The Effect of Overt Head Movements on Memory Retention of Valenced Items

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Abstract

Cognitive psychology's popular computational outlook on cognitive processes is being revolutionized by embodied cognition: the study of how the body affects cognition. My study contributes to this field by investigating the effect of overt head movements on the memory retention of valenced words: words with negative or positive association. Previous research suggests that body movements that induce certain emotions in conjunction with consistently valenced words will have a significant impact on memory retention. Do these findings transfer to emotionally connoted overt head movements having an effect on memory for valenced words? To answer this question, participants were split into two groups: nod-up-and-down, which instilled positive emotions, and shake-back-and-forth, which induced negative emotions. Afterwards, I presented them with a list of common positive words and common negative words. Subsequently, the participants' memories were tested using a questionnaire. My nod-up-and-down group had significantly higher memory retention for negative words and all words compared to the shake-back-and-forth group. The outcome of my study suggested that positively connoted body movements had an impact on memory retention. Future studies should investigate the impact of other important body movements on memory whilst circumventing this study's limitations.

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Contrary to popular computational models of cognition, recent research suggests that the body influences cognition. For example, Katinka Dijkstra and her colleagues (2007) demonstrated that autobiographical memory recall can be improved by having the same body position at recall and at encoding. Namely, subjects more accurately recalled their last appointment with the dentist while sitting in a reclined chair compared to standing up. This finding strongly contributed to the growing field of embodied cognition: a novel and crucial lens into how cognition is shaped by the body.

This field of study can be expanded to an important physical medium for conveying emotions: head movements. Förster and Strack's (1996) study discovered that concurrent, and overt head movements had an effect on memory for consistently valenced words. More concretely, these researchers split participants into three groups: nodding heads up and down (associated with positive emotions), shaking heads back and forth (associated with negative emotions), or, rotating heads (associated with emotional neutrality). Concurrently, all groups had to listen to tangos of Astor Piazzola, jovial music, and a list of positive, negative and neutral words using headphones. The music served as a cover for "headphone testing". Afterwards, questionnaires were used to test participants' memory of the words. The nod-up-and-down group had significantly higher memory retention for positive words than the two other groups. In contrast, the shake-back-and-forth and circular movements groups did not have a significant difference in memory retention for positive or negative words. In addition, the nod-up-and-down group had significantly higher memory retention of all words than the two other groups. Importantly, the researchers concluded that the compatibility between the words' valence and participants' motor actions influenced the retention of words (Förster & Strack, 1996). Moreover, this research's procedure will be partially reproduced in my experiment.

However, this study failed to control for the valence of the music played: a cheerful soundtrack. This limitation strengthened the retention of positive words but weakened the retention of negative words as evidenced in Jäncke's (2008) study's conclusion: music's valence

evoked consistent emotions, reinforced the recall of sentiment-compatible words, but weakened the recall of sentiment-incompatible words. This limitation may also have influenced Förster and Strack's (1996) shake-back-and-forth group not having significantly higher memory retention for negative words than their nod-up-and-down group. Therefore, researching the effect of overt head movements on the retention of words with emotionally neutral music would determine the true impact of overt head movements on the retention of valenced words.

Relative to emotional states and memory, Hittner et al.'s (2020) experiment found that positive emotions resulted in less memory decline when compared to negative emotions. Moreover, a study by Bisby and Burgess (2017) concluded that negative emotions enhanced the memory retention of negative items of an event. Finally, Madan et al.'s (2018) study found that positive emotions enhanced the memory retention of positive items of an event. Importantly, these results will be used in my hypotheses.

As such, the purpose of this study was to investigate the effect of overt head movements on memory retention for valenced words. This study attempted to fill this gap in knowledge by following Förster and Strack's (2010) approach but replaced the tangos of Astor Piazzola with an emotionally neutral sound and only having two groups: nod-up-and-down and shake-back-and-forth. Importantly, I assumed that nodding up and down would instill positive emotions and that shaking back and forth would induce negative emotions similar to Förster and Strack's (1996) study. Therefore, I predicted that my nod-up-and-down group would have significantly greater retention of words with a positive valence than my shake-back-and-forth group as per Madan et al.'s (2018) study and my shake-back-and-forth group would have greater retention of negatively connoted words than my nod-up-and-down group as per Bisby and Burgess' (2017) study. Plus, I hypothesized that my nod-up-and-down group would have significantly greater overall retention of words than my shake-back-and-forth group in accordance with Hittner et al.'s (2020) research.

Method

Participants

The participants were 34 undergraduate students from a large post-secondary institution in Ontario, Canada: 21 women and 12 men, omitting one unresponsive respondent. I sampled students who happened to be in the lecture room. The mean age of these subjects was 20.5 years (SD = 3.10, range: 18–35), excluding one unresponsive participant. Equally important, the mean number of years in university was 2.21 (*SD* = 0.96, range: 1–4), disregarding an unresponsive respondent. Language-wise, all participants were fluent in English. Finally, my participants were rewarded with a participation credit for participation.

Design

In terms of variables, the direction of head movement and the valence of words were the independent variables in this study and the number of correctly recognized words was the dependent variable. I randomly assigned the participants into two groups based on their seating position in the classroom: a nod-up-and-down group (22 people) and a shake-back-and-forth group (12 people). In terms of design, the study used a mixed-subject design, consisting of the direction of head movement being a between-subjects manipulation: both groups were instructed to perform different head movements, and the valence of words being a within-subjects manipulation: both groups were exposed to the valence of words.

Materials

I recited to both groups a list of eight commonly used positive words, such as happy and amazing, and eight commonly used negative words, such as mean and terrible, for a duration of two seconds each to control the encoding time. In terms of controlled variables, the list of words was composed of only adjectives to avoid participants from being attentive to the words' class, not valence. In addition, the list of words was composed of an equal amount of positive and negative words to prevent over-exposure to one type of word, which would have resulted in weighted memory retention. In addition, the placement of the positive and negative words was random to avoid participants being more attentive to placement, not valence.

Following this list, I administered 28 10-second-long questions on a large projector screen subsequently participants had to indicate whether or not they remembered the words

presented. These 28 queries consisted of the 16 previously shown positive and negative words, six new positive words and six new negative words. These prompts, reflective of timed cued recall, were used to gauge the participants' explicit memory of the words. Participants had to respond using their electronic devices on an online platform called *TopHat*.

Procedure

In a large lecture room, I, undivulged to the shake-back-and-forth group, instructed participants in the nod-up-and-down group to listen to the list of words whilst nodding their heads up and down to a loud beat at a rate of one head movement per second. The beat was produced by a metronome to draw out emotional cues and ensure that all participants' head movements were in synchrony, limiting skewed data. In the same room and briefly afterwards, I, undivulged to the nod-up-and-down group, instructed participants in the shake-back-and-forth group to listen to the list of words whilst shaking their heads back and forth to the beat at a rate of one head movement per second. Following these instructions, the participants were presented with words as per the materials section. Afterwards, participants were prompted with 28 questions as per the materials section.

Results

I wanted to investigate the effect of overt head movements on memory retention for valenced words. Towards this goal, an independent samples t-test investigated the effect of head movements on the number of correctly recognized positive words. I found no significant difference in memory for positive words between the nod-up-and-down group ($M = 5.40$, $SD = 1.43$) and the shake-back-and-forth group ($M = 4.92$, $SD = 1.62$), $t(32) = 0.91$, $p = 0.37$, suggesting that body movements had no impact on memory for positive words.

Similarly, an independent samples t-test investigated the effect of head movements on the number of correctly recognized negative words. I found that the nod-up-and-down group ($M = 5.86$, $SD = 1.21$) had a significantly higher memory for negative words than the shake-back-and-forth group ($M = 4.50$, $SD = 1.73$), $t(32) = 2.70$, $p = 0.011$, positing that

nodding up and down improved memory for negative words compared to shaking back and forth.

Moreover, an independent samples t-test investigated the effect of head movements on the total recognition of words. I found that the nod-up-and-down group ($M = 11.3$, $SD = 2.23$) had a significantly higher memory for words overall than the shake-back-and-forth group ($M = 9.42$, $SD = 2.47$), $t(32) = 2.24$, $p = 0.032$, implying that nodding up and down improved memory for all words compared to shaking back and forth.

Discussion

The purpose of this experiment was to determine how positively and negatively connoted overt head movements would influence the retention of valenced words. In reference to previous hypotheses, I did not find any significant difference in memory for positive words between my two groups. This result did not replicate Förster and Strack's (1996) finding where their nod-up-and-down group had a significantly higher memory retention for positive words compared to their other groups. I deduce that my nod-up-and-down group not overtly and synchronously moving their heads up and down along with social embarrassment and the absence of positive emotion-inducing music resulted in an absence of positive emotions, leading to a lower retention of positive words. This inference agrees with Madan et al.'s (2018) claim that positive emotions enhance the memory retention of positive items.

Furthermore, my shake-back-and-forth group had a significantly lower memory for negative words compared to my nod-up-and-down group. This outcome did not replicate Förster and Strack's (1996) result where their shake-back-and-forth group did not have a significant difference in memory retention for negative words compared to other groups. Due to covert and asynchronous head movements and social embarrassment, I believe that my nod-up-and-down group had more negative emotions than the shake-back-and-forth group, leading to a higher retention of negative words. This reasoning matches with Bisby and Burgess' (2017) claim that negative emotions enhance the memory retention of negative items. In addition, Förster and Strack's (1996) shaking group not having higher memory for negative words may be due to their positive music offsetting negative emotions.

However, my hypothesis is partially supported by my nod-up-and-down group having a significantly higher total recognition of words compared to my shake-back-and-forth group. This result replicated Förster and Strack's (1996) finding where their nod-up-and-down group had significantly higher memory retention for all words compared to other conditions. I believe that my nodding up and down group covertly and asynchronously moving their heads in conjunction with social embarrassment induced more negative emotions, resulti/ng in significantly greater memory for negative words, leading to better overall memory. This outcome disagrees with Hittner et al.'s (2020) finding that positive emotions result in less memory decline when compared to negative emotions.

Limitations-wise, the shake-back-and-forth group was substantially smaller than the nod-up-and-down group, resulting in unequal variances between groups. These inequalities negatively affect the assumption of equal variances in t-tests, rendering them inconclusive. This effect can be limited by having an equal number of people in each group. In addition, my nod-up-and-down group did not exhibit overt and synchronous head movements due to social embarrassment, accentuating the instillation of negative emotions. This effect can be limited by offering more salient rewards to offset social anxiety (Richards et al., 2015).

I encourage further exploration of this conceptual-motor compatibility construct as I believe that my study's major shortcomings severely distort my data. In addition, my speculative interpretations are in need of empirical corroboration. This goal can be accomplished by studying this compatibility construct in the context of other body movements, such as smiling versus frowning, whilst circumventing my study's limitations. Ultimately, this field of research may contribute to the understanding of complex everyday phenomena, such as how our body movements help us solve problems (Xing et al., 2018).

In conclusion, body movements that induce negatively connoted body movements increase overall memory retention for items; however, it is uncertain how emotionally connoted body movements influence memory retention for positive and negative items. Therefore, be mindful of how your brain listens to your body as the emotional connotation of your movements is partially transferable to your memory retention abilities.

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