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Affective responses to ambivalence are context-dependent: A facial EMG study on the role of inconsistency and evaluative context in shaping affective responses to ambivalence

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HIGHLIGHTS

- We used facial EMG to investigate affective responses to ambivalent information.
- Mere processing of ambivalent information elicits the same direct affective response as positive stimuli.
- Affective responses to ambivalence when a choice had to be made resembled responses to negative stimuli.
- This effect was qualified by context: ambivalent information has to be inconsistent in the context to cause negative affect.
- The possiblity to resolve ambivalence in the evaluative context affected facial muscle activation within 500 ms.

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ABSTRACT

It has long been debated whether attitudinal ambivalence elicits negative affect and evidence for such a link is inconclusive. Using facial EMG, we tested the idea that affective responses to ambivalence are dependent on the inconsistency of evaluations in the current situation. In a person perception task, participants were presented with positive (e.g., friendly, intelligent), negative (e.g., jealous, dominant), or positive and negative information (e.g., intelligent, dominant) about different target persons. When participants were only exposed to the information without having to respond, ambivalent information elicited the same affective response as positive stimuli, participants showed more zygomaticus (positive affect) and less corrugator activation (negative affect) than to negative stimuli (task 1). When participants had to make a choice, ambivalent information elicited the same affective response as negative information (task 2). This was qualified by the possibility to resolve the inconsistency between evaluations. Specifically, ambivalence only led to a relative decrease in positive affect when evaluative context did not help resolve the inconsistency between ambivalent evaluations and created a choice conflict (e.g., "Bob is intelligent and dominant. Do you think Bob is a good collaborator?"). When the same ambivalent information (e.g. "Bob is intelligent and dominant") was presented in a context in which the opposing evaluations were not inconsistent (e.g., "Do you think Bob can write a good research paper?"), participants reported to experience lower levels of conflict and displayed more positive affect (i.e., more zygomaticus activation). The current data contribute to the reconciliation of previously inconclusive results on affective responses to attitudinal ambivalence. The results suggest that ambivalence only leads to relatively more negative affect (i.e., a decrease in positive affect) when ambivalent information is inconsistent in a current situation and thus creates conflict. Implications of these findings are discussed.

1. Introduction

Humans can evaluate effortlessly, and many evaluations help us behave appropriately in a given situation: we generally approach and explore positively evaluated stimuli and avoid or attack negatively evaluated ones (Chen & Bargh, 1999). Often, though, evaluations are not that straightforward and we have to deal with contradictory information

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that makes us evaluate a stimulus positively and negatively at the same time. This ambivalence (i.e., the simultaneous presence of positive and negative associations with an attitude object; Kaplan, 1972; Thompson, Zanna, & Griffin, 1995) thus reflects conflict between evaluative responses, and as such has been suggested to elicit negative affect (e.g., McGregor, Newby-Clark, & Zanna, 1999). This idea is traditionally based on Festinger's work on cognitive dissonance and the suggestion that inconsistent thoughts about a reference object produce negatively valenced arousal (Festinger, 1957; Gawronski, 2012). However, evidence for a relation between ambivalence and negative affect has been mixed, with some studies reporting a positive relation (Hass, Katz, Rizzo, Bailey, & Moore, 1992), some a negative relation (Maio, Greenland, Bernard, & Esses, 2001), and others showing that a negative affective response to ambivalence is contingent on having to make a dichotomous, consequential choice (Van Harreveld, Rutjens, Rotteveel, Nordgren & Van der Pligt, 2009). In the current study we aim to contribute to reconciling previously inconclusive results on the affective response to ambivalence by proposing that affective responses to ambivalence are context-dependent. We suggest that affective responses to ambivalence are only negative if ambivalent evaluations are inconsistent in the current situation and thus create evaluative conflict.

According to Festinger's original formulation of cognitive dissonance theory, consistency is a fundamental human motive and it has recently been argued that we should revive the idea of consistency as a core motive (Gawronski, 2012). Two thoughts, beliefs, or feelings (x and y) are inconsistent "if not-x follows from y" (1957; p. 13; e.g., Bob is friendly and Bob is unfriendly; see also Gawronski, 2012). Ambivalence can represent such an inconsistency, however, specific to ambivalence is that the inconsistency always occurs on the valence dimension (e.g., 'I like and dislike Bob'). Along this reasoning, ambivalence is thought to elicit negative affect (e.g., Briñol & Petty, 2005; McGregor et al., 1999; Van Harreveld, van der Pligt & Liver, 2009). Newby-Clark and colleagues (Newby-Clark, McGregor, & Zanna, 2002), for example, suggested that simultaneous accessibility and awareness of opposing evaluations lead ambivalent individuals to experience 'discomfort' (often equated with negative affect in the ambivalence literature; see Van Harreveld, Nohlen, & Schneider, 2015; Van Harreveld, van der Pligt, et al., 2009). In their study, individuals reported to be more conflicted and feel more torn about a controversial societal issue if they were repeatedly asked to write down both, their positive and negative, evaluations regarding the issue. Similarly, Hass et al. (1992) reported that exposing racially ambivalent participants to controversial (pro and con) racial statements was related to a greater increase in self-reported negative mood than exposing less ambivalent participants to the same statements. Some studies also report that valence-incongruence between subliminally presented primes and supraliminally presented target information leads to greater self-reported discomfort (i.e., negative affect; Rydell, McConnell, & Mackie, 2009). However, other studies have not replicated the direct relation between ambivalence and negative affect. For example, Van Harreveld, Rutjens, et al. (2009) only reported negative affective responses to ambivalence in the context of a consequential forced choice and found no relation when participants read ambivalent information outside of a choice context. Additionally, Maio et al. (2001) observed no relationship between ambivalence and self-reported negative affect in an intergroup context (Study 2), and even found a negative correlation between ambivalence and physiological arousal measured by skin conductance (GSR) when participants were asked to report their attitude toward groups of different nationalities (Study 1).

Taking the approach that inconsistency, not ambivalence itself, is responsible for a negative affective response to ambivalent information may reconcile these inconclusive results. More specifically, dependent on the level of analysis, ambivalent evaluations are not necessarily inconsistent. Evaluations are based on specific associations with a stimulus that has a certain positive or negative value. For example, I may like Bob, because he is intelligent (= positive), but at the same time I may dislike Bob, because he is dominant (= negative). Whereas my general attitude toward Bob then represents an inconsistency ("I like and dislike Bob"), the two associations that make up the ambivalent attitude are not inconsistent: Bob being intelligent does not logically exclude Bob from being dominant. As stimuli are rarely interpreted outside of context, a negative affective response to ambivalence should thus depend on whether such ambivalent evaluations are inconsistent in the current situation. For example, when determining whether Bob can write a good article, the inconsistency of ambivalence (like and dislike) is present but irrelevant, because whether one thinks that Bob can write a good article may be determined by his intelligence, but has nothing to do with whether one finds him dominant or not. In this case, evaluative context can be used to change the weight of associations with the stimulus that can help represent the stimulus in a less conflicted way. However both evaluative aspects are relevant if you have to decide whether Bob is a good collaborator. In this situation, evaluations are thus inconsistent and ambivalence should be experienced negatively. Indirect evidence for the idea that inconsistency may be responsible for negative affective responses to ambivalence is provided by Van Harreveld, Rutjens, et al. (2009). When presenting participants with ambivalent information about a new labor law, they found that being ambivalent only resulted in more physiological arousal and negative affect when individuals had to commit (i.e., forced choice) to one side of their evaluation. When forced to make a choice on an ambivalent topic, individuals behave inconsistently (and interestingly also consistently) with their attitude since choosing one response (either positive or negative) consequently means choosing against the other. This creates an inconsistency between cognitions (i.e., thoughts, feelings, or behavior) in Festinger's (1957) terms in that one's evaluation is incongruent with one's behavioral response. This interpretation of the results is additionally supported by the finding that an increase in negative affect was only observed after the choice had been made, thus when individuals had chosen inconsistently with their attitude. Choice may thus serve as an evaluative context that creates inconsistency in two ways, by forcing individuals to behave in contradiction with their attitude (i.e., a one-sided choice based on a two-sided evaluation) and by determining whether the inconsistency of the general ambivalent attitude is relevant (e.g., Bob is intelligent and dominant: Bob as a collaborator vs. Bob's writing skills).

The current study was designed to test the preconditions for negative affect elicited by ambivalence, and explore whether evaluative context can regulate a negative affective response to ambivalence by determining whether ambivalent evaluations are inconsistent. The experiment tasks were designed to combine the testing of previous ideas on affective responses to ambivalence with testing the current idea that affective responses to ambivalence are dependent on the immediate inconsistency of ambivalent evaluations. We first investigated whether the simultaneous accessibility of opposing positive and negative evaluations directly elicits negative affect as suggested by McGregor et al. (1999). Even though a study using GSR (Van Harreveld, Rutjens, et al., 2009) suggests that ambivalence does not elicit physiological arousal in the absence of a forced choice context, we aimed to test this hypothesis using a physiological measure that can assess positive and negative valence (facial EMG). Second, we tested whether ambivalence elicits more negative affect and less positive affect when a choice has to be made on the (conflicting) valence dimension (cf. Van Harreveld, Rutjens, et al., 2009). Third, we were interested if and how evaluative context in the choice moment itself influences affective responses to ambivalence. That is, if evaluative context helps resolve inconsistency between evaluations, is this reflected in implicit measures of affect (i.e., facial EMG) as well as self-reported conflict?

2. The current study

Using facial EMG in a person perception paradigm we assessed affective responses to ambivalent and univalent information. Facial

EMG measures overt and covert facial expressions reflecting positive (i.e., m. zygomaticus major) and negative (i.e., m. corrugator supercilli) affective responses, and is thought to be more sensitive to weak affective responses that would be undetectable using self-report only. Positive affect, elicited by pleasant stimuli is associated with a stronger zygomaticus response, whereas negative affect, elicited by unpleasant stimuli is associated with more corrugator activation (Brown & Schwartz, 1980; Cacioppo & Petty, 1979; Larsen, Norris, & Cacioppo, 2003). The zygomaticus is responsible for pulling the corner of the mouth back and up into a smile, whereas the corrugator lowers the eyebrows into a frown (van Boxtel, 2010).

In two tasks, we presented target names in association with positive and/or negative trait characteristics (e.g., X is intelligent and dominant). Trait characteristics were presented under circumstances in which valence-incongruent components were both equally accessible but did not have to be responded to (stimulus exposure; task 1), and under circumstances in which participants had to respond to the stimulus in a forced-choice paradigm (forced choice; task 2). In this second task, we created evaluative contexts that either put more weight on one of the conflicting evaluative aspects (or not) by varying the context in which the forced choice had to be made. This was done to create evaluative contexts in which inconsistency could be situationally resolved (e.g., 'Do you think X can write a good research article?': more weight on 'intelligent') or not (e.g., 'Do you think X would be a good collaborator?': both 'intelligent' and 'dominant' are important). Three factors were thus manipulated in this study: valence of the target persons' trait characteristics (univalent vs. ambivalent; task 1 and 2), having to make a choice (stimulus exposure vs. forced dichotomous choice; task 1 vs. task 2), and inconsistency resolution through evaluative context (situationally resolvable vs. situationally unresolvable ambivalence; task 2). This setup allowed us to test the different predictions that have been made to explain negative affective responses to ambivalence: We were able to test whether simultaneous accessibility of opposing evaluative aspects is sufficient in eliciting negative affect (cf. Newby-Clark et al., 2002; task 1), whether a forced choice is responsible for negative affective responses to ambivalence (cf. Van Harreveld, Rutjens, et al., 2009; task 2), or whether inconsistency is indeed the driving force behind negative affective responses to ambivalence (task 2). In line with the idea that inconsistency is the driving force of negative affect in ambivalent decision-making, we expected ambivalent stimuli to only result in increased negative and decreased positive affect (reflected by increased corrugator and decreased zygomaticus activity) when individuals had to make a dichotomous choice and evaluative tendencies were inconsistent in the evaluative context. Likewise, we expected self-reported experienced ambivalence to depend on whether opposing evaluative aspects were inconsistent in the current evaluative context (see Fig. 1 for an overview of conditions and stimuli).

3. Method

3.1. Participants

97 undergraduates of the University of Amsterdam participated in both tasks in exchange for course credits. Only female undergraduates were recruited based on research showing that women are usually more facially reactive than men (Dimberg & Lundquist, 1990). Age of participants ranged from 17 to 25 years ($M_{\text{age}} = 20$, $SD_{\text{age}} = 1.39$). Due to electrode failure, zygomaticus major data of six participants for the first task and five participants for the second task were excluded from further analyses along with corrugator supercilii activation of eight participants for both parts of the experiment. This left us with zygomaticus major data of 91 participants for task 1 and 92 participants for task 2, as well as corrugator supercilii data of 89 participants for both tasks. The study was approved by the ethics board of the University of Amsterdam.

3.2. EMG measurement

EMG was recorded from m. zygomaticus major and m. corrugator supercilii, both on the left side of the face using 6-mm sintered silver-silver chloride (Ag/AgCI) electrodes filled with electrode paste (Signa gel, Parker). A common ground electrode was placed on the forehead of participants at the border of the hair line. Electrodes were positioned according to standard guidelines (Fridlund & Cacioppo, 1986; Van Boxtel, 2010). Before attaching the electrodes the skin was lightly scrubbed and cleaned with alcohol. Continuous EMG recording was acquired with a custom made bipolar EMG amplifier with an input resistance greater than 1000MOhm and a bandwidth of 5–1000 Hz. The amplification of both EMG channels was fixed at 5100×. Data acquisition was done with a NI-USB6210 device, sampling at 1000S/s. EMG data were filtered by a 50 Hz notch filter and a 20–500 Hz Butterworth band-pass filter to reduce environmental noise and signal drift. EMG signal was rectified and smoothed by a contour follower with a time constant of 10 ms.

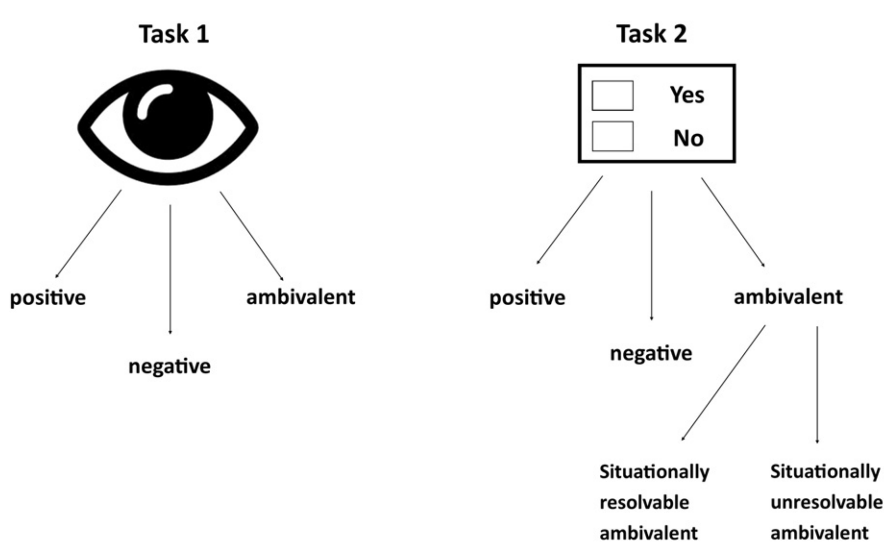

Fig. 1. Graphic display of the conditions in task 1 (exposure) and task 2 (dichotomous forced choice).

3.3. General procedure

The study was introduced as an electroencephalography (EEG) experiment measuring brain activation in order to prevent participants from attempting to influence their facial expressions. All participants were tested individually. E-Prime software 2.0 was used to present stimuli to participants in both tasks. The first and second task were separated by a short break to give participants time to relax and read the instructions for the second task carefully. Different names were used to describe target persons in the first and second person perception task.

At the end of the experiment session (after task 2), we assessed individuals' positive and negative evaluations of the different combined personality characteristics used in task 1 and the ones used in task 2 in a computerized post-test using an adapted evaluative space grid (Larsen, Norris, McGraw, Hawkley, & Cacioppo, 2009). The 5 × 5 evaluative space grid is a single-item measure of positive and negative reactions toward a particular stimulus, with positivity measured on the x-axis and negativity on the y-axis ranging from not at all (1) to very much (5). Using Thompson et al.'s (1995) formula, we combined these scores into an attitudinal ambivalence score: (Pos + Neg)/2 − |Pos − Neg|.[1] Scores on this measure can range from −1 (low attitudinal ambivalence) to 5 (high attitudinal ambivalence).[2]

4. Task 1: Ambivalence exposure

4.1. Design and procedure

In the first task, participants were presented with a total of 24 male names that were each followed by two personality characteristics. Four positive (friendly, enthusiastic, charming, intelligent) and four negative (jealous, dominant, dumb, lazy[3]) characteristics were combined in order to create target persons that were described as having either two positive traits (e.g., enthusiastic, friendly), two negative traits (e.g., dumb, dominant), or one positive and one negative trait (ambivalent: jealous, intelligent). Each trial started with a fixation cross (3000 ms) followed by the presentation of the name (3000 ms), a fixation dot (1500 ms) and subsequently the presentation of the two characteristics (each presented for 4000 ms) separated by a fixation dot lasting 3000 ms. Then the name was presented again (6000 ms, see Fig. 2a). As we were interested in the moment that all characteristics were integrated and positive, negative, or ambivalent impressions were formed, we limited analyses to the second presentation of the target name under the assumption that by then an attitude has been formed based on the previously presented characteristics. The combination of names and personality characteristics was semi-randomized across participants in that participants were randomly allocated to one of 24 different combinations of names and personality characteristics. Presentation order of the characteristics within a trial and and the presentation order of target name-trait characteristics were randomized across trials.

4.2. Data preparation: Task 1 and 2

Mean EMG signal was calculated for epochs of 500 ms and a 1000 ms pre-trial period was used as a baseline. In accordance with others (e.g., Mathersul et al., 2013; Sestito et al., 2013), analyses were limited to the first 2000 ms after the second onset of the target name. For each muscle separately, EMG activity was expressed as a difference score by subtracting the baseline activation (1000 ms pre-trial epoch) from the 2000 ms lasting activation starting at the second onset of the target name (Fig. 2). In order to determine extreme values, z-scores were calculated across participants and trials for each muscle over the average activation during the baseline period (1000 ms) and average activation during target stimulus exposure (2000 ms, 2nd presentation of the name/presentation of evaluative context). A trial was excluded from analyses if its associated z-scores during target stimulus exposure or during baseline measurement exceeded a value of 3.29 based on the idea that none of the scores should yield an absolute z-score above 3.29 in normally distributed data (Field, 2013). We decided to include baseline and stimulus presentation in the outlier detection instead of change scores in order to detect extreme values present during the whole length of the trial including baseline and stimulus exposure (e.g., if participants yawn) that would not be detected by focusing on change scores alone. Using this procedure, 1.36% of the trials (29 of 2136 trials across participants) were flagged as outliers for the corrugtor in the first task as well as 3.66% for the zygomaticus (80 of 2184 trials across participants). In the second task, a total of 1.74% of the trials (93 of 5340 trials across participants) were excluded for the corrugator and 4.31% for the zygomaticus (238 of 5520 trials across participants[4]).

5. Results and discussion: Task 1

5.1. Manipulation check

We assessed the extent to which combinations of personality characteristics used in task 1 created univalent or ambivalent target persons after the experimental session. The different combinations of positive and negative personality characteristics manipulated attitudinal ambivalence succesfully. Using Thompson et al.'s (1995) formula[5] to calculate attitudinal ambivalence, we found that the combination of positive and negative characteristics elicited greater attitudinal ambivalence ($M = 2.06$, $SE = 0.07$) than the combination of only positive ($M = -0.49$, $SE = 0.07$) or only negative characteristics ($M = -0.31$, $SE = 0.08$), $t(96) = 26.57$, $p < .001$. All participants for whom data of at least one of their muscles was valid and used in subsequent analyses were included in this analysis; excluding participants for whom measures of one of the muscles were invalid yielded similar results.

5.2. EMG response

We compared spontaneous facial muscle activity when presented with ambivalent, positive and negative target persons to test whether simultaneous accessibility of opposingly valenced information directly evokes negative affect. EMG data were entered into two repeated-measures ANOVAs, one for each muscle, with valence (positive, negative, ambivalent) as within-participants factor.

5.3. Stimulus exposure

5.3.1. Zygomaticus

Valence of the target persons was a significant predictor of zygomaticus major activity, $F(1.47,131.85) = 5.80$, $p = .009$, $\eta^2 = .06$ (Greenhouse–Geisser corrected). As expected, zygomaticus activity was stronger for targets described by positive ($M = 0.34$ μV, $SE = 0.17$ μV) than negative characteristics ($M = -0.22$ μV, $SE = 0.10$ μV), $p = .006$, 95% CI for the difference [0.16, 0.96], validating that the zygomaticus responds more strongly to targets described by only

[1] Pos = positive rating; Neg = negative rating

[2] For exploratory reasons, we also added a single item per combination of characteristics assessing to what degree participants experienced mixed feelings and/or thoughts about each trait combination ranging from 0 (not at all) to 100 (very much). This item was not analyzed in the current study, because attitudinal ambivalence may be more accurately described by combining positive and negative reactions (see above).

[3] Translated from Dutch. Original stimuli: vriendelijk, enthousiast, charmant, intelligent, jaloers, dominant, dom, lui. Combinations were pretested (N = 30) and chosen so that they are evaluated as positive, negative, or ambivalent.

[4] The total number of trials differs for the zygomaticus major and corrugator supercilii due to electrode failure on one of the muscles for some participants (see subheader 'Participants').

[5] $(P + N)/2 - |P - N|$

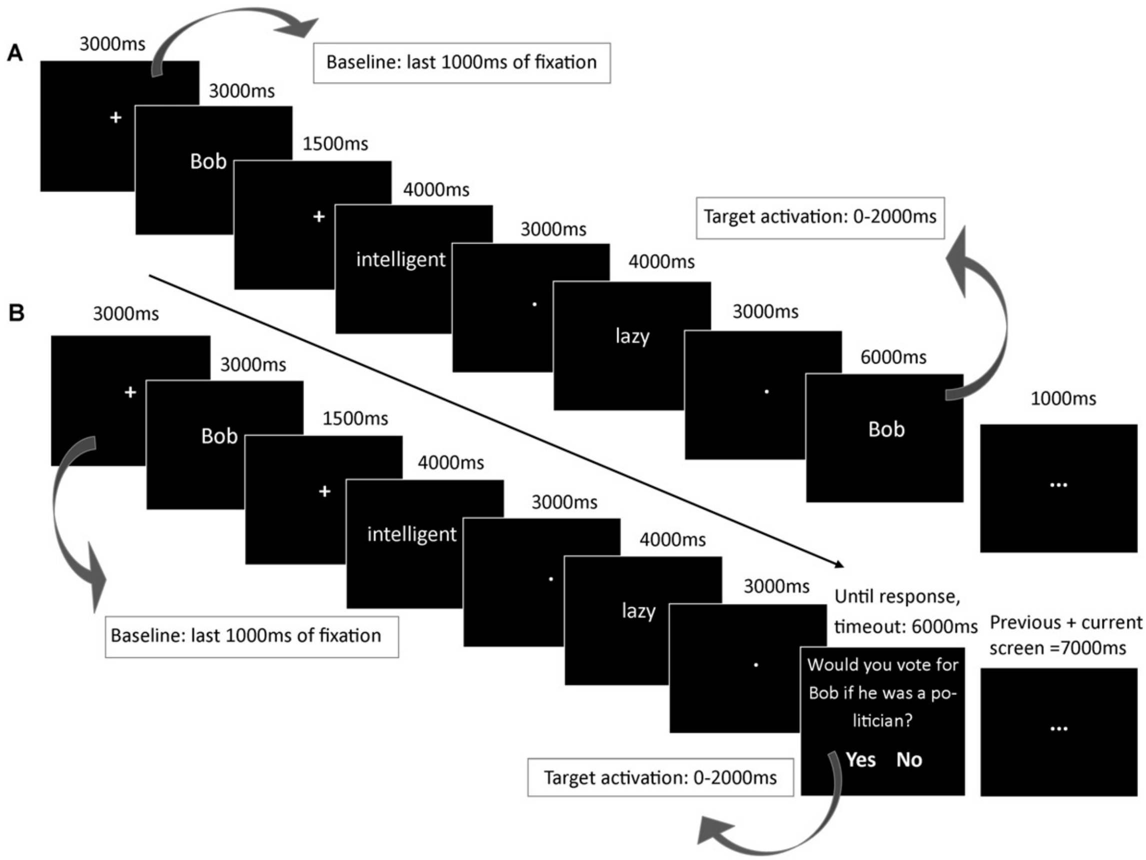

Fig. 2. Schematic overview of a trial set-up. (A) Task 1. (B) Task 2.

positive characteristics than targets with only negative characteristics. In line with the idea that mere accessibility of ambivalent information is insufficient to elicit negative affect, zygomaticus response to ambivalent stimuli was relatively stronger ($M = 0.02$ μV, $SE = 0.05$ μV) than to negative stimuli, $p = .028$, 95% CI for the difference [−0.47, −0.03]. Further supporting this idea, we found that the zygomaticus response to ambivalent stimuli did not differ significantly from the response to positive stimuli, $p = .07$, 95% CI for the difference [−0.03, 0.66] (Fig. 3a).

5.3.2. Corrugator

The results found on the zygomaticus were mirrored by the pattern of corrugator activity. Again, the analysis showed a main effect of valence on muscle activation relative to baseline, $F(1.68,147.44) = 7.51$, $p = .002$, $\eta^2 = .08$ (Greenhouse–Geisser corrected). Validating more corrugator activity with negative than with positive stimuli, we found corrugator response to be stronger for negative ($M = 0.46$, $SE = 0.18$) than positive targets ($M = -0.41$ μV, $SE = 0.17$ μV), $p = .003$, 95% CI for the difference [−1.43, −0.31]. Further support that ambivalent information is not spontaneously experienced as a negative event is provided by the finding that corrugator response to ambivalent stimuli ($M = -0.22$ μV, $SE = 0.13$ μV) was similar to the response to positive stimuli, $p = .35$, 95% CI for the difference [−0.59, 0.21], but was significantly weaker than toward negative stimuli, $p = .002$, 95% CI for the difference [0.25, 1.10] (Fig. 3b).

First, the results on zygomaticus and corrugator activity to univalent, positive and negative target persons, validate our paradigm. We found the expected effects of increased zygomaticus and decreased corrugator activity reflecting a positive affective resonse to positive target persons,

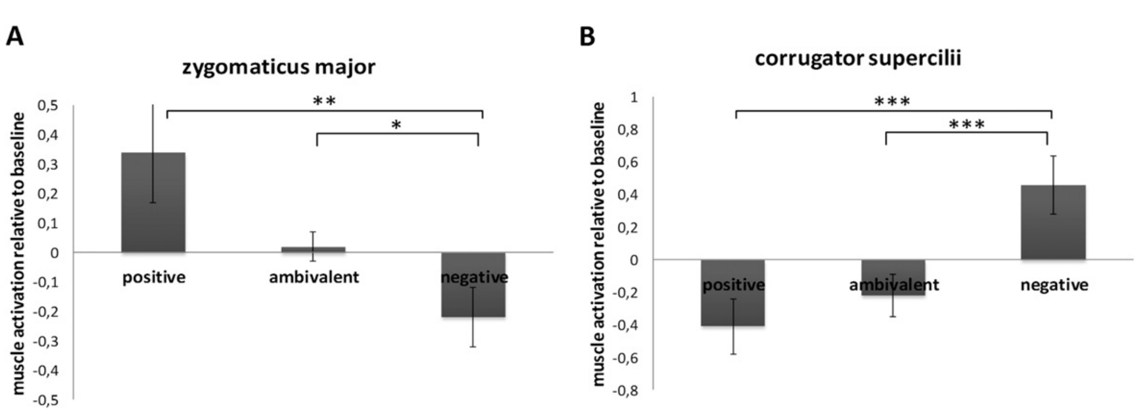

Fig. 3. Task 1. Facial muscle activity - muscle activity during baseline in microvolts (μV) during exposure to positive, negative, and ambivalent stimuli. Error bars represent standard errors. (A) Zygomaticus major (B) corrugator supercilii. * $p < .05$; ** $p < .01$; *** $p < .005$.

and decreased zygomaticus and increased corrugator activity reflecting a negative affective response to negative target persons. This validation shows that we can indeed measure affective responses using the current paradigm.

Second, mere exposure to ambivalent stimuli outside of a context that stresses an inconsistency of opposing evaluations, does not result in negative affect as shown by increased zygomaticus and decreased corrugator activity to ambivalent compared to negative targets. This indicates that simultaneous accessiblity of opposingly valenced information is insufficient to produce negative affect. The data suggest that ambivalence may even elicit positive affect in the absence of choice conflict. Patterns of zygomaticus and corrugator activity show that affective responses to ambivalent stimuli are not distinguishable from responses to positive stimuli when participants do not have to respond to the information by making a choice. This may be explained by a positivity offset in that situations and stimuli that are relatively neutral are generally evaluated more positively (Ito & Cacioppo, 2005). Similarly, most people report to feel happy, or positive in the absence of major, negative events (Diener & Diener, 1996). Possibly not only neutral information, but also information that contains positive and negative information can be subject to a positivity offset.

6. Task 2: Choice context and resolving inconsistency

Results of task 1 suggest that merely processing ambivalent information does not elicit negative affect. If anything, responses to ambivalent target persons were more comparable to reponses to positive persons than to negative persons. Task 2 was designed to address whether a negative affective response to ambivalence can be explained by an inconsistency approach. Based on the idea that having to make a choice about ambivalent stimuli can be aversive (Nohlen, van Harreveld, Rotteveel, Lelieveld, & Crone, 2014; Van Harreveld, Rutjens, et al., 2009), we first expected a more negative affective response to ambivalent targets compared to positive targets as well as no difference in affective response between ambivalent and negative targets in this task.

Additionally, we varied evaluative context in that it highlighted or resolved the inconsistency between evaluative aspects by manipulating the importance of characteristics for response selection across trials. Twenty of the 40 ambivalent trials were designed in such a way that both evaluative aspects were important for the choice and thereby created inconsistent evaluations (X is friendly and lazy: would you ask his help in solving a difficult puzzle?) and twenty were designed so that one of the aspects was more important than the other, thereby resolving inconsistency (e.g., X is friendly and lazy: would you go to the movies with X?). We predicted that the situational resolution of inconsistency would translate into a reduction of negative affect and an increase in positive affect reflected by facial EMG activation. Likewise, self-reported experienced conflict should be lower for ambivalent trials in which one of the aspects was more important for the choice at hand than for trials in which both were equally important and pointed toward different choice options.

6.1. Design and procedure

Participants proceeded with the second task after taking a short break following task 1. Trial setup was very similar to the first task, differing only in the last part of the each trial. Instead of showing target names for a second time as was done in the first task, participants were presented with a dichotomous choice question creating different evaluative contexts (e.g., 'Would you vote for X if he was a politician?', Fig. 2b). The question was visible until participants gave a response with a time limit of 6000 ms. Two positive (handy, friendly) and two negative characteristics (dumb, lazy[6]) were combined to create one positive, one negative, and four ambivalent target persons. Participants answered the same ten questions for each person resulting in 60 trials. Questions were designed in such a way that inconsistency could be situationally resolved or not (see earlier example). Participants were instructed that there were no right or wrong answers and that we were interested in their personal opinions.

At the end of the experimental session, we measured individuals' positive and negative evaluations of the combined personality characteristics using the evaluative grid (see General procedure at the beginning of the methods section for a more extensive description of this measure). In addition, we assessed their subjectively experienced ambivalence toward each trait combination within each evaluative context using Priester and Petty's subjective ambivalence scale (1996). This was done to assess participants' experienced conflict (i.e., 'discomfort') toward each target taking into account the different evaluative contexts. The measure consists of three questions anchored with "I have completely one-sided feelings, feel no conflict, and feel no indecision" (0) and "I have mixed feelings, feel maximum conflict, and maximum indecision" (100). Responses were given using a slider without numeric labels ($\alpha = .94$). To facilitate the task, participants were given a sheet of paper with the characteristics of each target person so that they were not required to remember all targets and their corresponding characteristics.[7]

[6] Translated from Dutch. Original stimuli: handig, vriendelijk, lui, dom.

7. Results and discussion: Task 2

7.1. Manipulation check

On the basis of Thompson et al.'s (1995) ambivalence formula, attitudinal ambivalence scores were calculated from participants' positive and negative evaluations of the combinations of the four personality characteristics. The results show that the manipulation of attitudinal ambivalence was successful. As expected, attitudinal ambivalence for combinations of positive and negative characteristics was greater ($M = 2.11$, $SE = .08$) than for combinations that were only positive ($M = -0.24$, $SE = .14$) or only negative ($M = -0.63$, $SE = .10$), $t(96) = 21.54$, $p < .001$. All participants for whom at least one of their muscle activation measures were valid and used in subsequent analyses were included in this analysis; excluding participants for whom measures of one of the muscles was invalid yielded similar results.

7.2. EMG response

7.2.1. Choice context

7.2.1.1. Zygomaticus. To assess the effect of informational valence on zygomaticus activity in a forced choice situation, we ran a repeated measures ANOVA with valence (positive, negative, ambivalent) as a within-subject factor. As in task 1, zygomaticus activation was reliably predicted by valence of the target, $F(1.76,160.25) = 3.37$, $p = .04$, $\eta^2 = .04$. In contrast to task 1, muscle activation during the forced choice about ambivalent targets ($M = -0.41$ μV, $SE = 0.05$ μV) did not differ from activation during the choice about negative targets ($M = -0.35$ μV, $SE = 0.06$ μV), $p = .44$, 95% CI for the difference [−0.21, 0.09]. However, making a choice about ambivalent targets led to a greater decrease in zygomaticus activation than judging positive targets ($M = -0.18$ μV, $SE = 0.09$ μV), $p = .016$, 95% CI for the difference [0.04, 0.41]. Also, note that zygomaticus activation was negative compared to baseline, showing an overall relative decrease in positive affect during the choice task (Fig. 4A).

[7] For exploratory purposes, participants also answered the same questions as during the experiment using a slider instead of a dichotomous choice. This measure could be used as an additional attitude measure, however, since it does not provide the possibility to distinguish 'neutral' from 'ambivalent' (both indicated by the midpoint of the scale), it was not included in the analyses.

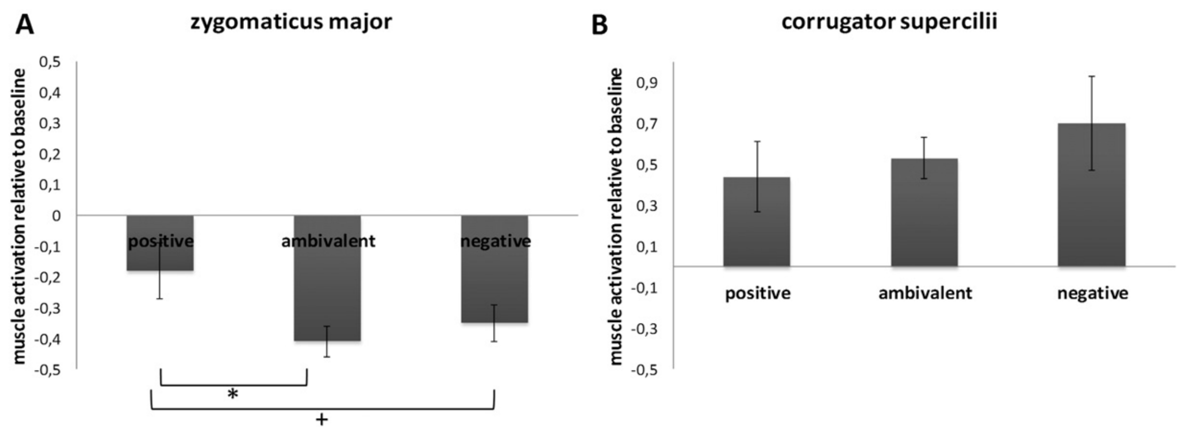

Fig. 4. Task 2. Facial muscle activity — muscle activity during baseline in microvolts (μV) during evaluation of positive, negative, and ambivalent stimuli. Error bars represent standard errors. (A) Zygomaticus major (B) corrugator supercilii. $+\ p = .11$; * $p < .05$.

7.2.1.2. Corrugator. Surprisingly, activity of the corrugator was not predicted by valence of the target persons in a forced choice situation, $F < 1$, $p = .41$. In that the corrugator showed relatively high levels of activation during task 2 compared to baseline activation (Fig. 4) and that mental effort leads to greater corrugator activity (Van Boxtel & Jessurun, 1993), the absence of a valence effect might have occurred because participants exerted more effort due to having to make choices in task 2. This may have overshadowed the effect of affective valence observed in zygomaticus activity and found on both muscles in task 1. We will return to this finding in the general discussion.

7.2.2. Exposure vs. choice

To assess the effect of having to make a choice on the affective response to ambivalent stimuli, we compared zygomaticus and corrugator activity between task 1 and task 2. As both tasks were conducted among the same participants, paired t-tests were conducted on zygomaticus and corrugator activity with task (stimulus exposure vs. forced choice) as within-subject factor. Note, however, that besides changing that participants had to respond to the stimuli by making a choice in the current task, the procedures of the two tasks were also slightly different in that stimuli (i.e., combination of name and characteristics) in task 2 were each repeated ten times in combination with 10 different evaluation contexts compared to task 1 in which each stimulus was only presented once. Affective responses to ambivalent stimuli indicated by both zygomaticus and corrugator activity differed significantly between the two tasks. As predicted, participants showed less zygomaticus activation as a response to ambivalent stimuli when they had to make a choice about the stimulus ($M = -.41$ μV, $= .05$ μV) compared to when they did not have to make a choice ($M = .02$ μV, $SE = .05$ μV), $t(90) = 6.006$, $p < .001$. Consistently, participants displayed more corrugator activation as a response to ambivalent stimuli when they had to make a choice about the stimulus ($M = .53$ μV, $SE = .10$ μV) compared to when they did not have to make a choice ($M = -.22$, $SE = .13$), $t(88) = -4.841$, $p < .001$. These results support the idea that having to make a choice on the basis of ambivalent information results in less positive and more negative affect (cf. Van Harreveld, Rutjens, et al., 2009).Since forcing a one-sided response from a two-sided evaluations forces individuals to behave inconsistenly with their attitude, a relatively more negative affective response to ambivalence in this context is also consistent with an inconsistency explanation of negative affect. This idea was further tested below.

7.2.3. Situational resolution of inconsistency

Based on the idea that ambivalence only elicits negative affect if it creates conflict due to inconsistent evaluations, another objective of the second task was to assess the effect of situational resolution of inconsistency on the direct affective response to ambivalent information and the experience of conflict (i.e., discomfort). To assess whether we successfully manipulated the possibility to situationally resolve inconsistency we first looked at participants' self-reported conflict regarding the three different stimulus types (univalent, situationally resolvable ambivalent, situationally unresolvable ambivalent). As expected, we found an overall effect of stimulus type on subjectively experienced ambivalence, $F(1.38, 132.74) = 230.86$, $p < .001$, $\eta^2 = .71$ (Greenhouse–Geisser corrected). Subjectively experienced ambivalence toward univalent target persons ($M = 9.87$, SE .87) was lower than toward situationally resolvable ambivalent targets ($M = 28.33$, $SE = 1.54$), which was significantly lower than experienced ambivalence toward situationally unresolvable ambivalent targets ($M = 37.40$, $SE = 1.59$), all p's < .001. The possibility to resolve inconsistency in the evaluative context thus significantly lowered participants' self-reported experience of conflict, yet participants still experienced more conflict for situationally resolvable ambivalent stimuli than univalent stimuli.

Subsequently we assessed the effect of evaluative context on direct affective responses to ambivalent stimuli. To test the more direct effect of situational resolution of inconsistencies, we looked at the zygomaticus response within the first 500 ms[8] after stimulus presentation across the three stimulus types (univalent, situationally resolvable ambivalent, situationally unresolvable ambivalent). Mirroring the results on self-report measures, this analysis revealed that even within the first 500 ms after stimulus exposure we found an overall effect of stimulus type on zygomaticus response, $F(1.81, 164.42) = 3.92$, $p = .026$, $\eta^2 = .04$ (Greenhouse–Geisser corrected). Zygomaticus activation to situationally resolvable ambivalent stimuli ($M = -0.23$ μV, $SE = 0.05$ μV) was similar to activation to univalent stimuli ($M = -.23$ μV, $SE = 0.06$ μV), $p = .99$, 95% CI for the difference [−0.13, 0.13]. Additionally, zygomaticus showed decreased activation when processing situationally unresolvable ambivalent stimuli ($M = -0.42$ μV, $SE = 0.07$ μV) than when processing situationally resolvable ambivalent stimuli, $p = .02$, 95% CI for the difference [0.03, 0.35], suggesting that relatively spontaneous affective responses are influenced by the possibility to resolve conflict within a current situation. Participants processing ambivalent information in a choice context only displayed less positive affect when ambivalent evaluations were inconsistent in the current evaluative context (Fig. 5). This indicates that situational resolution of ambivalence may appear as quickly as 500 ms after stimulus presentation.

[8] Based on the recorded data, this was the shortest time window in which our data could be analyzed. Data from the corrugator were not analyzed because no effect of valence was found on the corrugator in task 2.

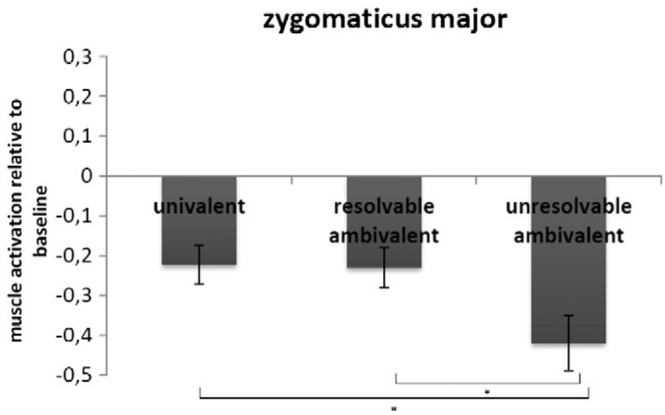

Fig. 5. Task 2: Situational resolution of inconsistency. Zygomaticus major activity during evaluation of univalent, situationally resolvable and unresolvable ambivalent stimuli — zygomaticus major activity during baseline in microvolts (μV). Error bars represent standard errors. * $p < .05$.

Summing up, affective responses to ambivalent stimuli in a forced dichotomous choice context in which both attitude components are relevant and thus inconsistent resemble responses to negative stimuli. We found a decrease in zygomaticus activitiy compared to baseline for negative and ambivalent stimuli compared to positive stimuli. This effect was qualified by the possibility to resolve inconsistency between evaluations in the choice situation. If the evaluative context helped resolve inconsistency for ambivalent evaluations, participants reported lower levels of self-reported ambivalence and showed altered affective responses to ambivalent information assessed by zygomaticus activation. Within 500 ms after stimulus onset, zygomaticus activation was stronger for situationally resolvable than unresolvable ambivalent evaluations.

8. General discussion

In the current paper we shed further light on the affective response to ambivalence and identified that affective responses to ambivalence are context-dependent. Our aim was to test three different approaches that aim to explain negative affective responses to ambivalence: a) the suggestion that simultaneous accessibility of positive and negative evaluations elicits negative affect (cf. Newby-Clark et al., 2002), b) the idea that ambivalence elicits negative affect when individuals are forced to resolve their ambivalence by making a dichotomous choice (c.f. Van Harreveld, Rutjens, et al., 2009), and c) the suggestion that taking a consistency motive approach to explaining negative affective responses to ambivalence may clarify inconclusive results on the relation between ambivalence and negative affect. The results support our suggestion that inconsistency is the driving force of a negative response to ambivalence. Ambivalent information elicits relatively more negative affect (i.e., a relative decrease in positive affect) when evaluations are inconsistent in the current context, whereas affective responses to ambivalence are more positive in a context in which ambivalence does not create inconsistency. Based on these results, we suggest to revive and further scrutinize the idea of cognitive consistency influencing affective responses to ambivalence, and recommend to take contextual demands into account when studying affective responses to ambivalence.

Before turning to the broader implications of these results, several specific findings deserve discussion. First, we found that ambivalent information elicits a similar affective response as positive stimuli in the absence of a forced choice situation. This could suggest that an ambivalent evaluation ("I like and dislike Bob") does not elicit negative affect outside of a context that stresses this inconsistency by demanding a choice. Such an interpretation would, for example, be in line with Schacht, Dimigen, and Sommer's (2010) suggestion that conflicting stimuli only elicit a negative affective response if the conflict is made relevant by context. This makes sense in an energy-conservation modality, in that individuals are unwilling to spend energy on either affective processes or solving conflict that is irrelevant in a current situation. However, relying on the idea that inconsistency is generally experienced negatively, it is also possible that individuals did not form an overall, inconsistent judgment ("I like and dislike Bob") from the presented positive ("Bob is intelligent) and negative descriptions ("Bob is dominant"). Given that the specific ambivalent traits we presented were not logically inconsistent by themselves (e.g., Bob being intelligent does not exclude Bob from being dominant), this result provides further evidence that the inconsistency of ambivalent evaluations is context-dependent. If inconsistency is indeed responsible for negative affective responses to ambivalence as we suggest here, presenting opposingly valenced evaluative aspects that are inconsistent even outside of a choice context (e.g., "Bob is friendly and Bob is cold") should also elicit a more negative affective response. Future studies will have to show whether that is indeed the case.

Second, whereas processing ambivalent information in a forced choice context led to a relative decrease in positive affect (i.e., zygomaticus response), no effect of informational valence was found on the corrugator in task 2. This was surprising as other research has mostly focused on an increase in negative affect as a response to conflict (cf. Botvinick, Braver, Barch, Carter, & Cohen, 2001; Dreisbach & Fischer, 2012; Festinger, 1957; Van Harreveld, Rutjens, et al., 2009). The lack of an effect on the corrugator in our second task may be due to cognitive load, in that participants had to process additional information (choice options) as well as weigh this information in order to make a choice. EMG amplitude in the corrugator supercilii is known to respond to mental effort and task difficulty (van Boxtel & Jessurun, 1993). As suggested above, the absence of an effect of valence in the choice task may be due to greater mental effort that is exerted in the task itself compared to baseline, thus possibly overshadowing the effect of valence. The zygomaticus major, on the other hand, is known to respond only little to mental effort and task load (e.g., van Boxtel & Jessurun, 1993), so that affective responses to the stimuli could mostly be mirrored in zygomaticus major activation in the more mentally taxing, second task. Notably, the fact that we find decreased zygomaticus activity during processing of ambivalent information in a situation of choice conflict and that the zygomaticus responds only little to mental effort (van Boxtel & Jessurun, 1993; Waterink & van Boxtel, 1994) also shows that the change in affective response to ambivalence is not due to processing a more complex evaluation per se, or due to forcing participants to resolve ambivalence in the forced choice paradigm. Processing complexity and accompanying mental effort are often suggested as alternative explanations for negative affective responses to ambivalent and other conflicting stimuli, and research has proven it difficult to disentangle complexity and ambivalence. This is because ambivalent evaluations are by definition more complex than univalent evaluations, because they cannot be easily combined into a straightforward, one-sided behavioral response. Whereas several positive or several negative evaluations can easily be translated into a single-factor solution (Bob is intelligent and friendly: I *like* Bob), this is not the case for ambivalent evaluations (Bob is charming and dumb: I like and dislike Bob) and complexity is thus an inherent feature of these evaluations. However, the fact that the current results are also found on zygomaticus activation suggests that complexity and mental effort that accompany the processing of ambivalent information in a forced choice context are not by themselves responsible for the more negative affective response to ambivalence.

Third, the effect of choice was qualified by the evaluative context in which ambivalent information was presented. By emphasizing the importance of both evaluative aspects or emphasizing one evaluative aspect over the other, evaluative context either highlighted or helped resolved the inconsistency among evaluations. Interestingly, the effect of situational resolvability of ambivalence on zygomaticus activation appeared within 500 ms after presenting ambivalent information, suggesting that a negative response to ambivalent information either did not develop or was down-regulated very quickly. A downregulation interpretation is in line with finding greater zygomaticus activation when presenting ambivalent information in a resolving context, as a quick resolution of conflict is thought to result in positive affect (Phaf & Rotteveel, 2012). Further research will have to show how and when contextual information influences the interpretation of ambivalent stimuli in order to clearly interpret this quick affective response to situationally resolvable ambivalent stimuli. Specifically, neuroimaging research may be able to shed light on this by comparing networks involved when processing situationally resolvable ambivalent information with univalent information. It could be that if an evaluative context makes one evaluative aspect more relevant than the other, there are essentially no differences in the processing of and responding to ambivalent and univalent information. If evaluative context prevents evaluative conflict, this should, for example, be reflected in similar activation levels of regions related to conflict-processing (e.g., ACC) when processing univalent and situationally resolvable ambivalent information. However, if evaluative context helps resolve conflict after ambivalence has been detected, we should be able to distinguish processing of univalent and situationally resolvable ambivalent information on a neural level.

Even though the idea that cognitive inconsistency underlies negative affective responses to ambivalence is not new (e.g., McGregor et al., 1999) and actually often underlies the argumentation why ambivalence should be experienced negatively (Van Harreveld et al., 2015), research on affective responses to ambivalence has thus far been inconclusive. By analyzing ambivalence in terms of logical (i.e., consistent) relations between cognitions, and taking the approach that relations between cognitions change based on situational construal, we have shown that observed affective responses to ambivalence are dynamic and context-dependent. This approach may offer an explanation for previously inconsistent results. Specifically, depending on context, measurement and timing of the measurement, reported affective responses to ambivalence may be very different. For example, if current goals (e.g., a positive self-presentation in a social context) suggest that evaluative conflict is desirable because it represents a balanced attitude (cf. Maio et al., 2001; Pillaud, Cavazza, & Butera, 2013), evaluative conflict may elicit positive instead of negative affect since it resolves the negativity of inconsistent evaluations (e.g., "I want to have an opinion that people can agree with, so liking and disliking Bob is fine."). However, if being ambivalent represents something undesirable (e.g., being prejudiced in a racial context; cf. Hass et al., 1992) or creates a choice conflict, ambivalence may elicit relatively more negative affect. All in all, this suggests that dependent on whether opposingly valenced evaluations are interpreted as inconsistent in the current evaluative context, ambivalent stimuli may elicit negative, or positive affect.

9. Conclusions

Recently, cognitive consistency has again been suggested as a core motive wich can explain a range of social psychological phenomena (Gawronski, 2012). The current article fits with this view and we have explained negative affective responses to ambivalence from a cognitive consistency perspective. In addition to clarifying affective responses to ambivalence, this approach has implications for other consequences of ambivalence. Negative affect is often thought to drive (advantageous and less advantageous) ways of coping with ambivalence such as changes in information processing (Clark, Wegener, & Fabrigar, 2008; Jonas, Diehl, & Broemer, 1997). According to our view, these changes should depend on whether ambivalent evaluations are indeed inconsistent and should be less frequent, or nonexistent, if ambivalence does not represent an inconsistency in the current context. This approach may also explain the goal of such changes in information processing. It may not always be to reduce attitudinal ambivalence and change the underlying structure of the attitude, but it may also be to make ambivalent evaluations consistent in the current context. This also has implications for the way in which we should measure these changes. Contrary to context-sensitive measurements (e.g., "What do you think about X in the current context"), measurements that are less sensitive to contextual information ("What do you think about X") may not be able to capture evaluative changes that take place to reduce inconsistency in the current context.

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