal Of Educational Psychology*, doi:10.1037/a0027179


## Appendix

Table 1 – Mean Word Usage by Condition

<table>
<thead>
<tr>
<th>Word Type</th>
<th>Warm</th>
<th>Cold</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Emotion</td>
<td>3.20(1.87)</td>
<td>2.43(1.63)</td>
<td>1.53</td>
</tr>
<tr>
<td>Negative Emotion</td>
<td>2.70(1.41)</td>
<td>2.23(1.37)</td>
<td>1.17</td>
</tr>
<tr>
<td>Affect</td>
<td>5.88(2.10)</td>
<td>4.69(1.51)</td>
<td>2.24*</td>
</tr>
<tr>
<td>Cognitive Mechanism</td>
<td>19.46(4.30)</td>
<td>17.38(4.30)</td>
<td>1.74</td>
</tr>
</tbody>
</table>

*Significant at .05 level.*