THE EFFECT OF VOCAL EMOTION IDENTIFICATION ON WORD REPETITION AND RECALL ACCURACY IN NOISE

Sylvia Mancini[1], Kate Dupuis[1] & M. Kathleen Pichora-Fuller[1]
[1]Department of Psychology, University of Toronto Mississauga

1 Introduction

In everyday life, facts and events associated with strong emotions are better remembered than those lacking rich emotional content [1]. In particular, information that is associated with the emotion of fear has been found to be highly memorable [2]. Little is known about whether or not there is a similar effect of emotion on memory for speech spoken with emotion, in particular fear. In a prior study, we investigated if there would be such an effect if the semantic content of the spoken information is neutral, but it is spoken with vocal emotion and heard in noise. In the current study, we added an emotion identification task to investigate if the effect of vocal emotion on memory would be enhanced. We tested young adults' recognition and recall of semantically neutral words spoken to portray fear, sadness, neutral and pleasant surprise in a noisy background in two conditions, one with and one without an additional vocal emotion identification task. It was hypothesized that there would be an effect of vocal emotion on repetition and recall accuracy, with performance being better for words portraying arousing emotions (fear and pleasant surprise) than for words spoken in a neutral voice or with sad vocal emotion, and that the effect would be greater for repetition and recall accuracy when listeners completed the emotion identification, and.

2 Method

2.1 Participants

Participants were 12 undergraduate students from the University of Toronto Mississauga (M = 18.08 years, SD = 0.67, 67% female) who were enrolled in PSY100. All were native speakers of Canadian English who reported being in good health. They had pure-tone audiometric thresholds ≤ 25 dB HL from 250 to 3000 Hz, and no significant inter-aural differences in thresholds.

2.2 Design

All participants completed a demographic questionnaire and nine measures were taken to categorize their characteristics, including two measures of hearing, six measures of cognition and one measure of emotion. All participants completed the same experimental procedures which yielded three key outcome measures, including (1) accuracy of word repetition, (2) accuracy of emotion identification, and (3) accuracy of word recall.

Note that the design followed that used in an earlier study [3] so that it would be possible to compare the current findings to previous findings. The key difference between the previous experiment conducted in our lab and the current experiment is that in the present experiment participants completed the additional emotion identification task following each sentence. Thus, the procedure used in the current experiment is distinguished in its label of WARRMNIE by adding "IE" for "identification of emotion" to the label of WARRMN used to describe the procedure of the previous study.

2.3 Experimental Measures

Working Auditory Recognition and Recall Memory in Noise with Identification of Emotion (WARRMNIE). The 12-talker babble stimuli from the Speech Perception in Noise test were used as background noise. Participants listened to 100 sentences that were spoken in one of four different emotion conditions: fear, sadness, neutral, or pleasant surprise. All words were semantically neutral. The sentences all began with "Say the word" and then a semantically neutral monosyllabic target word was presented. After each sentence, participants repeated the target, identified the emotion in which it was spoken (1 = fear, 2 = neutral, 3 = pleasant surprise, 4 = sad), judged whether the word begins with the first or second half of the alphabet (first = A-M, Second = N-Z) as an unrelated additional processing task to tax working memory. Sentences were presented in recall set sizes of 2, 4, 6, and 8 items, with 5 trials at each set size. After each set, participants recalled as many words as possible that had been heard in the set.

3 Results

3.1 Repetition

An ANOVA was conducted with word repetition accuracy as the dependent variable and Emotion (fear, neutral, pleasant surprise, sadness) and Setsize (2, 4, 6, 8) as within-subjects factors. As seen in Figure 1, there was a significant main effect of Emotion on repetition, $F(3, 33)$ = 7.574, $p < .0005$, with word repetition accuracy being poorer for sad compared to fear ($t(11)$ = 4.78, $p < .0005$) and neutral ($t(11)3.1$, $p = .003$). There was no main effect of Setsize on repetition accuracy, $p > .05$, nor was there a significant interaction ($p > .05$).

3.2 Recall

An ANOVA was conducted with recall as the dependent variable and Emotion (fear, neutral, pleasant surprise, sadness) and Setsize (2, 4, 6, 8) as the within-subject factors. As seen in Figure 2, results indicated a significant main effect of Emotion on recall, $F(3, 33)$ = 3.419, $p = .03$, with a significant difference in performance for words spoken to portray sadness compared to those spoken to portray fear ($t(11)$ = 2.04, $p = .03$). There was also a significant main effect of Setsize on recall, $F(1,11)$ = 26.23, $p = .000$. All setsizes were significantly different from each other ($ps < .05$), with recall scores decreasing as the setsize increased.
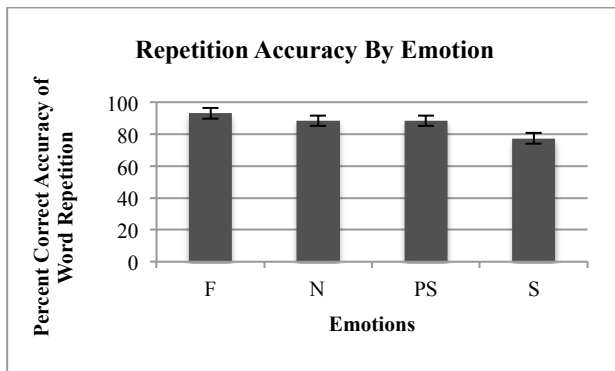
Repetition Accuracy By Emotion

Figure 1. Repetition accuracy by Emotion (Fear, Neutral, Pleasant Surprise, Sad). Error bars are standard deviations.
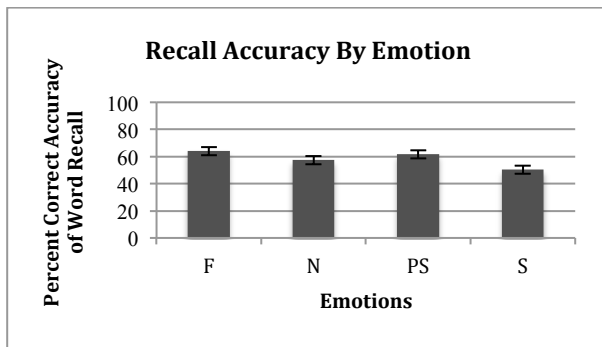
Recall Accuracy By Emotion

Figure 2. Recall accuracy by Emotion (Fear, Neutral, Pleasant Surprise, Sad). Error bars are standard deviations.

3.3 Emotion Identification

An ANOVA was conducted with emotion identification accuracy as the dependent variable and Emotion (fear, neutral, pleasant surprise, sadness) and Setsize (2, 4, 6, and 8) as the within-subject factors. The ANOVA revealed a significant main effect of Emotion ($F(3,33) =$ 8.76, $p < .0005$), and a significant main effect of Setsize ($F(1,11) = 12.24$, $p = .005$), but no significant interaction ($p > .05$). Post hoc comparisons indicated that words spoken to portray pleasant surprise and sadness were identified significantly better compared to words spoken with the other emotions $ps < .05$. (See figure 3).
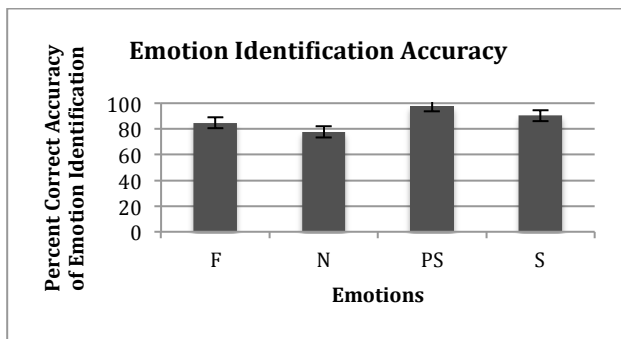
Emotion Identification Accuracy

Figure 3. Emotion identification accuracy for the four emotions tested. Error bars are standard deviations.

To see if there was an association between the accuracy of repeating words and the accuracy of later recalling the words, a 2x2 chi-square test of independence was conducted. Results indicated that recall accuracy was not dependent on repetition accuracy, $\chi^2 = 1.75$, $p = .17$. Similarly, we tested if there was an association between correctly identifying the emotion and repeating the word. Results indicated that word repetition was not dependent on emotion identification accuracy, $\chi^2 = 1.47$, $p = .23$. Finally, we tested if there was an association between correctly identifying the emotion and recalling the word. Results indicated that recall was not dependent on emotion repetition accuracy, $\chi^2 = 0.0009$, $p = .98$.

3.4 Comparisons to Prior Study

Repetition. An ANOVA to examine the accuracy of word repetition was conducted with Experiment (WARRMNIE, WARRMN) as a between-subjects factor, and Emotion (fear, neutral, pleasant surprise, sadness) as the within-subject factor. Results indicated a significant main effect of Experiment, $F(1,22) = 15.45$, $p < .0005$. There was also a main effect of Emotion $F(3,66) = $ 11.962, $p = .000$, but there was no significant interaction, $p = .08$.

Recall. The effect of emotion on recall accuracy did not differ significantly between the prior WARRMN and current WARRMNIE experiments. This was confirmed with an ANOVA for recall accuracy, with Experiment (WARRMN and WARRMNIE) as the between-subjects factor and Emotion (fear, sad, neutral, pleasant surprise) as the within-subject factor. Results showed that there was a significant main effect of Emotion on recall $F(3, 66) = 8.946$, $p < .0005$, but no significant effect of Experiment or an interaction between Experiment and Emotion ($ps > .05$).

4   Discussion

Taken together, the present experiment confirmed the expected effects of vocal emotion on the accuracy or word repetition and recall, but these effects were not enhanced when an emotion identification task was added in an attempt to focus more of the listeners' attention on the vocal emotion of the talker. Indeed, adding the additional task reduced overall performance on the repetition task, likely because processing was increased.

Acknowledgements

References

[1] Kensinger, E., & Corkin, S. (2003). Memory enhancement for emotional words: Are emotional words more vividly remembered than neutral words? *Memory and Cognition,31*(8), 1169-1180.

[2] Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition*, 5, 73- 99. doi:10.1016/0010-0277(77)90018-X.

[3] Pichora-Fuller, M.K., Dupuis, K., & Smith, S. (in press). Effect of vocal emotion on word recall. *Experimental Aging Research*.