Emotional Psychophysiological Responses during Self-Referential and Persuasive Talks

An Honors Thesis by

Marika C. Coffman

at Vanderbilt University

Advised by

Stephen D. Benning, Ph.D.

Abstract

Previous studies of individuals performing public speech tasks have not included a broad array of speech conditions or employed psychophysiological measures of a broad range of emotional states. In this study, we asked one participant to give self-referential and persuasive pleasant, neutral, and aversive talks while two other participants listened to those talks *in vivo*. We explored the modulation of corrugator, zygomatic, and orbicularis oculi EMGs as well as P3 brain responses to startle probes that elicited startle blink and postauricular reflexes during these talks. We found that EMG activity, particularly in the listeners, was greater during persuasive than self-referential talks; however, there were no clear patterns of valence-related modulation of these psychophysiological responses. Suggestions for improving this paradigm are advanced.

Emotional Psychophysiological Responses during Self-Referential and Persuasive Talks

Public speaking is a paradigm proven to generate physiological stress and emotion; however, this has predominantly been exploited using cortisol levels in saliva (Bassett, Marshall, & Spillane, 1987; Lehnert, Beyer, Wager et al., 1989). The Trier Social Stress Test (TSST) is a standardized laboratory paradigm that contains a public speaking component to induce stress in participants by asking them to prepare a job talk and deliver it in front of judges. Participants in the TSST demonstrated significant changes in a variety of physiological stress responses after delivering this sort of speech (Kirschbaum, Pirke, & Hellhammer, 1993). However, the researchers in the TSST state were only interested in eliciting stress and did not consider eliciting or measuring broader categories of emotions. They also examined only the effects of trying to persuade listeners to enact a decision; they did not study how simply talking about one's self might impact various indicators of emotional response. Our main goal is to elucidate different psychophysiological measures and examine the responses during social stress. Thus, our research goal was to investigate the way that multiple psychophysiological measures of emotion were modulated in a variety of social speech conditions.

Defensive Psychophysiology: Startle Blink Reflexes and Corrugator EMG

Reliable patterns of EMG expression exist during aversive stimuli. For instance, there is an increase in corrugator EMG, as well as increased startle blink reflex during aversive picture viewing. Increased corrugator activity has been found in response to aversive sounds when compared to pleasant and neutral sounds (Bradley & Lang, 2000). This increased activity is also present during aversive pictures and words (Larsen, Norris & Cacioppo, 2003).

It has also been shown that the intensity of physiological reflexes is augmented when it matches a current emotional state; for instance, the startle blink has greater modulation when an

individual is in an aversive state. Conversely, startle blink reflex is reduced during appetitive emotional states (Lang, Bradley & Cuthbert, 1993). Increased affective intensity of pictures correlates with increased magnitude of the startle blink response as well as corrugator activity (Bernat, Patrick, Benning & Tellegen, 2006). However, although this phenomenon is well documented, it has mostly been studied during picture viewing tasks.

Within the first second of picture onset, startle blink modulation is evident, and has been shown to be much greater in during aversive pictures when compared to startle blink modulation during neutral pictures (Bradley, Cuthbert, & Lang, 2003), which reflects activation of the amygdala that feeds into the neurocircuitry of the startle reflex (Hitchcock & Davis, 1986). However, consistent with the notion that those high in psychopathy have a basic deficit in fear processing, this pattern is divergent in the psychopathic prisoner population, these individuals have an inhibited startle blink reaction to both pleasant and unpleasant pictures when compared to normal populations (Patrick, Bradley, & Lang, 1993). This decreased startle blink response is found specifically in individuals high in the fearless dominance factor of psychopathy, which is the factor of psychopathy most strongly related to reduced fear processing. However, no significant differences are seen between individuals high in impulsive antisociality compared to individuals low in those traits (Benning, Patrick & Iacono, 2005).

Appetitive Psychophysiology: Postauricular Reflexes and Zygomatic EMG

The postauricular reflex is a vestigial response in humans, which works to pull the ear backwards. It is evoked by noise probe and can be assessed concurrently with the startle blink reflex (Hackley, 1993). The postauricular reflex is moderated by emotional stimuli, and is an appetitive reflex. It shows increased modulation during pleasant pictures than aversive and neutral (Benning, Patrick & Lang, 2004).

Similar to the postauricular reflex, the zygomaticus major shows increased activity during pleasant stimuli. Activity is shown to increase as ratings of pleasantness of sounds, pictures, and words increases (Bradley, Codispoti, Cuthbert & Lang, 2001). However, there is no difference in modulation of the zygomatic during aversive sounds, words, or pictures (Bradley & Lang, 2000).

Arousal Psychophysiology: Skin Conductance and P3 Amplitude

Skin conductance is traditionally used a general measure of arousal. Skin conductance has greater activity during both pleasant and neutral conditions when compared to neutral (Bradley et al., 2001). Suggesting that this measure may be modified by personality factors related to chronic underarousal, young adults who rate highly on measures of impulsive antisociality show a decreased skin conductance response (Benning et al., 2005). Similar results are found in juvenile populations, suggesting a general construct present throughout development (Fung, Raine, Lynam, et al., 2005).

However, skin conductance may not be a good measure of emotional arousal or attention during social speech tasks. Individuals often move their hands as they talk, which introduces overwhelming amounts of noise into skin conductance recordings that are typically taken at the fingertips or on the palm of the hand. A better measure of overall emotional arousal in such tasks may be the P3 brain response, a measure of context updating during tasks (Donchin & Coles, 1988) that could be elicited during noise probes during talks. P3 amplitude to noise probes is reduced during emotional pictures compared to those during neutral pictures (Schupp, Cuthbert, Bradley, Birbaumer, & Lang, 1997). This finding reflects the limited capacity of the attentional system to process a second acoustic stimulus during an ongoing task, whether that second stimulus is task relevant or irrelevant (Cuthbert, Schupp, Bradley, McManis, & Lang, 1998).

Current Study and Hypotheses

However, pictures are static stimuli that have limited ecological validity. It would be useful to examine psychophysiological reactivity during tasks more similar to situations encountered in everyday life. One such situation involves talking with other people and listening to people talking.

We drew many of our hypotheses regarding expected facial muscle EMG modulation from the literature regarding facial EMG modulation during pictures. Thus, for the listeners, we expected greater activity in the corrugator EMG during the aversive talks compared to the neutral and pleasant talks. We hypothesized that listeners' zygomatic EMG would be greater during pleasant talks than during aversive and neutral talks. We also expected the listeners' orbicularis oculi muscles to have greater activity during the pleasant talks when compared to the neutral and aversive talks. This is because an indicator of a true smile, or a Duchenne smile, is the engagement of the muscles around the eye in addition to the zygomatic muscles (Eckman, Davidson, & Frieson, 1990). However, we anticipated finding reduced P3 amplitude in listeners during emotional talks than during neutral talks, as they were expected to be more attention grabbing and hence leave the listeners with fewer attentional resources available to process the incoming startle probe.

The startle blink reflex is typically potentiated during threatening and aversive pictures, relative to startle blinks during neutral and aversive pictures, so we hypothesized that we would observe greater startle blink magnitudes in the listeners during aversive vs. neutral and pleasant talks. In contrast, because the postauricular reflex is usually greater during pleasant pictures than during neutral or aversive pictures, we expected the listeners to have the same pattern of

postauricular reflex modulation during pleasant vs. neutral and aversive talks.

We did not advance *a priori* hypotheses regarding the modulation of EMG, P3, or reflexive magnitudes during self-referential vs. persuasive conditions, as this represents a novel manipulation whose affects appear not to have been tested previously in the literature. Similarly, we did not advance *a priori* hypotheses regarding the talker's psychophysiological data. The motion of their facial muscles combined with the competing demands of producing an attentionally demanding speech with strong emotional content made it difficult to know whether attentional or emotional effects would predominate in the talker's psychophysiology.

Method

Participants

Participants consisted of 76 members of the Vanderbilt community (females = 49) . Participants in all but three instances registered for the experiment using an online database, Sona systems, in order to receive class credit ($N = 70$). The three participants who did not participate for credit were last minute fill-ins for participants who had signed up but for various reasons did not participate. Of the total participants 28 were talkers, and 48 were listeners. The study was approved by the Vanderbilt Institutional Review Board.

Measures

All psychophysiological measures were collected with a Neuroscan SynAmps^2 bioamplifier with a sampling rate of 2000 Hz and a bandpass filter of 0.05-500 Hz. Skin conductance was initially collected using a Bioderm model 2701 transducer whose output was delivered to the SynAmps^2 system through high-gain inputs.

EMG. We collected EMG data from each participant. We prepared the skin for electrode

placement by exfoliating the skin using medical gauze pads coated with a dollop of NuPrep, an electro-conducive gel. Each placement was prepared for approximately 30 seconds.

Participants had electrodes placed on the orbicularis oculi, zygomaticus major, corrugator supercilii, and postauricular muscles. One electrode for the corrugator was placed directly above the right brow on an imaginary vertical line transversing the inner commissure of the eye fissure. The second electrode is positioned 1 cm lateral and slightly superior to the first. For the zygomatic muscle, one electrode was placed midway along an imaginary line between the pre-auricular dimple and the corner of the mouth. The second electrode was placed 1 cm closer to the mouth, slightly lower than the first. The first electrode for the orbicularis was placed directly below the pupil of the right eye, and the second electrode is placed 1 cm closer to the ear, but centered with the first (Fridlund & Cacioppo, 1986). For each participant, the ground electrode was placed in the middle of the forehead, and the electrical reference electrode was placed on the neck. All electrodes were filled with an electro-conductive gel in order to enhance the electrical signal. Each participant also had electrodes placed to record data for heart rate, with one electrode on each forearm; data for this channel will be analyzed later.

EEG. All participants had one EEG electrode placement at the Pz according to the 10-20 international system. Similar to the method of preparation for the EMG measures, the Pz site was exfoliated using a gauze pad lined with NuPrep for 30 seconds. Upon completing the preparation one large electrode was placed.

Skin conductance. Only the talker had electrodes for skin conductance placed due to hardware limitations. Electrodes were placed on the thenar and hypothenar eminences of the talker's nondominant hand. Unlike the other electrode placements, the placement skin conductance was prepared with a dry gauze pad. Additionally, an electrically paste rather than a

gel was used to ensure a good connection between the electrode and the skin. However, because of excessive motion artifacts, these data are not analyzed here.

Materials

Talkers were each given a binder holding six different talks. The talks corresponded to three separate valences and two different conditions. Talks were either self-referential or persuasive. Talkers delivered pleasant, neutral, and aversive talks within both the self-referential and persuasive conditions. In the pleasant self-referential condition, talkers explained their personal strengths; in the neutral self-referential condition, they talked about a typical day; and in the aversive self-referential condition, they talked about their own flaws and weaknesses. In the pleasant persuasive condition, talkers convinced the listeners why the talker should be liked; in the persuasive neutral condition, talkers attempted to sell an object described below to the observers; and in the aversive persuasive condition, talkers convinced the listeners that the bad things that have happened to them were not their fault. Each talk was on a separate page and had brief hints to assist in thought preparation. See Appendix A for the scripts used for these talks.

Procedure

Participants arrived simultaneously for the experimental session. After obtaining consent, the talker was led into the psychophysiological testing room and completed a personality questionnaire while initial psychophysiological hookups were completed. Before beginning the questionnaire the talker was shown an object, ‘clocky’, to be used in one of the talks. ‘Clocky’ is an alarm clock with a propeller that flies off when the snooze button is pressed. This was explained to the talker, and then the talker was asked not to reach for the alarm clock during the talk so that movement artifacts in the psychophysiological data would be minimized.

Meanwhile, the two listeners completed a different personality questionnaire in a separate

room and performed a color-word Stroop task, the data for which will be analyzed later. After the listeners finished the Stroop task, an experimenter led them back to the psychophysiological testing room to begin the hookups on the listeners.

Before data collection began, the talker was given a binder containing the talks corresponding to one of six possible orders of talks. Participants were shown the EMG/EEG data recording on the computer screen in the room and asked to move as little as possible once recording began in order to minimize noise in the data. Two video cameras for recording the talker and listeners were then focused on both the talker and the listeners; these data will be coded and analyzed at a later date. The experimenters then explained that a tone would sound to inform the talker to begin speaking for the entire two-minute period, the end of which would be marked by a second tone, after which the talker should flip to the next talk in the book and prepare it for one minute. They were also informed that loud noise blasts would sound during each talk and that these noises should be ignored. The listeners were instructed simply to keep eye contact with the talker and remain silent throughout the experiment. Recording began as soon as experimenters left the room. A short demonstration of the startle probes and start and end tones was then played in order to habituate participants to the various sounds.

During each talk, six startle probes were triggered at 90 dB each and occurred randomly throughout the talks. The minimum inter-startle interval was 13 s and a maximum inter-startle interval was 23 s. The talker had one minute in between talks to read the next prompt and prepare thoughts, during which no startle probes were sounded.

After the talks, electrodes were removed, and the observers returned to the computer testing room to complete the Stroop task again. After this, they rated the talker on the effectiveness of talks. Three items were used to assess the effectiveness of each talk, and each

item was rated on a scale from 1 (least effective) to 9 (most effective). The talker was free to leave after finishing the talks. Sona credit was awarded to all participants after debriefing.

Data Reduction and Analysis

Offline, corrugator, zygomatic, and postauricular EMG data were filtered with a 10 Hz highpass filter. The EEG data were subjected to a 64 Hz lowpass filter. Startle blink data were bandpass filtered between 20-250 Hz, per the recommendations of van Boxtel et al. (1998). All offline digital filters used IIR algorithms with a 24 dB/octave rolloff; filters were implemented in Neuroscan Acquire 4.4. Corrugator, zygomatic, orbicularis oculi, and postauricular data were then rectified. Startle blink data were also smoothed using an IIR Butterworth filter that was implemented in Matlab version 7.6.

Corrugator EMG, zygomatic EMG, and orbicularis oculi were scored for each trial as the median activity in the 120 s window during the talk. We discarded any EMG result for the listeners that was greater than 100 mV, as it likely represents artifactual, non-biological activity. Startle blink reflexes were scored for each trial as the maximum smoothed EMG activity 30-140 ms post-noise probe onset minus the mean activity in the 50 ms pre-probe baseline. Postauricular reflexes were scored for the average waveform within each condition as the maximum rectified EMG activity 8-30 ms post-noise probe onset minus the mean activity in the 50 ms pre-probe baseline. P3 amplitude was scored for the average waveform within each condition as the maximum activity 250-500 ms post-noise probe onset minus the mean activity in the 250 ms pre-probe baseline.

For each set of talk ratings and each psychophysiological measure, data were subjected to a 2 Condition (self-referential, persuasive) x 3 Valence (pleasant, neutral, aversive) within-subjects MANOVA to avoid possible violations of sphericity. Significant main effects and

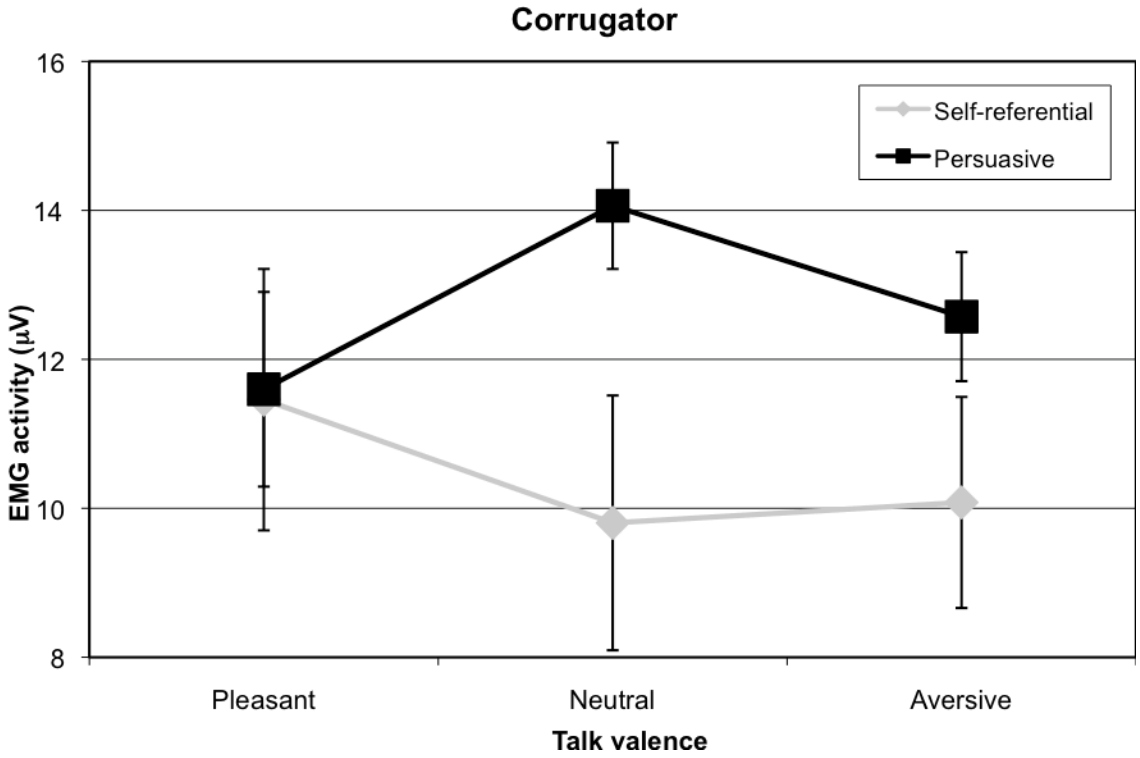
interactions were followed up with planned orthogonal contrasts.

Results

Listener's Psychophysiological Results

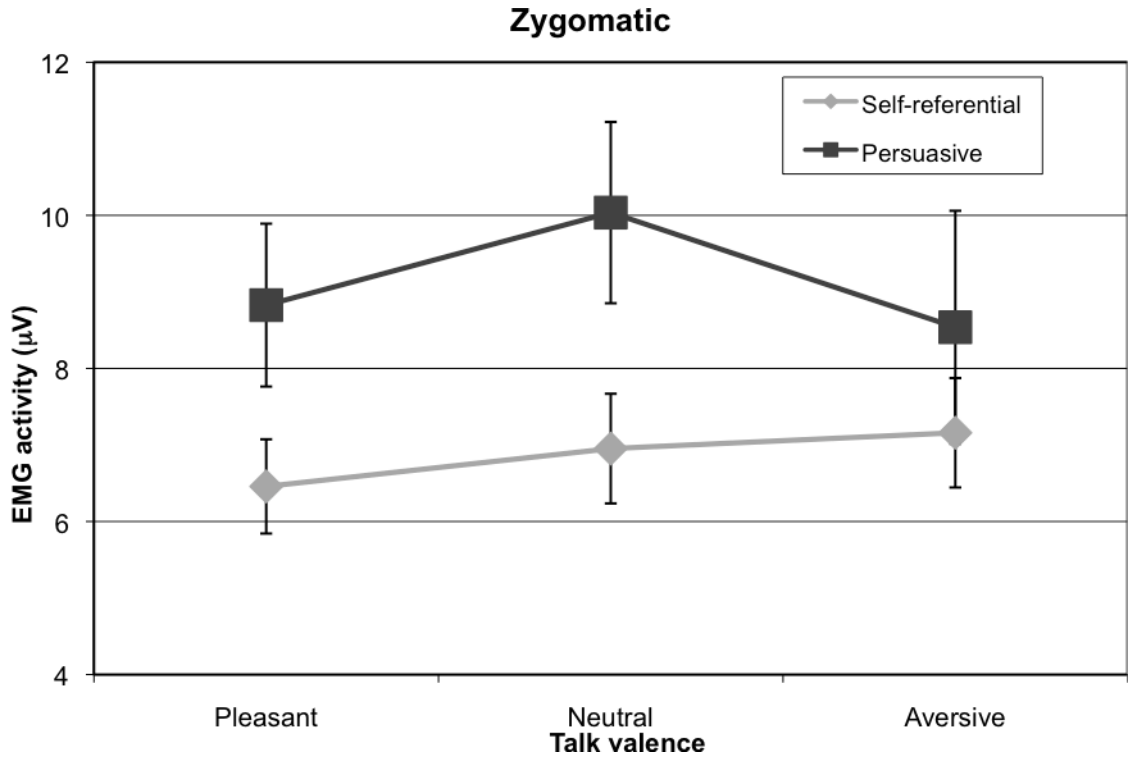
Corrugator EMG. As shown in Figure 1, corrugator activity was greater overall during persuasive than self-referential talks, $F(1,43) = 7.90$, $p = .007$, $h_p^2 = .155$. There was also a significant Condition x Valence interaction, $F(2,42) = 4.24$, $p = .021$, $h_p^2 = .168$, such that the corrugator EMG tended to be largest during neutral vs. emotional persuasive talks but not during self-referential talks, quadratic Condition x Valence $F(1,43) = 6.54$, $p = .014$, $h_p^2 = .132$. However, there was no significant main effect of Valence on corrugator EMG magnitude, $F(2,42) = 0.69$, $p = .509$, $h_p^2 = .032$.

Figure 1. Mean listeners' corrugator EMG (±*SEM*) during persuasive and self-referential talks.



Zygomatic EMG. As displayed in Figure 2, zygomatic EMG magnitude was greater during persuasive than self-referential talks, $F(1,42) = 6.27$, $p = .016$, $h_p^2 = .130$. However, there were no significant effects of Valence, $F(2,41) = 1.96$, $p = .154$, $h_p^2 = .087$, nor was there a significant Condition x Valence interaction, $F(2,41) = 1.54$, $p = .228$, $h_p^2 = .070$.

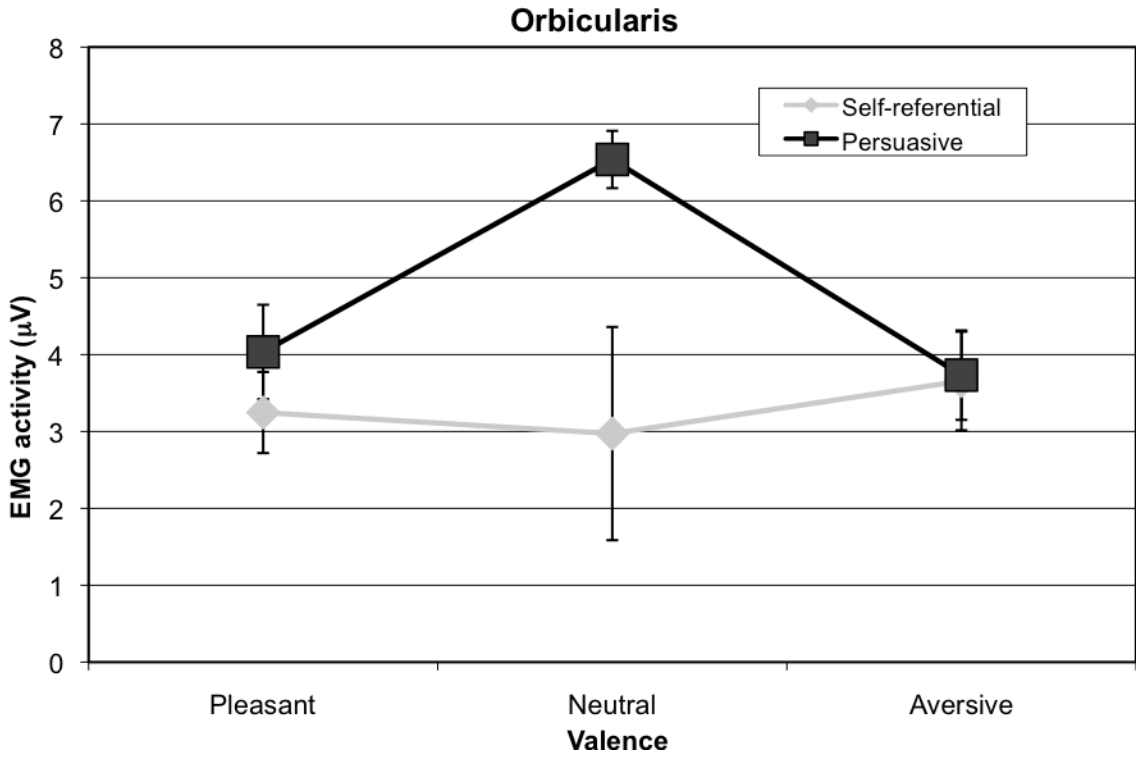
Figure 2. Mean listeners' zygomatic EMG (±*SEM*) during persuasive and self-referential talks.



Orbicularis EMG. Once more, orbicularis oculi EMG activity was greater during persuasive than self-referential talks, $F(1,45) = 9.49$. $p = .004$, $h_p^2 = .170$. There was also a significant Condition x Valence interaction, $F(2,44) = 4.42$, $p = .018$, $h_p^2 = .167$, such that orbicularis EMGs were greater during neutral persuasive talks than during pleasant or aversive persuasive talks, a pattern that was not present in the self-referential talks, quadratic Condition x

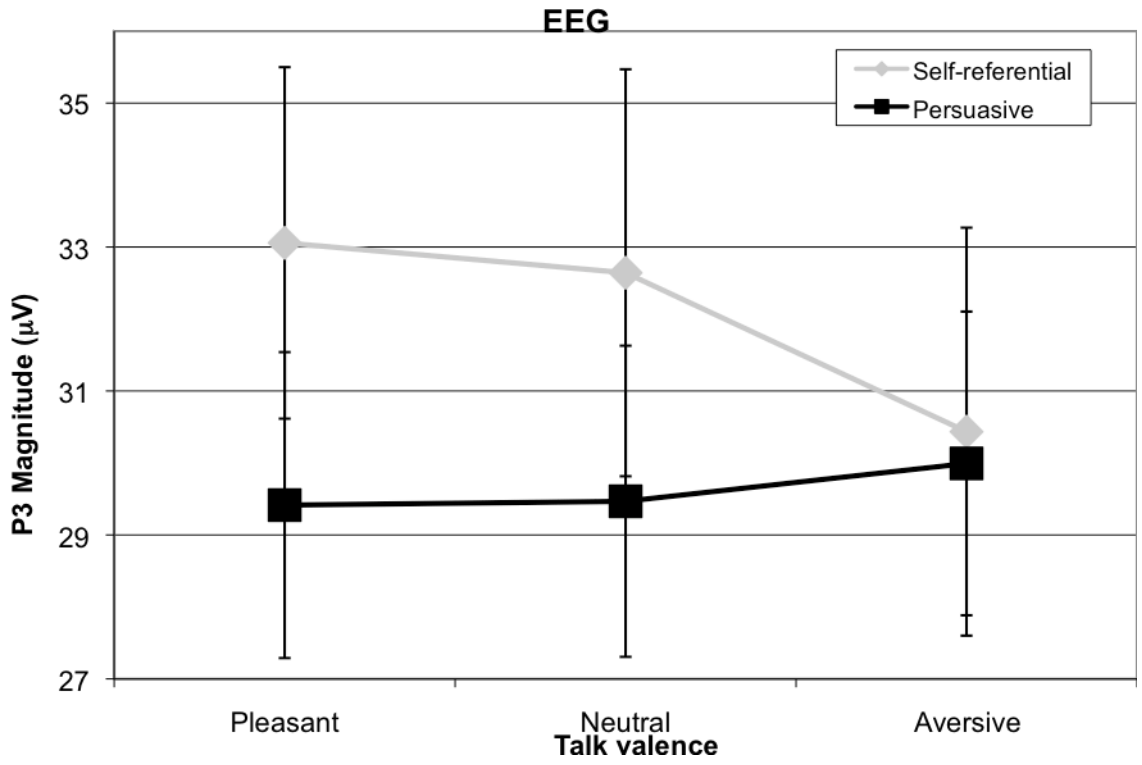
Valence $F(1,45) = 5.83$, $p = .020$, $h_p^2 = .115$. There was no main effect of Valence on orbicularis EMG magnitude, $F(2,44) = 1.52$, $p = .231$, $h_p^2 = .065$. These effects are diagrammed in Figure 3.

Figure 3. Mean listeners' orbicularis EMG (±*SEM*) during persuasive and self-referential talks.



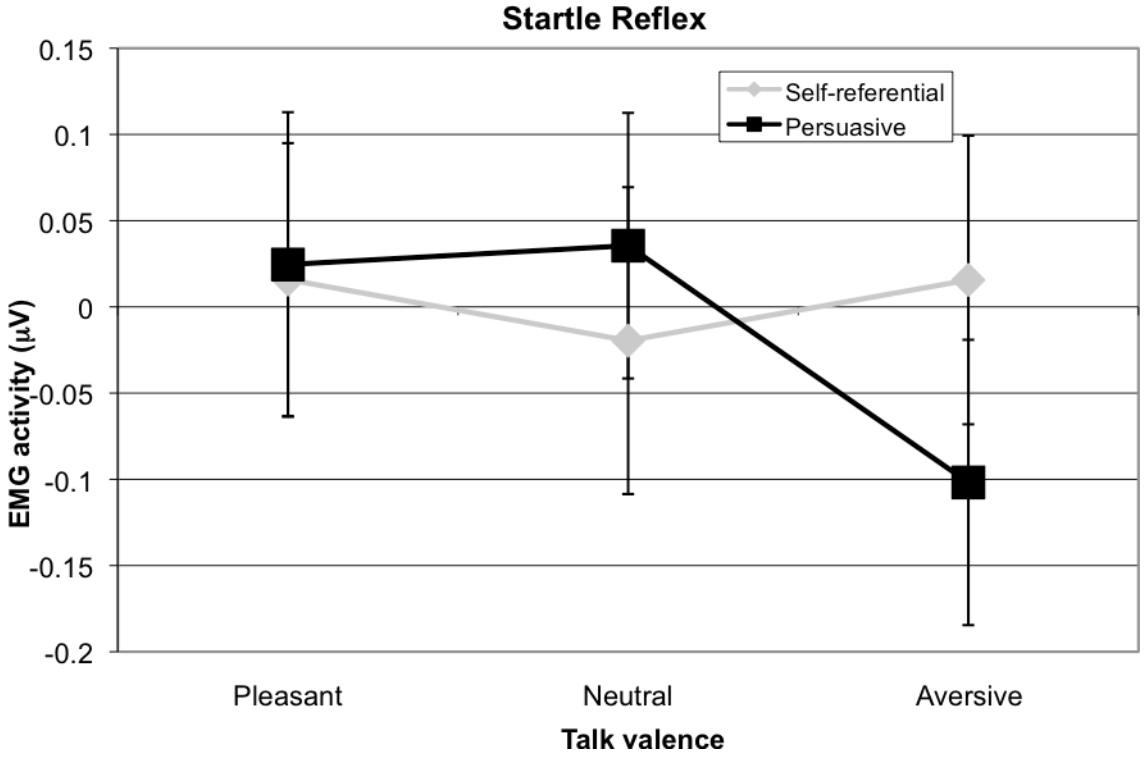
EEG (PZ). Results of the EEG, shown in Figure 4, help to clarify the main effects in the EMG data, which show greater during the persuasive conditions. The P3 response shows a trend toward a smaller amplitude during the persuasive condition, $F(1,38) = 3.72$, $p = .062$, $h_p^2 = .065$, indicating that the listeners were more attentionally engaged during the persuasive than the self-referential talks. There was no main effect of Valence, $F(2,37) = 0.20$, $p = .823$, $h_p^2 = .010$. and there was no significant Condition x Valence interaction, $F(2,37) = 1.19$, $p = .316$, $h_p^2 = .060$.

Figure 4. Mean listeners' P3 amplitude (±*SEM*) during persuasive and self-referential talks.



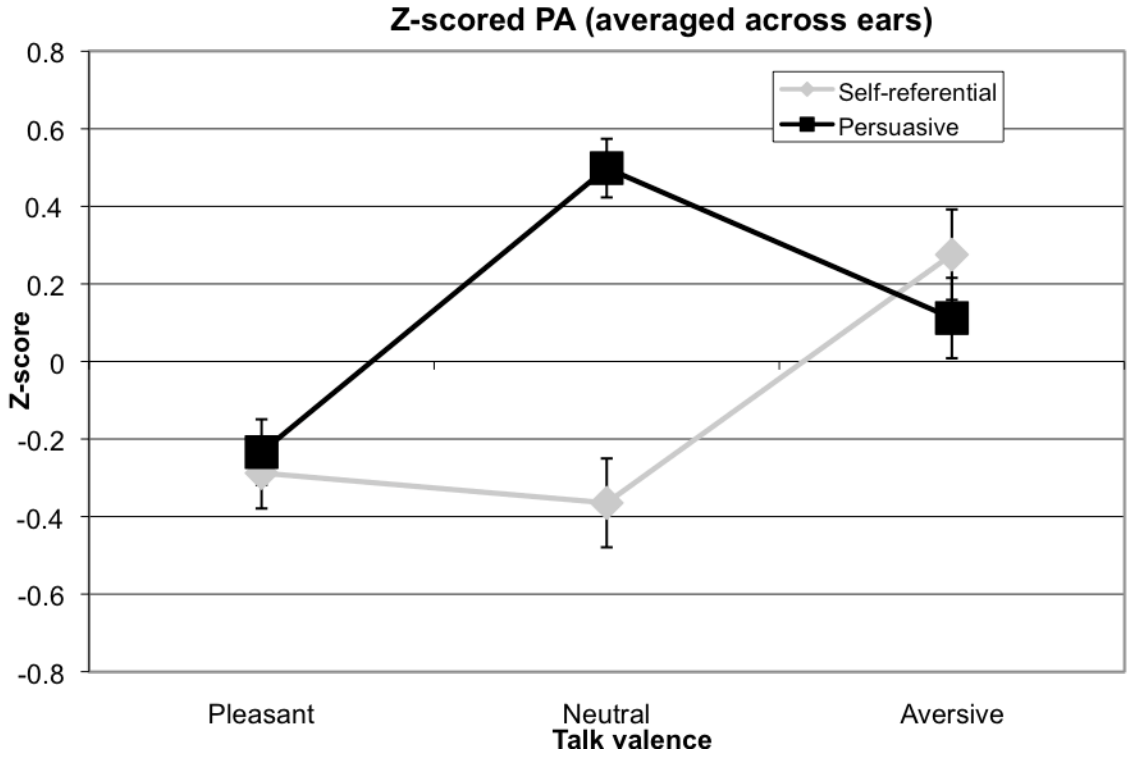
Startle blink. As shown in figure 5, there were no significant effects on startle blink magnitude, Fs < 1, ps > .4, h_p^2s < .040.

Figure 5. Mean listeners' startle blink reflex magnitude (±*SEM*) during persuasive and self-referential talks.



Post-auricular reflex. Postauricular reflexes during persuasive talks were greater than those during self-referential talks, $F(1,47) = 6.26$, $p = .016$, $h_p^2 = .118$. There was also a significant Condition x Valence interaction, $F(2,46) = 11.99$, $p < .001$, $h_p^2 = .343$, such that postauricular reflexes were greater during neutral persuasive talks than during emotional persuasive talks, in contrast to the pattern observed for self-referential talks, quadratic Condition x Valence $F(1,47) = 24.5$, $p < .001$, $h_p^2 = .343$. This interaction qualified the significant Valence effect, $F(2,46) = 12.7$, $p < .001$, $h_p^2 = .355$, which was essentially due to postauricular reflex magnitudes being during aversive than pleasant talks, linear $F(1,47) = 20.8$, $p < .001$, $h_p^2 = .307$. These results are shown in figure 6.

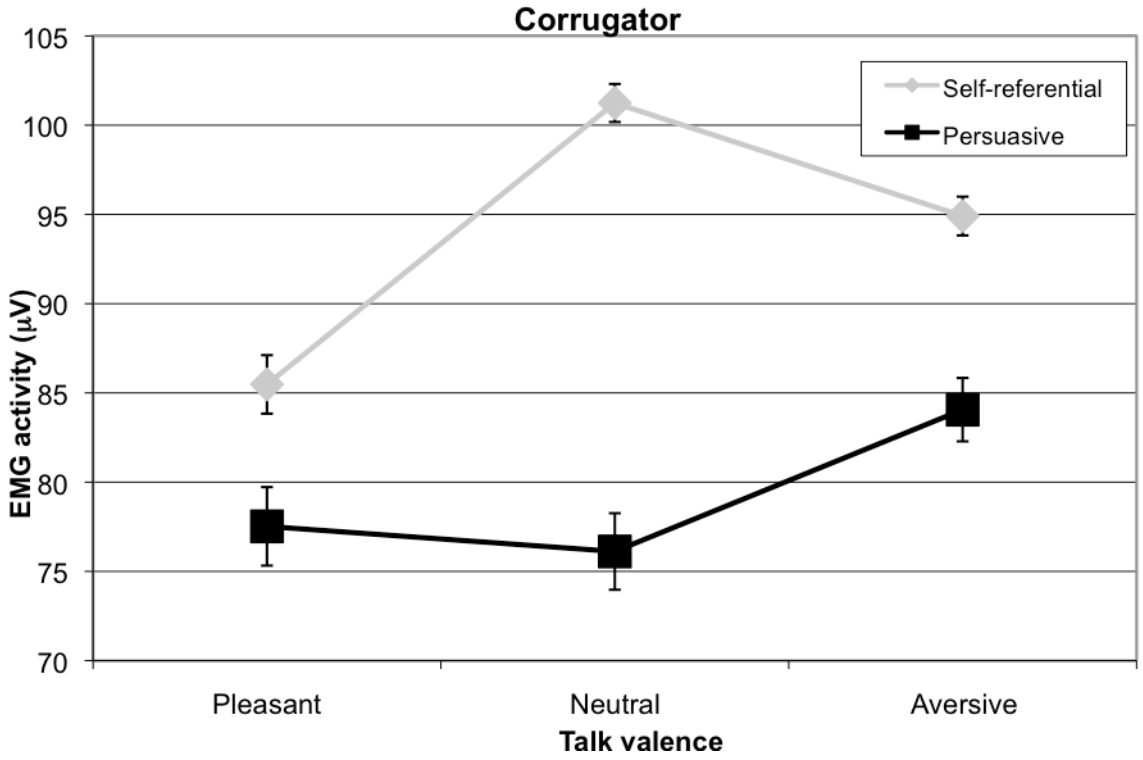
Figure 6. Mean listeners' postauricular reflex magnitude (±*SEM*) during persuasive and self-referential talks



Talker's Psychophysiological Results

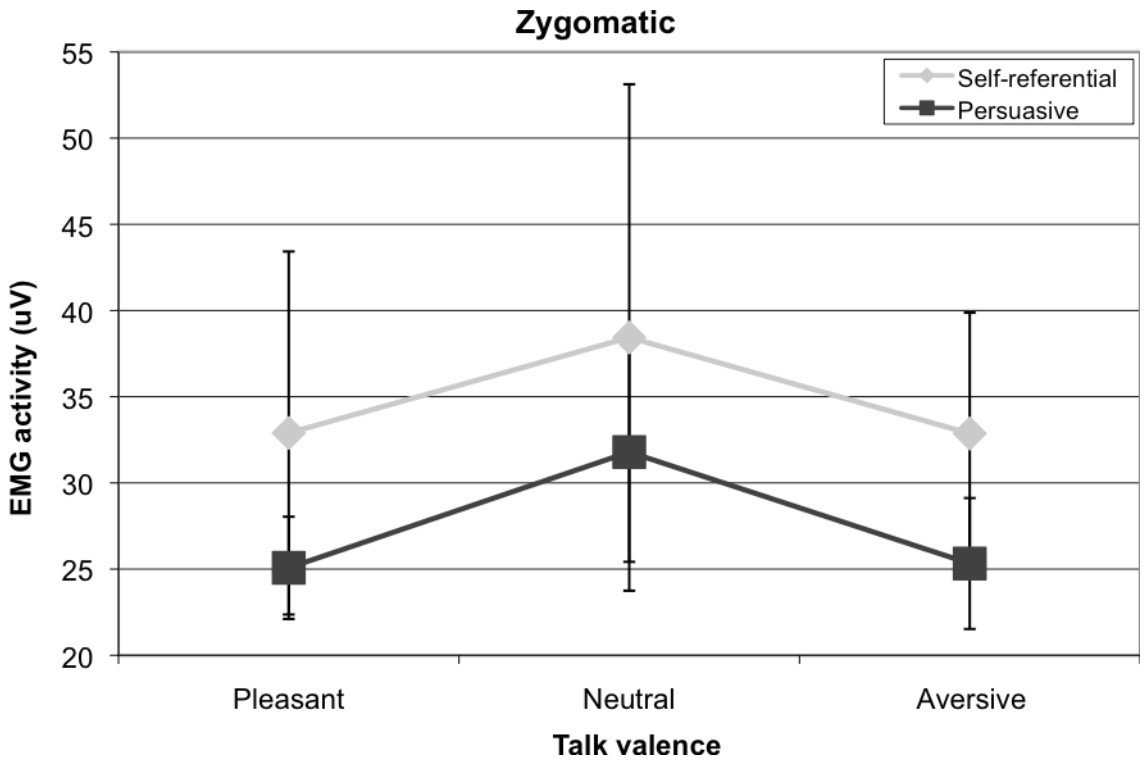
Corrugator EMG. As shown in figure 7, corrugator activity was greater overall during the self-referential talks, rather than the persuasive talks $F(1,24) = 7.90$, $p = .007$, $h_p^2 = .155$. There was also a significant Condition x Valence interaction, $F(2,42) = 4.24$, $p = .021$, $h_p^2 = .168$, such that the corrugator EMG tended to be largest during neutral vs. emotional persuasive talks.

Figure 7. Mean talkers' corrugator EMG (±*SEM*) during persuasive and self-referential talks.



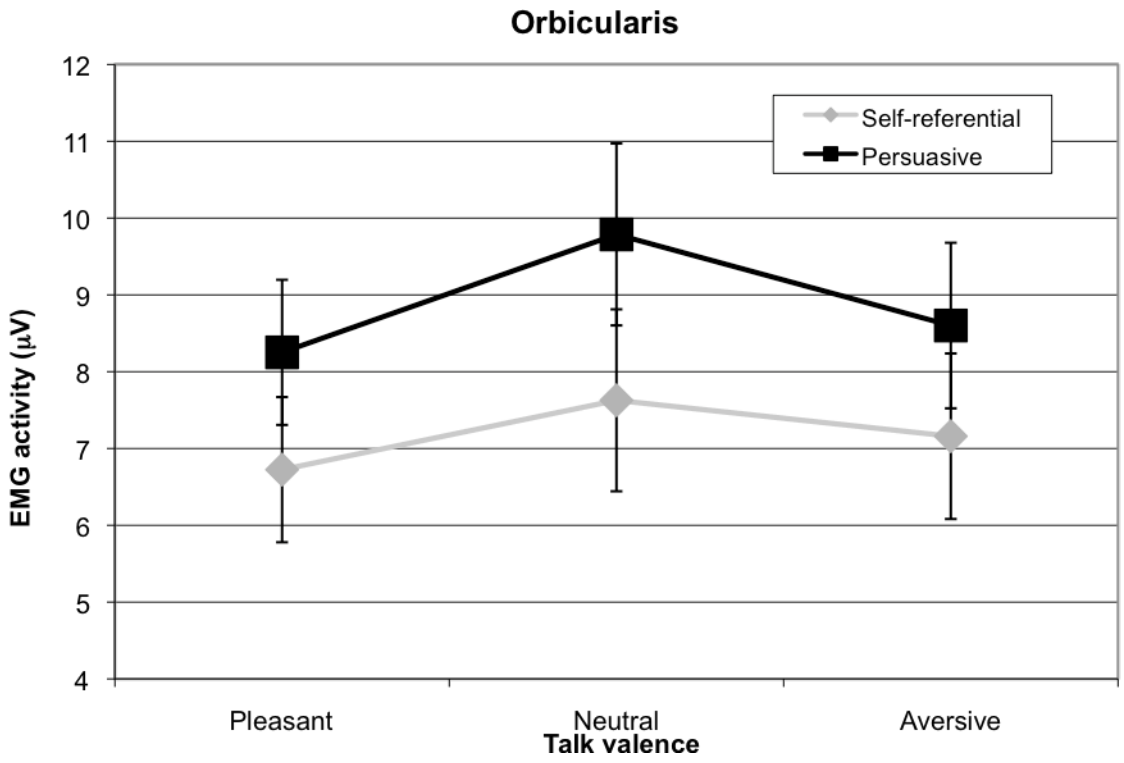
Zygomatic EMG. As displayed in Figure 8, zygomatic EMG magnitude was greater during persuasive than self-referential talks, $F(1,27) = 1.094$, $p = .304$, $h_p^2 = .038$. However, there were no significant effects of Valence, $F(2,26) = 2.356$, $p = .0.099$, $h_p^2 = .162$, However, there was a significant Condition x Valence interaction, $F(2,26) = .292$, $p = .748$, $h_p^2 = .585$, in which the neutral valences were more highly modulated than the emotional.

Figure 8. Mean talkers' zygomatic EMG (±*SEM*) during persuasive and self-referential talks.



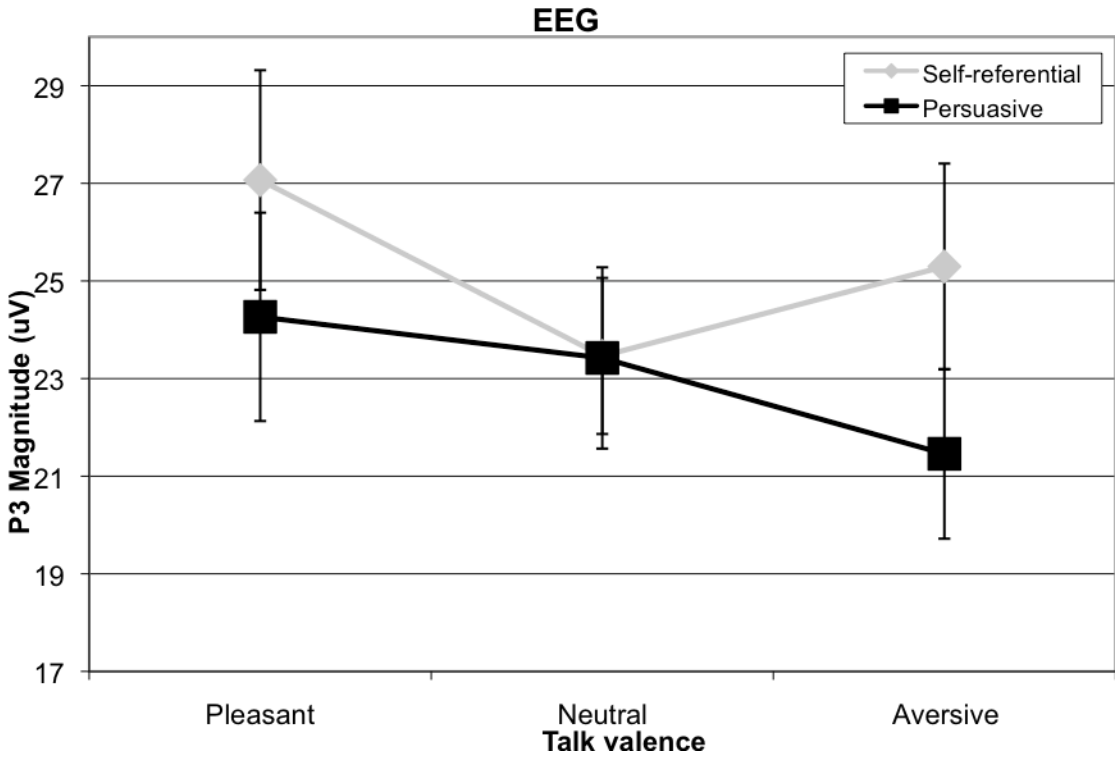
Orbicularis EMG. Once more, orbicularis oculi EMG activity was greater during self-referential than the persuasive talks, $F(1,27) = 2.356$. $p = .136$, $h_p^2 = .080$. There also no significant Condition x Valence interaction, $F(2,26) = 0.352$ $p = .706$, $h_p^2 = .026$. There was an approaching significance main effect of Valence on orbicularis EMG magnitude, $F(2,26) = 3.193$, $p = .057$, $h_p^2 = .197$. These effects are diagrammed in Figure 9.

Figure 9. Mean talkers' orbicularis EMG (±*SEM*) during persuasive and self-referential talks.



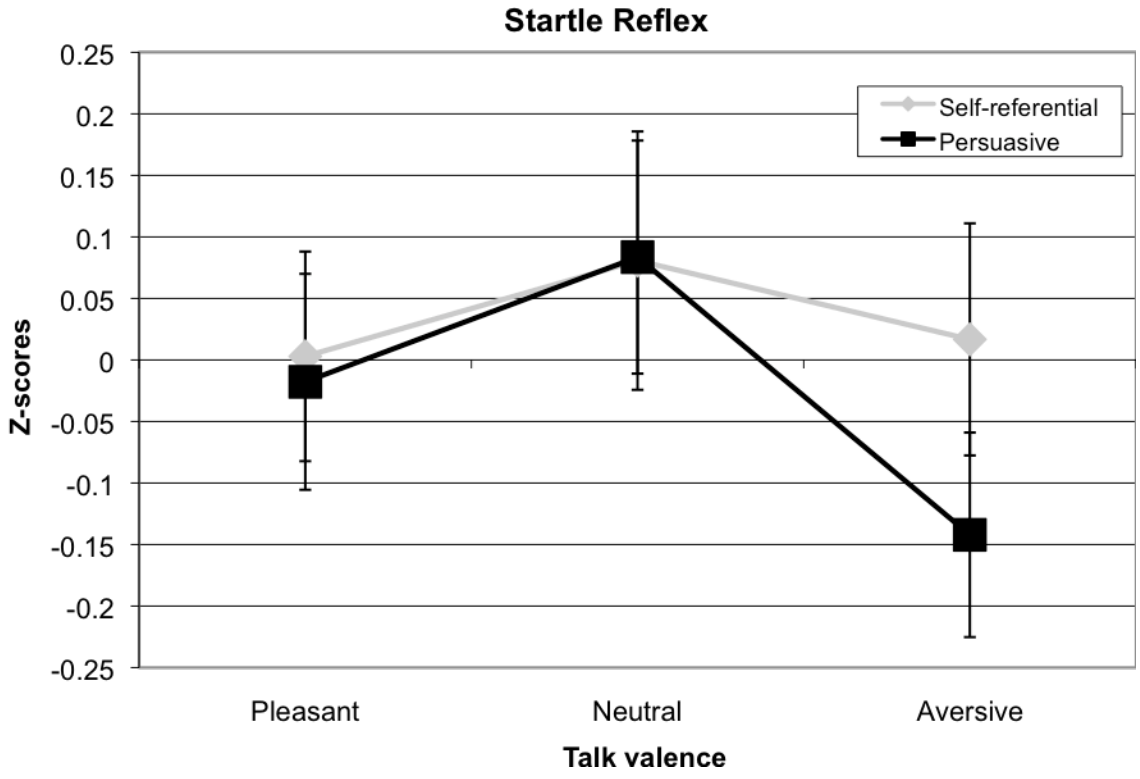
EEG (PZ). Results of the EEG for the talker, seen in figure 10, are overall insignificant. The P3 response between the self-referential and persuasive conditions was not significant, $F(1,12) = 2.451$, $p = .141$, $h_p^2 = .158$, indicating that the listeners were more attentionally engaged during the persuasive than the self-referential talks. There was no main effect of Valence, $F(2,13) = 0.445$, $p = .141$, $h_p^2 = .0158$. and there was no significant Condition x Valence interaction, $F(2,13) = .625$, $p = .551$, $h_p^2 = .094$.

Figure 10. Mean talkers' P3 amplitude (±*SEM*) during persuasive and self-referential talks.



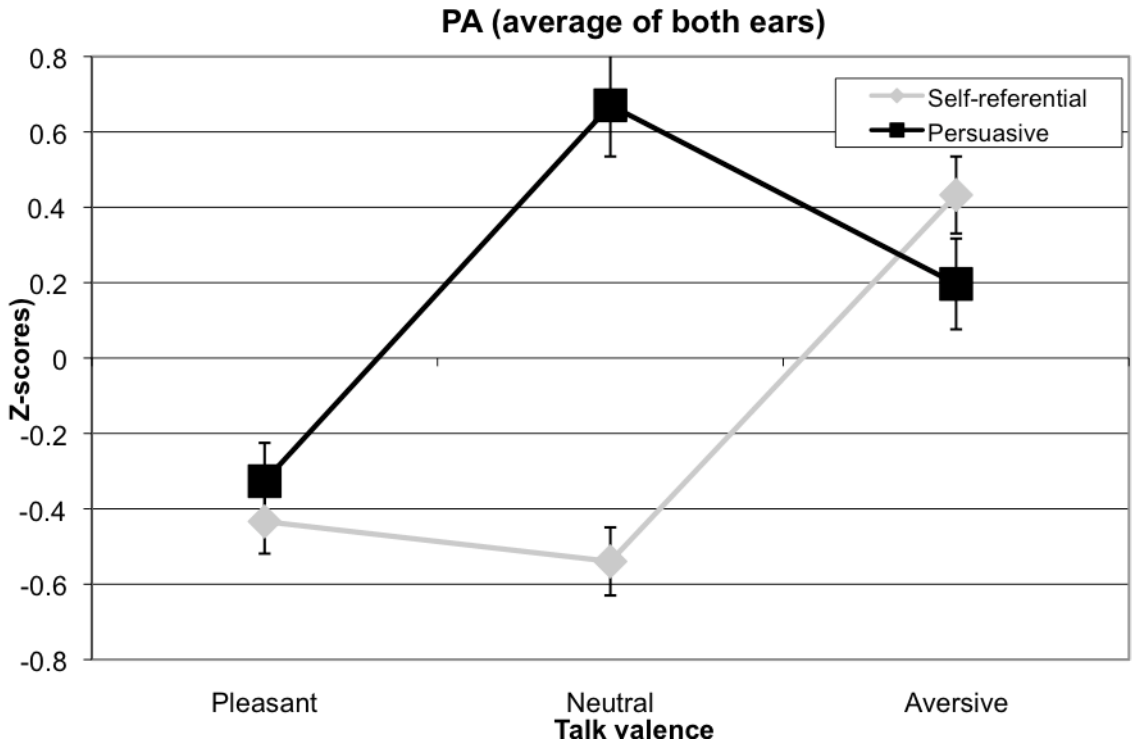
Startle blink. As shown in Figure 11, There were no significant effects on startle blink magnitude, such that the condition by valence interaction was $F(2, 24)$, $p = .644$, $h_p^2 s < .036$. There was also no significant difference between self-referential and persuasive conditions, such that $F(1, 25)$, $p = .652$, $h_p^2 s < .008$, and no significant interaction between valences, $F(2, 24)$, $p = .219$, $h_p^2 s < .119$.

Figure 11. Mean talkers' startle blink reflex magnitude (±*SEM*) during persuasive and self-referential talks.



Post-auricular reflex. Postauricular reflexes during persuasive talks were greater than those during self-referential talks, $F(1,25) = 10.503$, $p = .003$, $h_p^2 = .296$. There was also a significant Condition x Valence interaction, $F(2.26) = 14.862$, $p < .000$, $h_p^2 = .553$, such that postauricular reflexes were greater during neutral persuasive talks than during emotional persuasive talks, There is also a significant Valence effect, $F(2,26) = 11.529$, $p < .000$, $h_p^2 = .490$, which was essentially due to postauricular reflex magnitudes being during aversive than pleasant talks. These effects are diagrammed in Figure 12.

Figure 12. Mean talkers' postauricular reflex magnitude (±*SEM*) during persuasive and self-referential talks



Discussion

We found a consistent increase in EMG activity in all listeners' muscles during persuasive vs. self-referential talks with a concomitant decrease in P3 amplitude during these talks. However, the only significant pattern of valence modulation for the EMGs involved the potentiation during neutral persuasive talks. For the listeners, startle blink magnitude was not modulated by talk condition or valence, but the postauricular reflex was modulated in a manner that was more consistent with what would be expected of the startle blink. Results for the talker

overall were insignificant.

Listeners

There is a main effect between listeners, which shows greater activity of the EMGs during the persuasive talks. Overall patterns for the listeners indicate higher overall engagement or attention to the persuasive conditions than to the self-referential. There may be many reasons for this. One possible explanation could be that the listeners are simply more engaged or interested during the persuasive talks. Often the talkers address the listeners directly during the persuasive talks, but not always during the self-referential talks, which may contribute to modulating the attention of listeners. The EEG results bolster this interpretation that listeners are more engaged or attentive during the persuasive talks. This explanation is plausible because literature has shown a common EEG response to acoustic stimuli is greatly diminished when attention is focused elsewhere (Suzuki, Nittono, Hori, 2005; Wickens, Kramer, Vanasse, Donchin, 1983). Essentially, there is a limited capacity of attention, and when it is focused on the talker there is less attention available for processing the startle probe. Therefore, the lessened EEG response during the persuasive talks confirms that they are more engaging and captivating for the listeners.

This attentiveness could also be described as a lack of attention when talkers are simply talking about themselves; listeners may become weary of hearing one person's strengths and weaknesses while they cannot contribute to the 'conversation'. Indeed, one possible interpretation of the postauricular findings could be that listeners experience a type of schadenfreude at hearing another person's weaknesses. Indeed, it has been found that when high-achieving individuals encounter difficulty, observers view their misfortunes with more

schadenfreude (Feather, 2008). Continuing with this line of reasoning, the listeners may become irritated by hearing the talker brag about their strengths.

Talkers

Data for the talker seems to indicate increased negative affect during the self-referential conditions. Increased corrugator responses, and decreased postauricular and corrugator responses during the self-referential conditions imply that the talker does not find it pleasant to talk about his or her life in front of two strangers.

The corrugator responses indicate that the talker does not find it pleasant to talk about their day-to-day lives. While all talkers are Vanderbilt undergraduates, and likely feel stress because of their daily routines, there may be another explanation. Talkers may be looking around the room attempting to remember their normal routines. We have video camera data to look through at a later date to confirm whether this is the case.

Data for the zygomatic muscle for the talker is very messy, which substantially reduced our power to detect effects but is not surprising because of the constant talking. This problem was present to a lesser extent in the talkers' other electrodes due to the motion and muscle activity inherent in talking. Also, data for the EEG is not usable in many of the talkers. Again, this is likely because of movement while talking, which may have made the electrode fall off, as they were all secured only by a piece of tape. More effective ways of keeping these electrodes in place is needed.

Limitations and Future Directions

One of the limitations with the persuasive neutral condition (the 'clocky' condition) is that it is the only talk containing a prop, and therefore may add whimsy into a supposedly neutral

talk. This would create a more pleasant talk than the intended neutral valence. A way to correct this in future studies is to either give 'clocky' a more sterile name, such as 'Product 378b', or to use a less entertaining props, such as school supplies or gardening tools.

Another way to correct this effect is to include additional props in the persuasive talks. These props could serve a dual purpose. One, of not having clocky be an oddity in the room, and also increase valence arousal in the other talks. For instance, using a stuffed animal in the persuasive pleasant condition, and asking the talker to convince the two participants that this is the cutest animal one has ever seen may increase engagement of the zygomatic muscle more than convincing the two participants that they should like you. This is because the zygomatic muscle is particularly sensitive to 'cute' pictures, such as pictures of happy couples (Bradley, Codispoti, Cuthbert & Lang, 2001). By adding props into the persuasive aversive condition we would also be able to heighten threat and therefore potentially increase startle blink and corrugator responses, due to a reported increase in corrugator and startle response while viewing threatening pictures (Bernat, Patrick, Benning & Tellgan, 2006). For instance, by using a knife, and having the talker explain why the listeners should be careful with knives and why they are dangerous would likely increase threat.

An addition limitation is that our self-referential talks may not be eliciting the reactions we desired. For instance, talking about one's strengths may not elicit a pleasant response, but rather an aversive or off-putting response. Instead, we could ask the talker to tell the listeners about a good memory, the nicest thing they ever did for another person, or the person they admire. Also, talking about one's weaknesses may not be entirely unpleasant for the listeners. They may derive some pleasure from hearing another's shortcomings or downfalls. Therefore, having the talker retell an embarrassing story or the saddest story they have ever heard may elicit

the response we desire more accurately. We also intend to include valence ratings after each talk as a check to ensure the talks are accomplishing what we intended, because to our knowledge there has been no manipulation using these specific conditions to elicit emotional responses.

Another limitation in the study is the artificial setting. The participants do not know each other, and all have peripheral electrodes placed on their faces in an unfamiliar laboratory setting. Once the talks begin, listeners are instructed not to respond vocally to the talker. Although this setting is more authentic to real life than viewing threatening pictures, it is still may not elicit emotion as effectively as a casual exchange between two or three strangers. Nevertheless, previous research involving the Trier Social Stress Test indicates that even these artificial conditions can successfully elicit emotion, particularly in group settings (Childs, Vicini, De Wit, 2006).

Overall, our results demonstrate that persuading strangers is more physiologically engaging than simply talking about oneself to strangers. An important next step in research will be to examine cortisol levels immediately before and after the task to examine whether it is more stressful talking about oneself than persuading others. Also, it would be interesting to learn is more stressful to be persuaded, or if this is purely an attentional effect.

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Appendix

Self-referential pleasant

Please describe your personal strengths to the other people.

-You might describe character traits that you are proud of in yourself or things you like about yourself.

- You might focus on a specific incident in which you were tested and feel you performed well, or some good things about you that others might have commented on, or some things other people might have told you that you do well.

Self-referential neutral

Please describe a typical day in your life.

-You might describe things that you do nearly every day.

- You might describe your work or classes you attend, morning rituals or typical meals, or bedtime routines.

Self-referential aversive

Please describe what you consider to be your biggest faults and/or weaknesses.

- You might want to talk about insecurities, emotional control issues, or have things you don't like about yourself.

- You might have to work harder than other people do at some task, have bad habits, or wish you could change something about yourself.

Persuasive pleasant

Please try to tell the other people why they should like you.

- You might talk about good things you've done, or your interests.

- You might focus on a specific incident in which you helped other people, why other people like you, or why your hobbies are interesting.

Persuasive neutral

Please try to sell the other people a device called 'Clocky'.

-You might talk about the observers need for this particular item that is not already being met: alarm clock, child's toy, or a fan.

-You could comment on the usefulness of an alarm clock that flies away when snoozed, a child's hide 'n seek toy, or having a personal-sized fan.

Persuasive aversive

Please try to convince the other people that the bad things that have happened in your life are not your fault.

-You might talk about difficulties with school, work, or friends.

-You might talk about a car accident, problems completing a project, a bad grade, or a falling out with someone close to you.