



Mixed feelings: the case of ambivalence

Iris K Schneider¹ and Norbert Schwarz²

Mixed feelings come in many forms. We focus on mixed feelings resulting from conflicting evaluations of a single attitude object, that is, attitudinal ambivalence. Research on attitudinal ambivalence has led to specific measures that assess the presence, intensity, and resolution of ambivalence, shedding new light on underlying dynamics and moderators. This work has also spawned an interest in the metacognitive experiences of conflict that arise from ambivalence and their downstream consequences for judgment and choice. Because research into mixed emotions may benefit from these conceptual and methodological developments, the current article provides an introductory overview of attitudinal ambivalence and its measurement.

Addresses

¹ University of Cologne, Germany

² University of Southern California, United States

Corresponding author: Schneider, Iris K (i.k.schneider@uni-koeln.de)

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Introduction

Mixed feelings come in many forms, as illustrated by the contributions to this issue. In some cases, people experience different discrete emotions simultaneously, like happiness and sadness [1] or disgust and amusement [2]. In other cases, people experience mixed feelings due to conflicting evaluations. A pecan pie can simultaneously evoke strong positive evaluations because of its sweet taste and strong negative evaluations because of its high calorie content. In such instances, people experience mixed feelings because they both dislike *and* like something, want to approach *and* avoid it, and are positive *and* negative at the same time. This review addresses the latter form of mixed feelings, also known as attitudinal ambivalence. We briefly introduce attitudinal ambivalence, explain why it often goes unnoticed, and review recent methodological advances that further its exploration.

Attitudinal ambivalence

Attitudinal ambivalence refers to the simultaneous occurrence of positive and negative implicit or explicit evaluations of a single attitude object [3–6]. Ambivalence has been documented for a wide range of stimuli, including abortion, organ donation, euthanasia [7**], contraception [8], minority groups [9], food [10,11], labor laws [12], tobacco [13], and consumer products [14–16] (for overviews, see Refs. [17,18,19,20**]). On a neurological level, attitudinal ambivalence is associated with increased activation in the anterior cingulate cortex [21,22*], an area associated with conflict monitoring processes [23].

Ambivalence is distinct from uncertainty, because each of the two conflicting evaluations can be held with great confidence [19,22*,24]. It is also distinct from ambiguity, where the attitude object cannot be interpreted due to lack of cues [25]. Finally, ambivalence is explicitly distinct from neutral attitudes, which are the result of indifference, that is, *the lack* of either positive or negative evaluations [26]. The degree to which people experience ambivalence may vary from person to person. Ambivalence increases with preference for consistency [27], need for cognition, personal fear of invalidity [28], and schizophrenia or schizotypal disorder [29] and decreases with dialectical thinking [16] and mindfulness [30].

Because ambivalence is at its core a consistency violation, it is often presumed to be aversive. However, many moderating factors have been identified. For instance, this aversion increases with the relevance of the conflicting evaluations for the perceiver. People who evaluate Bob's dominance negatively but his intelligence positively experience more aversive ambivalence when judging Bob as a collaborator than when merely judging his ability to write a good research paper [31]. Ambivalence also becomes more aversive when the evaluative conflict is particularly salient [27,32] or when people are forced to make a choice [33].

To reduce ambivalence, people employ different strategies. When the decision is of low personal relevance, people may focus on only the positive or only the negative evaluations in order to sway their attitude in one direction [34]. When personal relevance is high, they engage in more systematic processing to resolve the conflict [35,36], potentially at the risk of further increasing ambivalence [37]. Alternatively, people can reduce ambivalence in a compensatory way. When the conflicting evaluations are difficult to change, people cope with the attitudinal disorder by affirming and creating order in the world around them [38]. But despite the aversive quality of

ambivalence, people sometimes embrace their ambivalent states. In situations where outcomes remain uncertain, ambivalence can be desirable because it reduces disappointment when a desired outcome is not obtained [39^{*}]. When a topic is controversial, people may also strategically exaggerate their ambivalence (or its display) to maintain positive self-presentations [40].

Why ambivalence is easily missed and how to detect it

Although ambivalence has distinct psychological consequences, it is often overlooked as an important aspect of human experience. More specifically, ambivalence is often mistaken for neutrality. Whereas ambivalence entails strong positive and negative evaluations, neutral attitudes reflect the absence of both (*i.e.*, indifference, *cf.* [4]). Ambivalence and neutrality are difficult to distinguish when people are asked to report their feelings on bipolar scales with negative and positive endpoints (*e.g.*, good/bad; pleasant/unpleasant) and a neutral (*e.g.*, neither/nor) midpoint. On such scales, something that evokes mixed feelings (such as the pecan pie from the example above) can yield a midpoint rating because people are trying to do justice to both their negative and positive evaluations [4,26]. This ambiguity of supposedly neutral mid-point ratings is apparent in laboratory experiments [4,41^{*}] and online customer ratings [14].

How to empirically distinguish ambivalence and neutrality has been a concern in ambivalence research for decades (*e.g.*, [4,26,41^{*}]). Two approaches have been suggested. One focuses on the differences in evaluations that give rise to ambivalence, whereas the other focuses on the subjective experience of ambivalence. To assess differences in underlying evaluations, positive and negative evaluations of the same attitude object can be assessed separately [27]. For example, respondents can be asked, “Please think about <this attitude object>. When you think about the positive [negative] aspects of <this attitude object>, how positive [negative] is your evaluation of it?” Ratings are provided along two unipolar scales (‘not at all positive [negative]’ to ‘very positive [negative]’) instead of a single bipolar scale (‘very negative’ to ‘very positive’).

The ratings on these unipolar scales are then submitted to a formula that takes both the strength and similarity of the ratings into account, for example, $((P + N)/2) - ABS | P - N|$, where P stands for the positive component and N stands for the negative component (for an overview of different formulas, see Ref. [42]) Because ambivalence differs from neutrality in terms of the extremity of the opposing evaluations, this method distinguishes between them [4,26,43]. Note that such formulas can accommodate evaluative ratings as well as the number of positive and negative thoughts in free response formats [38] and could also be applied to reports of discrete emotions.

Because this measure focuses on the evaluations underlying the attitude, it is often referred to as *objective ambivalence*. Other measures assess the subjective experience of ambivalence. They ask people to report how conflicted, mixed and indecisive they feel on a scale ranging from ‘not at all’ to ‘very strongly’. Items are averaged to arrive at an overall measure of *subjective ambivalence* [42].

When appropriate measures are used, it becomes apparent that many supposedly neutral stimuli are, in fact, ambivalent. For example, the International Affective Picture Set [44], which is widely used to evoke affective responses in research participants, includes pictures that are assumed to elicit neutral affect. However, the assumption of neutrality is only supported when responses are assessed with bipolar scales, as was the case when the pictures were normed [44]. When participants’ responses are assessed with the above measures of ambivalence, the supposedly neutral pictures result in the simultaneous report of positive *and* negative responses, indicating ambivalence [41^{*}]. Moreover, the level of objective ambivalence predicts participants’ self-reported arousal [41^{*}], an experience that is inherent to subjective ambivalence and not associated with neutrality. As this example illustrates, apparently neutral responses on bipolar scales can mask underlying ambivalence. Researchers are therefore well advised to assess positive and negative responses separately, which allows for the discovery of mixed feelings.

Embodied assessments of mixed feelings using mouse tracking

Although separate assessments of positivity and negativity and reports of experienced conflict can reveal hidden ambivalence, they provide little insight into how ambivalence evolves over time and how different types of conflict differ qualitatively. To address these shortcomings, Schneider *et al.* [7^{**}] turned to a paradigm that can capture the unfolding of attitudes in real time and used it to assess ambivalent attitudes.

As an illustration, suppose a person is asked to evaluate a target by selecting either a positive or a negative response option, as shown in the left panel of Figure 1. As they move the cursor toward their final response, the trajectory of their mouse movements is recorded. Different characteristics of these trajectories, such as their curvature, acceleration, and deviation, give insight into the temporal unfolding and resolution of ambivalence [45,46,47^{*},48]. When the target elicits either clearly positive or clearly negative evaluations, the trajectory follows a (relatively) straight line from the starting point of the cursor to the respective response alternative (middle panel of Figure 1). But when the target elicits mixed feelings, the trajectory shows considerable curvature (right panel of Figure 1),

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