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CONTEXT-DEPENDENT MEMORY AND CHEWING GUM

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Context-dependent memory refers to improved recall of specific episodes or information when the context present at encoding and retrieval are the same. The effects that chewing gum has on memory during the encoding phase has been studied many times with contrasting results. Some studies show evidence that chewing gum while encoding and during recall may improve performance and other studies show no effect. The current study sought to replicate and extend previous research. Results showed no support for the context-dependent memory phenomenon.

Key words: Context-dependent memory, perceptual cues, encoding

Considerable research indicates that individuals struggle with recall (Overman, Sun, Golding, & Prevost 2009; Scholey, 2004; Tucha, Mecklinger, Maier, Hammerl, & Lange, 2004). This problem is especially prevalent among college students as they are encoding large amounts of information in their courses. Typical exams utilize items that assess recognition and free-recall memory. Recognition memory is the ability to recognize places, events, people, or objects that have been previously seen before (i.e. multiple choice items). According to Haist, Shimamura and Squire (1992), free-recall memory is defined as the ability to write or say information that was previously asked to learn (i.e., essay items).

A question this research sought to explore is relevant to how can memory recall can be improved. One area of interest lies within the phenomenon called context-dependent memory. Context-dependent memory depends on the setting that the memory was formed (McLeod, 2008). For example, should students chew gum while taking an exam if they chewed gum while studying? Context-dependency and memory have produced contrasting results, with some findings supporting the phenomenon (Baker, Bezance, Zellaby, & Aggleton, 2004; Smith, 2009; Wilkinson, Scholey, & Wesnes, 2002) and others unable to replicate past results (Johnson & Miles, 2007; Miles & Johnson, 2007; Overman, Sun, Golding, & Prevost, 2009). The current pilot research sought to explore the gum chewing phenomenon and replicate past results.

A study conducted by Smith (2009) investigated three main areas surrounding the chewing gum phenomenon. The first area investigated whether chewing gum increases retention rate. The second area investigated if chewing gum improved short-term memory tasks and the third explored mood as an additional factor. Smith (2009) concluded that chewing gum increased alertness and increased intellectual task performance. Also, the study concluded that when chewing the gum, arousal increased in participants. Results showed that arousal benefits intellectual performance but may hinder episodic memory. A study conducted by Wilkinson and colleagues (2002) investigated the "gum effect" and they utilized a machine to keep track of aspects of working memory, long-term memory, and attention. The researchers also used extensive cognitive testing to be certain that the participants' memory was accurately tested. The results of the experiment showed that chewing gum had a positive effect on episodic and

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working memory. Moreover, Baker and colleagues (2004) found that chewing gum can aid in learning and that chewing gum can lead to context-dependent effects so that recall can be hindered when the context is changed.

Indeed, there are mixed findings when it comes to the "gum effect" phenomenon. For example, multiples studies conducted by researchers, Miles and Johnson in 2007 closely examined and replicated Baker, and colleagues' (2004) methodology. They were unable to reproduce the chewing gum effect. The current pilot study sought to replicate the results of Baker and colleagues' (2004). We hypothesized that students who chewed gum during the learning and during the recall (gum-gum) would perform better on the recall quiz than would students who chewed gum during the learning but not during the recall (gum-no gum).

METHOD

Participants

Sixty undergraduate students (49 female and 13 male; average age=18, *SD*=3.9) participated in this research. The sample consisted of 58.1% White/Caucasian, 32.3% Hispanic/Latino, 6.5% Black/African American, 1.6% Asian and 1.6% identified as Other. Course credit and/or extra credit was offered in return for participation. Participants were randomly assigned to one of two conditions (Gum=32; No Gum=28).

Measures

Demographic data. Participants completed a questionnaire assessing age, ethnicity, and gender.

Stimuli. Participants completed a short video as a learning task. In the 8-minute video, web psychologist Nathalie Nahai lectures about Big Five personality traits.

Retention quiz. Participants completed a 5-item multiple choice (recognition recall) quiz with 2 short answer items (free recall) about the lecture. The quiz was created by the current investigators. A sample multiple choice item includes "The Big Five Personality trait Conscientiousness includes which of the following?" A sample short answer item includes "Please describe some traits a person may exhibit if she/he scored high on openness (according to video)." Composite score were created for recognition recall (multiple choice items) and free recall (short answer items).

Procedure

We conducted this study with a one participant 30-minute session within a laboratory setting. Upon arrival to the lab, the participant was instructed to sit at a desk with a computer and told that he/she will be participating in a study that will measure chewing gum and memory. After informed consent was collected, each participants was given a piece of Double Bubble chewing gum, which was bubble gum flavored, and asked to chew the gum. Thirty-two participants chewed gum the entire study, and 28 participants chewed gum during the video but not while taking the quiz. Participants were prompted via computer software to watch an 8-minute video about the Big 5 personality traits provided by web psychologist, Nathalie Nahai. After the video was watched, Medialab software prompted participants to complete the retention quiz. Upon completion of the quiz, participants were provided with a debriefing statement.

RESULTS

A one way (gum vs. no gum) MANOVA was conducted on recall scores. The overall effect indicated no significant differences, F (2, 5) = .43, p >.05, as shown by Wilk's lambda. Moreover, there were no significant univariate effects for recognition recall, F (1, 60) = .87, p > .05, or free recall, F (1, 60) = .04, p > .05. Participants did not show improved recognition after chewing gum before and after learning (M = 5.8, SD = .27) versus those who chewed gum during the learning phase only (M = 6.34 SD = .21). Moreover, participants did not show improved recognition recall after chewing gum before and after learning (M = .75, SD = 0.54) versus those who chewed gum during the learning phase only (M = .78, SD = .57).

DISCUSSION

We hypothesized that students who chewed gum during the learning and also during the recall (gum-gum) would perform better on the recall quiz than students who chewed gum during the learning but not during the recall (gum-no gum). Our hypothesis was not supported by the current study. There was no significant evidence to indicate that chewing gum during the learning and during the recall (gum-gum) made a difference in the recall scores. These findings are consistent with recent literature (Johnson & Miles 2007; Miles & Johnson, 2007) with which investigators were unable to replicate the context-dependent effect reported by Baker and colleagues (2004).

Moreover, Tucha and colleagues (2004) instructed participants to learn a list of 15 nouns while chewing spearmint gum, chewing flavorless gum, and sham chewing or not chewing. Their results showed that after a 40-minute retention interval, memory for the words was not improved through any of the chewing conditions. The most recent research conducted by Reinhart (2015) also found no evidence that the flavor of chewing gum influenced context-dependent memory. Given these data, we speculate that flavor is not a contributing factor in our null results. Nonetheless, future research would benefit from assessing any potential long-term effects versus short-term. Other research conducted by Overman, Sun, Golding, and Prevost (2009) supports the notion that chewing-gum does not have effect on context-dependent memory. The study conducted by Kozlov, Hughes, and Jones (2012) not only supports that chewing-gum does not have effect on context-dependent memory, but also that chewing-gum impairs short-term memory.

Current results indicated that chewing gum during the learning and during the recall (gum-gum) did not make a difference in free-recall and recognition memory. It is possible that participants had previous knowledge about the subject matter that gave them an advantage during the recall quiz since many of them were enrolled in a general psychology course. Future research would benefit by utilizing a real classroom setting, which would provide investigators with more control over what subject matter has been taught. Future investigators may also benefit by instructing the participants to wait longer between the learning and the recall as in the study conducted by former researchers (Johnson & Miles, 2007).

In sum, the current findings extend recent literature that shows little support for the context-dependent memory phenomenon (Johnson & Miles 2007; Miles & Johnson, 2007). The implications of the findings will be of particular interest to instructors and students, as it is important to encode effectively to produce the best results possible. The current results are especially important as the current literature is mixed and our results provide support for a new growing area of research. The study will also aid future research and allow guidance for those interested in context-dependent memory.

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