Positive emotional reactions to loved names

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ABSTRACT

Studies concerning personal attachment have successfully used loved familiar faces to prompt positive affective and physiological reactions. On the other hand, the processing of emotional words has been associated with a pattern of peripheral and central physiological responses equivalent to those found with affective pictures. The objective of this study was to assess whether the passive viewing of loved names would produce a pattern of subjective and physiological reactivity similar to that produced by the passive viewing of loved faces. The results showed that compared to neutral (unknown) and famous names, loved names produced a biphasic pattern of heart rate deceleration-acceleration, heightened skin conductance and zygomaticus muscle activity, inhibition of corrugator muscle activity, and potentiation of the startle reflex response. This pattern of physiological responses was accompanied by subjective reports of higher positive affect and arousal for loved names than for neutral and famous ones. These findings highlight not only the similarity but also the differences between the affective processing of identity recognition by loved faces and names.

Keywords: positive emotion; loved names; heart rate; skin conductance; startle reflex

1. INTRODUCTION

Most social cognition studies focus their attention on the emotional factors of human relationships (Adolphs, 2003). Previous research has demonstrated that recognition of someone´s identity involves the activation of an affective route that is independent of conscious awareness (Tranel, Fowles, & Damasio, 1985). These studies have predominantly used faces to examine the emotional factors involved in identity recognition. However, faces are not the only method to identify someone. There are other social stimuli that can evoke the representation of a person we know. One of the most common ways we use every day to identify someone is by name.

The mere identification of someone that we know prompts unique emotional reactions associated with that person. Syndromes such as prosopagnosia (Bauer, 1984) and Capgras delusion (Bobes et al., 2016; Ellis & Lewis, 2001) confirm the strong relationship between identity recognition and emotional responses. Both central and peripheral psychophysiological measures have served as indicators of this strong relationship between person´s identification and affective modulation (Guerra, Vico et al., 2012; Guerra, Sánchez-Adam, Anllo-Vento, Ramírez, & Vila, 2012; Sánchez-Adam, 2013; Vico, Guerra, Robles, Vila, & Anllo-Vento, 2010). For instance, changes in heart rate as well as enhanced skin conductance and zygomaticus muscle responses have been related to positive emotional activation in identity recognition paradigms.

Early models of face and name processing (Bruce & Young, 1986; Gorno-Tempini et al., 1998) emphasized the importance of identity recognition and the retrieval of information concerning the identity of the person. More recent models of face processing have proposed a distributed neural system for face perception (Haxby, Hoffman, & Gobbini, 2000; Gobbini & Haxby, 2007; Haxby & Gobbini, 2010). It includes recognition of visual codes along with automatic retrieval of personal knowledge and emotional responses related to the person's identity. Since its first version, this model differentiates between a core system for face visual analysis and an extended system for the extraction of person information and emotion. Each system is associated with specific brain areas and both work by giving and receiving feedback from each other. On the one hand, the core system distinguishes between dynamic features for recognition of facial gesture (e.g., eye gaze direction) and invariant features for face identification. This core system is mainly associated with activations in occipital areas. On the other hand, the extended system processes previous knowledge about the person and the emotional reactions driven by that person. This latter system is associated with activation in cognitive and memory areas, motor simulation structures, and the limbic system. Although this model was developed only for face perception, it might be extended to other identity recognition pathways, such as name processing.

Names and faces are both social stimuli that refer to someone's identity. Although compared to faces, proper names do not have unique intrinsic properties, personally relevant names seem to be processed differently from simple nouns (Bundesen, Kyllingsbaek, Houmann, & Jensen, 1997; Müller & Kutas, 1996), even in people with an altered state of consciousness (Di et al., 2007; Perrin et al., 2006). The studies of identification by proper name processing focused their attention on familiarity attributes, studying name recognition primarily by central measures (Douville et al., 2005; Gorno-Tempini et al., 1998; Sugiura et al., 2006, 2008, 2009). Personally relevant names seem to engage automatic preferential processing as indexed by P300 and P200 (Kotlewska & Nowicka, 2015; Tacikowski, Cygan, & Nowicka, 2014; Tacikowski & Nowicka, 2010). Similar effects have been recorded for highly familiar faces based on the same components (Guerra, Campagnoli, et al., 2011; Guerra et al., 2012; Kotlewska & Nowicka, 2015; Vico et al., 2010). Neuroimaging research on name recognition highlights the importance of the medial prefrontal cortex (MPFC)

(Tacikowski, Brechmann, & Nowicka, 2013) when processing one's own name or personally relevant names. These findings fit previous research that emphasized the relationship of MPFC with the processing of personally relevant stimuli (Lieberman, 2007).

Most neuroscientific studies on name recognition have limited the investigation to the recording of central physiological measures. Far less research that records peripheral physiological measures has been reported. Two experiments by Ellis, Quayle and Young (1999) found a familiarity effect for face presentation but not for names in skin conductance responses, suggesting less emotional responsivity for names compared to faces. However, other peripheral physiological measures, both autonomic and somatic, can be used to examine emotional reactivity to proper names. One of the most popular peripheral measures used to study emotional modulation is the acoustic startle reflex (Bradley & Lang, 2007). Startle reactivity is modulated by the subject's current emotional state. The amplitude of the reflex is reduced under positive emotional states and augmented under negative emotional states compared to neutral states. This effect has been observed using different paradigms to induce positive and negative emotions, such as viewing affective pictures, listening to affective sounds, reading emotional words, or imagining affective scenes (Bradley & Lang, 2007; Lang, 1995) (Miller, Patrick, & Levenston, 2002; Vrana, 1994). To date, no study has analyzed startle reflex reactivity when viewing loved familiar names as has been done with loved familiar faces.

It is important to note that the paradigm of reading written emotional words is similar to the paradigm of reading personally relevant names (Herbert & Kissler, 2010; Herbert, Kissler, Junghöfer, Peyk, & Rockstroh, 2006; Kissler, Herbert, Winkler, & Junghofer, 2009). Emotional words have the same properties of relevant names in terms of resemblance and lack of unique intrinsic properties. This affective written stimulus can modify syntactic processing even when the subject is unaware of its content (Jiménez-Ortega, Espuny, de

Tejada, Vargas-Rivero, & Martín-Loeches, 2017). Their emotional value comes from the element to which it is referring. For significant names, P300 and P200 enhancement has been found to be related to highly arousing emotional words (Herbert et al., 2006). Previous research also recorded late positive potential increases for pleasant words (Herbert et al., 2006; Kissler et al., 2009). As in emotional face paradigms, personal relevance also seems to play an important role in emotional word processing, also affecting its late positive components (Fields & Kuperberg, 2016). Thus, the results of emotional word processing using central measures resemble those found in face viewing paradigms.

However, one of the major differences between emotional face and word processing has been found in eye-blink startle reactivity. Viewing loved familiar faces inhibits eye-blink startle (Guerra, Sánchez-Adam, et al., 2012), whereas viewing positive emotional words potentiates eye-blink startle (Herbert & Kissler, 2010; Herbert et al., 2006; Kissler et al., 2009). Eye-blink startle inhibition observed during emotional face processing (Guerra, Sánchez-Adam, et al., 2012) is consistent with the *motivational priming* hypothesis (Bradley & Lang, 2007), whereas eye-blink startle potentiation observed during emotional word processing is consistent with the *processing interrupt* hypothesis (Herbert & Kissler, 2010; Herbert et al., 2006; Kissler et al., 2009). *Motivational priming* patterns result in enhancing startle reactions to unpleasant stimuli in reference to neutral stimuli and decreasing reactivity for pleasant ones. These defensive reactions are coherent with the environment's emotional valence. *Processing interrupt* patterns, in contrast, show increases in eye-blink startle for both pleasant and unpleasant stimuli in comparison to neutral stimuli, but they are also greater for pleasant than for negative ones. Startle reactivity seems to covary with the depth of internal cognitive processing as seen by Herbert & Kissler (2010). Previous imagery research also showed this kind of pattern depending on the degree of internal processing (Miller et al., 2002; Vrana & Rollock, 2002). This was hypothesized as a defensive reflex reaction to sudden environment changes, i.e., an alert that reorients attention from sensorial environment disengagement to the external potential danger.

The aim of this study is twofold. First, we want to assess whether loved familiar names are processed in a similar way as other positive social stimuli, such as loved familiar faces. The emotional reactivity produced by the names of our loved ones could provide information on how this kind of stimulus is processed. According to the model proposed by Haxby and Gobbini (2010), emotional responses would be associated with the identity of the person whose name is displayed. In this study, we expect to obtain peripheral reactions associated with positive emotional states as seen previously with loved faces (Guerra, Vico, et al., 2012; Vico et al., 2010). Second, given the characteristics of written emotional words concerning the differential modulation of startle reflex response, our study intends to test whether the passive viewing of loved familiar names fits either the *motivational priming hypothesis* or the *processing interrupt* hypothesis. An inhibition of the startle reflex by loved familiar names would support the first hypothesis, whereas a potentiation of the startle reflex would support the second one.

2. METHOD

2.1.Participants

Thirty-six female students, aged from 18 to 32 (mean: 22.44; SD: 3.32), participated in this study. Participants were required to (a) have lived with their parents until, at least, the age of 18, (b) have been in a stable relationship for a minimum of 6 months and a maximum of 6 years, (c) to not live with their partner at the moment the experiment, and (d) have satisfactory relationships with both the parents and the companion. None of the participants disclosed physical or psychological problems, and none of them were under pharmacological treatment. All participants had normal or corrected-to-normal vision. They all signed informed consent forms before the experimental session and received course credits for their participation. Three participants had excessive noise in the EKG and were not included in the heart rate analysis. There was no more missing data.

2.2. Stimuli and task

Written proper names (name and first surname) were presented. They belonged to three categories: loved ones (boyfriend, father, mother, and female best friend), neutral (another participant´s loved ones) and famous names (2 masculine and 2 feminine names selected by the participant from a 40-item list). Participants were instructed to select famous names who did not evoke either positive or negative feelings. All names were presented on a 19 inch screen, placed at approximately 60 cm from the subject, using Presentation software (Neurobehavioral Systems, 2003, San Francisco, CA). Each participant was randomly assigned to one of six different sequences that followed a set of eight 3x3 latin squares (72 trials, 6 trials per category) to guarantee that all names had an equal preference distribution. Each trial consisted of a 4-sec baseline, 6-sec name presentation and 4-sec poststimulus interval. Inter-trial interval (ITI) was 2-4 sec. Two-thirds of the trials (N = 48), equally distributed across the three name categories, were presented along with a startle probe (105 dBs white noise of 50 ms duration and nearly instantaneous rise time). The probe appeared at either 4, 4.5, 5 or 5.5 seconds after name onset. Additionally, eight startle tones were presented during the ITI. Participants were told to pay attention to the names for the entire time they were on the screen.

2.3. Psychophysiological measures

Both stimulus presentation and signal acquisition were carried out by a PC running VPM software, v.12.6 (Cook, 2003). Heart rate, skin conductance, and electromyographic activity of the zygomaticus major, corrugator supercilii and orbicularis oculi muscles were recorded by means of a Coulbourn polygraph, LabLink V model (Coulbourn Instruments, Lehigh Valley, PA, USA).

Heart rate was derived from the EKG recorded at lead II with a Coulbourn V75-04 bioamplifier and sampled at 1000 Hz. Frequencies below 5 Hz and above 28 Hz were filtered out with a Coulbourn V75-48 bandpass filter. Skin conductance was recorded with a Coulbourn V75-23 bioamplifier. Electrodes filled with isotonic gel were placed on the hypothenar prominence of the left hand. The signal was acquired at a 50 Hz sampling rate. The EMG activity of orbicularis, zygomaticus, and corrugator muscles was measured using miniature electrodes filled with conductive gel and Coulbourn V75-04 bioamplifiers. The raw signals were bandpass filtered (28-500 Hz) with V75-48 filters and subsequently rectified and integrated by means of a Coulbourn V76-24 integrator. Time constant for orbicularis was 20 ms, whereas time constant for zygomaticus and corrugator EMG activity was 500 ms. The raw EMG signals were acquired at a sampling rate of 100 Hz, except for critical trials, where the sampling rate for orbicularis EMG was increased to 1000 Hz. Startle eyeblink EMG acquisition followed the guidelines proposed by Blumenthal et al. (2005).

Startle probes were delivered by a Coulbourn S81-02 white noise generator and presented through a TDH49P model Telephonics headphones. The intensity was calibrated with a Brüel & Kjaer sonometer (model 2235) and an artificial ear (model 4153).

2.4. Subjective ratings

At the end of the experiment all the names were evaluated using the Self-Assessment Manikin (SAM, Bradley & Lang, 1994), in three affective dimensions: Valence, arousal, and dominance. The SAM scales consist of five humanoid figures representing the intensity levels of each dimension, ranging from 1 to 9.

2.5.Procedure

Participants were contacted by phone or email and invited to a single experimental session. They evaluated the relationship with their close ones in advance and on the day of the experimental session, as satisfactory or very satisfactory using a 5-point Likert scale (1 = very unsatisfactory and 5 = very satisfactory). Participants were guided to an acoustically and electrically isolated chamber. Once the electrodes were placed, they were instructed to simply look at the names during the entire time they were on the screen and to ignore the auditory stimuli. Then, the lights were dimmed and they started the experiment. At the end of the experiment all sensors were removed and participants evaluated the stimuli according to the SAM scales.

2.6.Data reduction and analysis

Responses in heart rate, skin conductance, and zygomaticus and corrugator EMG activity were determined by averaging across each half-second during the 6-sec name presentation and subtracting that activity from the activity obtained in the 1-sec period immediately before the name onset.

The startle reflex amplitude was defined as the difference in microvolts between the peak and the onset of the response, in a time window between 20 and 120 ms, scored by means of the algorithm described by Balaban, Losito, Simons and Graham (1986). To control between-subject variability, the startle amplitude for each subject was converted to standardized *t*-scores.

Physiological data were averaged across trials within the same Name Category and analyzed by means of repeated measures ANOVAs. Heart rate, skin conductance, and both zygomaticus and corrugator EMG activity were analyzed by using a 3x12 design, with the first factor being Name Category (i.e., loved, neutral, famous) and the second factor, Time, containing the 12 half-second increments from stimuli onset. For eyeblink data, a single factor design (Name Category) was used. To avoid any violation of sphericity, the Greenhouse-Geisser correction was used. Post hoc analysis specifically examined whether the responses to the loved names were significantly different from the responses to the neutral and famous names. The level of significance was set at 0.05 for all analyses.

3. RESULTS

3.1. Psychophysiological measures

Heart rate. Figure 1 shows heart rate changes obtained from the EKG. The three categories show an initial deceleration that lasted 1.5 sec followed by acceleration that is specially marked for loved names. Famous names show, after the initial deceleration, further deceleration. The 3 (Name Category) x 12 (Time) ANOVA yielded a significant effect for the Name Category x Time interaction ($F(22, 704) = 3.387$, $p < 0.014$, $\eta_p^2 = 0.096$). Follow-up analysis of the interaction revealed heart rate increases from 1.5 sec until 6 sec significantly larger for loved names than for both neutral ($p < 0.043$) and famous ($p < 0.0001$) names. Differences between famous and neutral names were marginally significant ($p < 0.088$)

Skin conductance. Figure 2 displays the changes in skin conductance for the 3 name categories. All categories show a typical skin conductance response starting 2 seconds after stimuli onset. The 3 (Name Category) x 12 (Time) ANOVA revealed significant effects for the Name Category x Time interaction ($F(22, 770) = 8.129$, $p < 0.0001$, $\eta_p^2 = 0.188$). Follow-up analysis of the interaction revealed skin conductance increases from 2 sec until 6 sec significantly larger for loved names than for neutral ($p < 0.001$) and famous ($p < 0.0001$) names. No significant differences were found between famous and neutral names ($p > 0.9$).

Zygomatic muscle activity. Figure 3 (top) shows changes in zygomatic EMG activity across Name Category. Only the names of loved ones show a clear response, starting immediately after stimuli onset and continuing until the end of the 6-sec recording period. The 3 (Name Category) x 12 (Time) ANOVA yielded significant effects for Name Category (F(2,70) = 15.573, $p < 0.0001$, $\eta_p^2 = 0.308$), Time (F(11,385) = 15.668, $p < 0.0001$, $\eta_p^2 = 0.309$) and the Name Category x Time interaction (F(22,770) = 14.202, $p < 0.0001$, $\eta_p^2 = 0.289$). Analysis of the Name Category x Time interaction revealed zygomatic muscle activity increases from second 0.5 until second 6 significantly larger for loved names than for both neutral ($p < 0.001$) and famous ($p < 0.0001$) names. No significant differences were found between famous and neutral names ($p > 0.3$).

Corrugator muscle activity. Figure 3 (bottom) displays corrugator EMG changes. Only the names of loved ones show a clear inhibitory response, starting immediately after stimuli onset and continuing until the end of the 6-sec recording period. The 3 (Name Category) x 12 (Time) ANOVA yielded a significant effect for Name Category (F(2, 70) = 16.057, $p < 0.0001$, $\eta_p^2 = 0.314$), Time (F(11, 385) = 16.154, $p < 0.0001$, $\eta_p^2 = 0.316$)) and the Name Category x Time interaction (F(22, 770) = 15.742, $p < 0.0001$, $\eta_p^2 = 0.310$). Analysis of the Name Category x Time interaction revealed corrugator muscle activity decreases from second 0.5 until second 6 significantly larger for loved names than for both neutral ($p < 0.0001$) and famous ($p < 0.0001$) names. Although small, significant differences were also found for famous names compared to neutral names (p < 0.024)

Startle reflex. The ANOVA yielded a significant effect of Name Category (F(2, 70) = 3.366, $p < 0.046$, $\eta_p^2 = 0.088$). As shown in Figure 4, loved names prompted a larger startle response compared to neutral and famous names. Planned comparisons revealed significant differences between loved and neutral names ($p < 0.029$) and marginally significant differences between loved and famous names ($p < 0.075$). No significant differences were found between neutral and famous names ($p > 0.6$).

3.2. Subjective ratings

Valence (Figure 5 left): The ANOVA showed significant effects on the Name Category factor (F (2, 70) = 275.425 $p < 0.001$, $\eta_p^2 = 0.942$). Paired comparisons showed that loved names were significantly more positively evaluated than neutral and famous names (all $p_s < 0.001$). No significant differences were found between neutral and famous names.

Arousal (Figure 5 right): The analysis yielded significant effects on the Name Category factor (F (2, 70) = 19.902 $p < 0.001$, $\eta_p^2 = 0.363$). Loved names evoked greater activation than neutral and famous names (all $p_s < 0.001$). No significant differences were found between neutral and famous names.

Dominance: Subjective dominance scale ratings showed no significant differences between any of the name categories.

4. DISCUSSION

This is the first study that uses the passive viewing paradigm (Bradley & Lang, 2007; Lang, 1995) to examine the physiological mechanisms involved in the affective processing of loved familiar names. Our results using written proper names of loved people reveal similarities but also differences from previous studies that used loved familiar faces. The similarities include, in addition to the subjective reports, all physiological measures except the eye-blink startle reflex. Replicating previous findings (Guerra, Campagnoli, et al., 2011; Guerra, Sánchez-Adam, et al., 2012; Guerra, Vico, et al., 2012; Vico et al., 2010), loved familiar names were associated with a biphasic decelerative-accelerative heart rate response, increases in skin conductance and zygomaticus muscle activity, decreases in the corrugator muscle activity, and higher ratings of positive feelings and arousal. These responses were significantly higher for loved names than for neutral and famous names, suggesting the activation of a positive emotional response that was not confounded by familiarity or undifferentiated emotional arousal.

The cardiac response to loved names started with an initial deceleration followed by acceleration. The deceleration has been related to increased sensory intake and attention (Campbell, Wood & McBride, 1996), whereas the subsequent acceleration has been associated with the passive viewing of highly arousing positive stimuli (Bradley & Lang, 2007; Lang & Bradley, 2010). The electromyographic facial responses are also consistent with the activation of a positive emotional response. The increased activity of the zygomaticus major muscle was complemented by the inhibition of the corrugator supercilii muscle, a pattern of facial muscle activity related to positive emotions (Larsen, Norris, & Cacioppo, 2003) as well as to the expression of joy through smiling (Epstein, 1990). On the other hand, the enhanced skin conductance response has been widely interpreted in terms of cognitive or emotional arousal (Lang, Greenwald, Bradley, & Hamm, 1993; Miller et al., 2002). Finally, the subjective ratings confirm, as expected, that loved names elicited higher feelings of positive affect and arousal than neutral and famous names. Thus, the combined pattern of heart rate, skin conductance, facial electromyography, and subjective responses unambiguously indicate that loved familiar names activated a positive emotional response similar to the response elicited by loved familiar faces.

These similar findings for loved faces and names support the use of emotional words as a valid instrument to trigger emotional reactions, despite the lack of unique intrinsic properties. The physiological reactions recorded in this study are consistent with the preferential processing for emotional words proposed by Herbert and colleagues (Herbert et al., 2006). This processing would be motivated by what or who is being referenced, in this case the person whose name is shown. Proper names could be one of the best examples to prove that written stimuli can provoke similar reactions as the entity that is referring to. The results are in accordance with the idea that the proper name acquires the affective characteristics of the person. This seems to support the similarity between proper names and emotional words.

The major difference between our findings and those of previous studies on loved familiar faces has to do with the eye-blink startle reflex. Contrary to the startle inhibition by loved familiar faces found in Guerra et al.'s study (2012a), our study reveals startle potentiation by loved familiar names. This opposite effect may be explained by the differential processing of faces and words. Modulation of the startle reflex by emotional words has been shown to critically depend on the depth of processing (Herbert & Kissler, 2010). Thus, when participants are instructed to use shallow processing strategies, such as passive word viewing, the startle reflex shows a linear increase as a function of valence (inhibition to pleasant materials, and potentiation to unpleasant ones), whereas when individuals are involved in tasks requiring deeper processing, such as emotional imagery or semantic categorization, pleasant stimuli prompt larger blinks compared to both neutral and unpleasant stimuli. The startle inhibition under shallow processing strategies is consistent with the *motivational priming* hypothesis (Lang, 1995), which proposes that changes in the startle response reflect the congruence/incongruence between the motivational system engaged (appetitive versus aversive) by the perceptual stimuli and the type of reflex being elicited (aversive). On the other hand, the startle potentiation during tasks requiring deeper processing is consistent with the *processing interrupt* hypothesis (Herbert & Kissler, 2010; Herbert et al., 2006; Kissler et al., 2009), which proposes that the startle reflex represents an index of processing interruption aimed at reorienting processing resources to any potentially significant change in the environment.

In this study, we tested whether verbal stimuli that are processed in a preferential way and, at the same time, are evaluated as highly pleasant (relevant proper names) would modulate the startle reflex according to either the motivational priming or the processing interrupt hypothesis. The results showed that the startle reflex was potentiated by personally relevant names compared to neutral (unknown) and, to a lesser extent, famous names, giving support to the idea that, in response to pleasant verbal material, the startle reflex acts as a processing interrupt.

In general, our results are in line with previous research using central measures that highlight the existence of preferential processing systems associated with important familiar stimuli. Previous findings using personally relevant names showed P300 and P200 evocation (Kotlewska & Nowicka, 2015; Tacikowski et al., 2014; Tacikowski & Nowicka, 2010) and activation of areas associated with personally familiar stimuli, such as the MPFC (Tacikowski et al., 2013). This brain area is related to the recognition of self and close others (Sugiura et al., 2008) and to theory of mind processes (Adolphs, 2003; Lieberman, 2007). They are also in line with previous research on face identity recognition. The affective response produced by the recognition of someone's identity is commonly associated with the retrieval of the knowledge that we have of this person (Haxby & Gobbini, 2010). In previous studies using faces as stimuli for identity recognition, faces of loved ones evoked positive emotional autonomic and somatic reactions associated with the extended system of Gobbini and Haxby's model. Similar autonomic and somatic reactions have been observed in our study, suggesting that the emotional activation produced by loved names follows similar pathways to those activated by faces.

The implications of our study should be evaluated considering several methodological limitations. First, it only included female participants. It would be interesting to assess whether the results are replicated in males. Females usually show greater peripheral reactions to emotional stimuli than males (Bradley, Codispoti, Sabatinelli, & Lang, 2001). Second, it is highly unlikely that there was no emotional bias regarding the famous names used in our study. Although these stimuli were selected for each participant as a control for familiarity, with instructions to be emotionally neutral, it is unlikely that we achieved full neutrality. Lastly, this study does not have an aversive category of proper names to evaluate whether negative names also produce the expected opposite pattern of subjective and peripheral physiological responses elicited by unpleasant pictures.

In summary, our study confirms that the passive viewing of loved familiar names produces an emotional reaction similar to that produced by the passive viewing of loved familiar faces. In addition, the startle reflex results support the *processing interrupt* hypothesis rather than the *motivational priming* hypothesis, consistent with the idea that proper loved names are processed in a deeper way than loved faces, although both evoke a complete cognitive and emotional representation of the recognized person.

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FIGURES

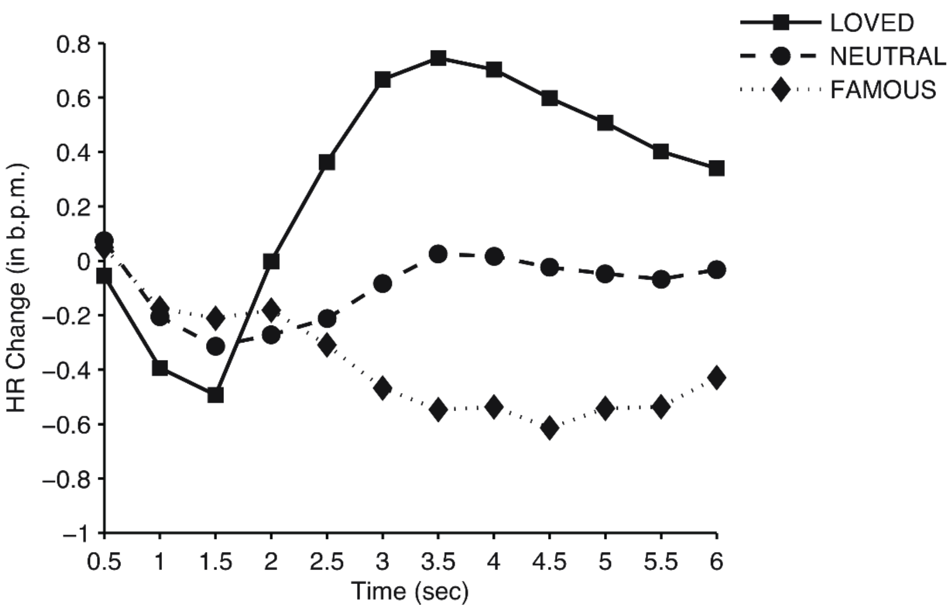


Fig 1. Heart rate change (in beats per minute) as a function of name category.

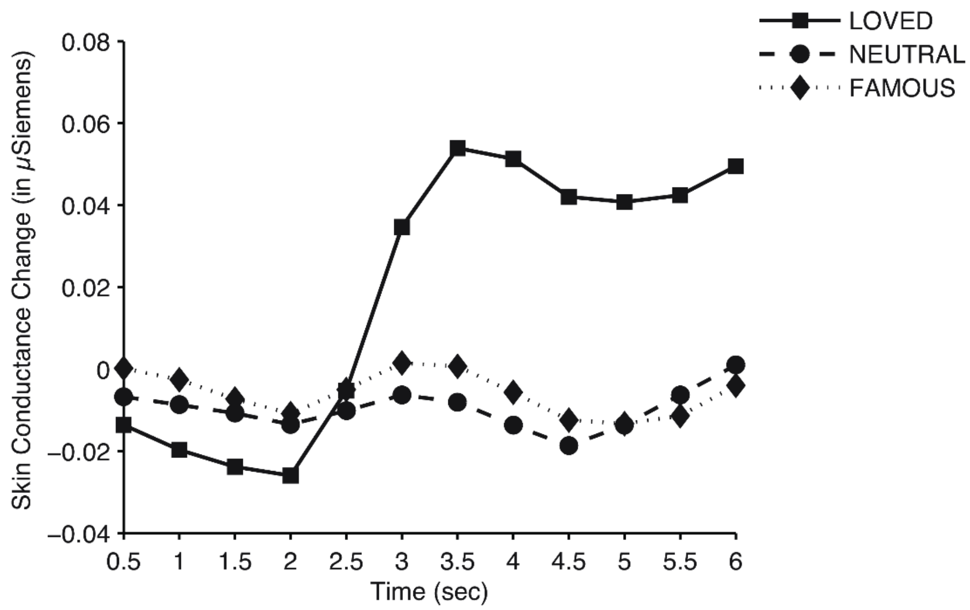
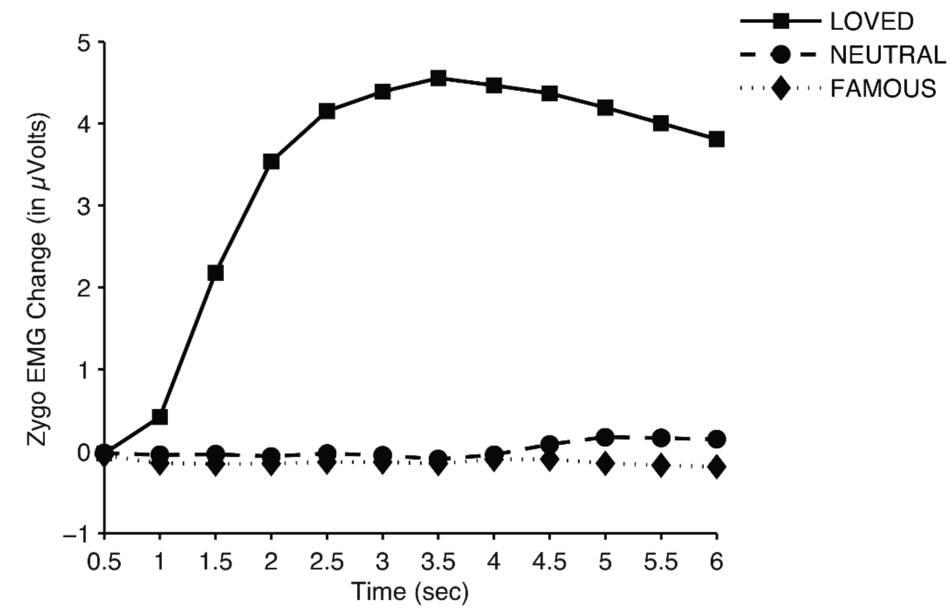


Fig 2. Skin conductance changes (in µSiemens) as a function of name category.



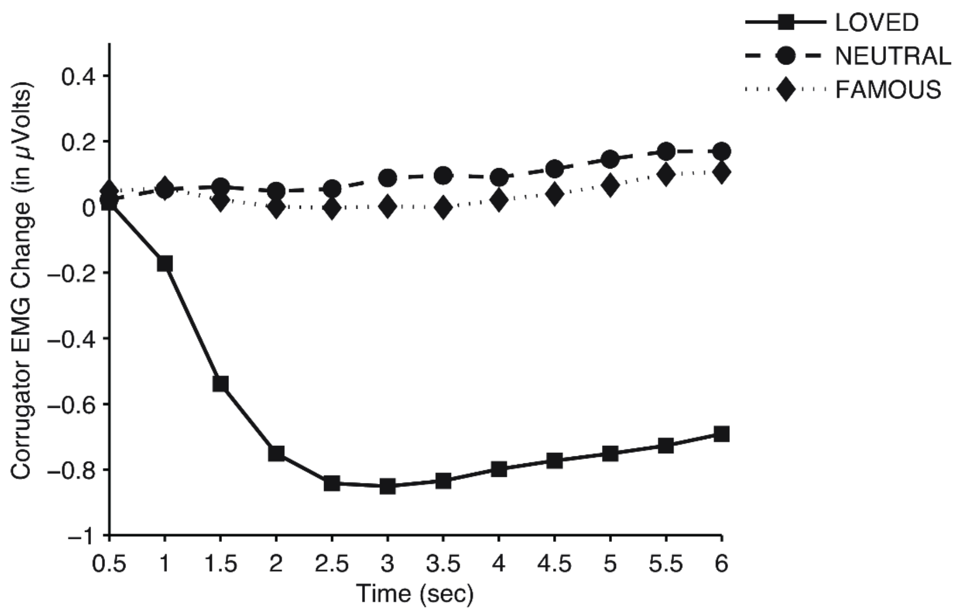


Fig 3. Zygomaticus (top) and corrugator supercilii (bottom) activation (in µVolts) for the three name categories.

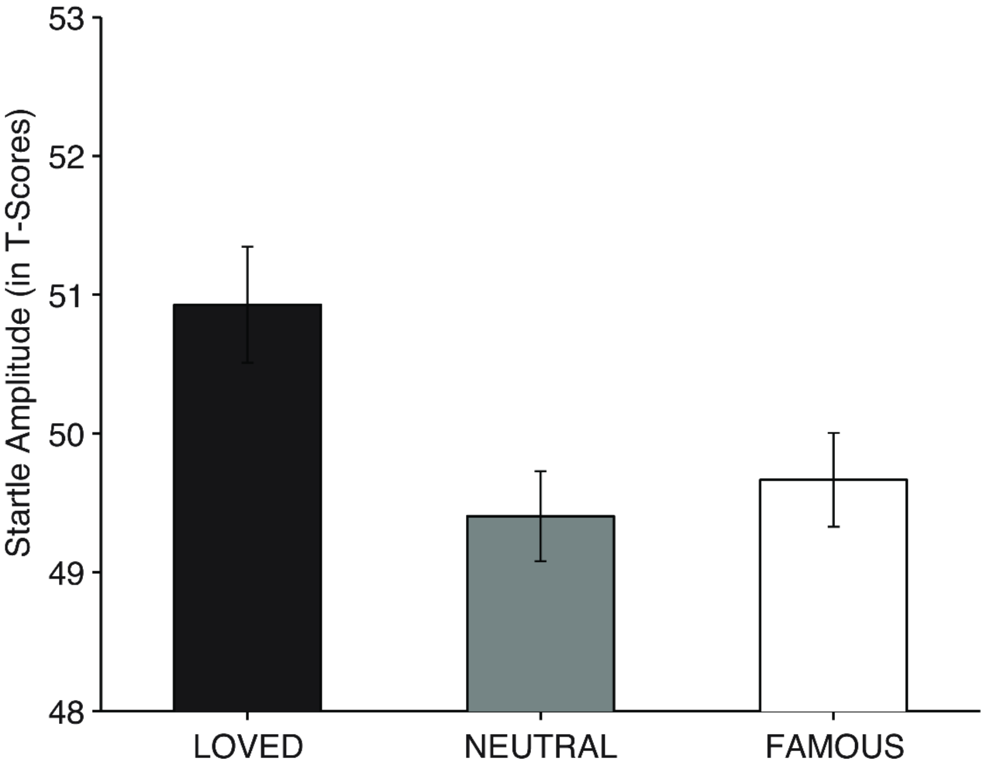


Fig 4. Standardized *t*-scores for orbicularis oculi startle amplitude as a function of name category.

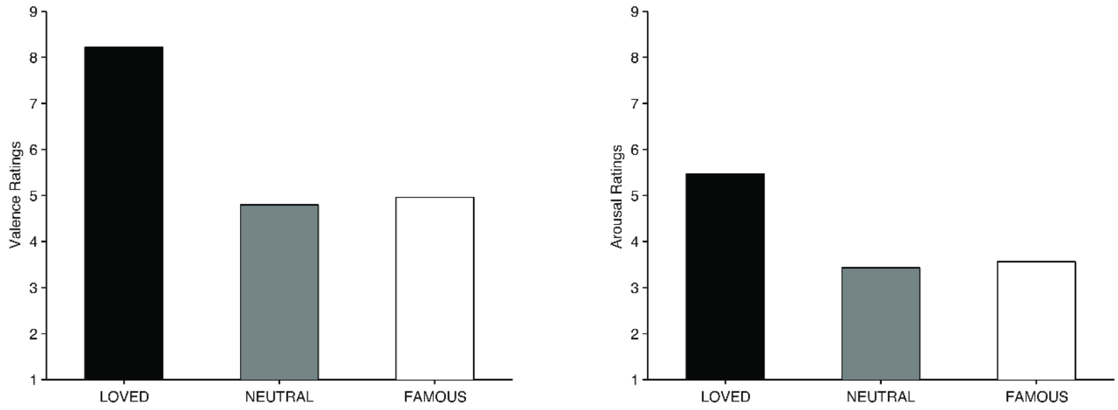


Fig 5. Valence (left) and arousal (right) subjective ratings across categories.