Attitudinal Ambivalence – A New Look at Structure, Measurement, and Induction Approaches

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Abstract

Attitudinal ambivalence is defined as the simultaneous positive and negative evaluation of an attitude object. Although the research field investigating this special type of attitudes has generated valuable insights in many domains, it generally suffers from conceptual and methodological ambiguities. In a theoretical chapter, the current state of the art is critically reflected with regard to these shortcomings, and numerous directions for future research are suggested. In two empirical sections, six studies are presented that contribute to the field in at least three ways. First, in Experiments 1 to 3, using evaluative priming paradigms in which ambivalent material either served as primes or as targets, it is shown that positive and negative evaluations may be activated simultaneously and unintentionally if a univalent categorization is required. At short SOAs, ambivalent material generally increases response latencies in comparison to congruent trials, independent of its role and contextual cues. In Experiment 4, a similar experimental set-up with a valent/neutral categorization task further suggests that the ambivalence-induced conflict occurs at the response execution rather than at stimulus encounter. Second, in Experiments 2 to 6, direct and indirect attitude measures are systematically compared revealing that self-reported ambivalence predicts latencies if ambivalent material is used as targets, but not if it serves as primes. Third, in Experiments 5 and 6, univalent, neutral, and ambivalent attitudes are induced on direct measures by applying evaluative conditioning procedures in which conditioned stimuli are paired with two pictures (Experiment 5), or a picture and a sound (Experiment 6), respectively. In both studies, however, ambivalence does not carry over to an evaluative priming paradigm suggesting a complex interaction of automatic and deliberate processes. Finally, the main findings are summarized, and their methodological and theoretical implications regarding the nature, measurement, and induction of attitudinal ambivalence are discussed.

Keywords: ambivalence, attitudes, priming, evaluative conditioning

Zusammenfassung

Einstellungsambivalenz ist definiert als die gleichzeitige positive und negative Bewertung eines Einstellungsobjekts. Obwohl das Forschungsfeld, welches sich mit diesen spezifischen Einstellungen befasst, bedeutsame Erkenntnisse in zahlreichen psychologischen Bereichen hervorgebracht hat, leidet es unter konzeptuellen wie auch methodischen Unklarheiten. In einem theoretischen Kapitel wird zunächst der aktuelle Forschungsstand im Hinblick auf diese Unzulänglichkeiten widergegeben, sowie zahlreiche Vorschläge für zukünftige Forschung gemacht. In zwei empirischen Kapiteln stelle ich sechs Studien vor, die in dreifacher Hinsicht einen Beitrag für das Forschungsfeld leisten.

Erstens, in den Experimenten 1 bis 3 wird mit Hilfe von Evaluativen Priming Paradigmen, in denen ambivalentes Material entweder als Prime- oder als Zielreize verwendet wird, gezeigt, dass positive und negative Bewertungen gleichzeitig und unabsichtlich aktiviert werden können, wenn eine univalente Kategorisierung des Materials erforderlich ist. Bei kurzen SOAs erhöht ambivalentes Material die Reaktionszeiten im Vergleich zu kongruenten Trials unabhängig von seiner Rolle als Prime- oder Zielreiz einerseits, und Kontextreizen andererseits. In Experiment 4 lässt ein ähnliches experimentelles Setup mit einer Valent/Neutral Kategorisierungsaufgabe vermuten, dass die Ambivalenz-bedingten Konflikte beim Ausführen der Antwort und nicht bereits bei dem Zusammentreffen mit ambivalenten Reizen auftreten.

Zweitens, in den Experimenten 2 bis 6 werden direkte und indirekte Einstellungsmaße systematisch verglichen und zeigen, dass berichtete Ambivalenz die Reaktionszeiten nur dann vorhersagt, wenn das ambivalente Material als Zielreiz, nicht aber als Primereiz verwendet wird.

Drittens, in den Experimenten 5 und 6 werden univalente, neutrale und ambivalente Einstellungen auf direkten Maßen erzeugt, indem konditionierte Reize in einem Evaluativen Konditionierungsparadigma jeweils mit zwei Bildern (Experiment 5), oder einem Bild und einem Ton (Experiment 6) gepaart werden. Ambivalenz spiegelt sich in keiner der zwei Studien

in einem Evaluativen Priming Paradigma wider. Diese Ergebnisse lassen eine komplexe Interaktion von automatischen und deliberativen Prozessen vermuten.

Zuletzt werden die wichtigsten Ergebnisse zusammengefasst, und ihre methodischen und theoretischen Implikationen in Bezug auf die Art, Messung, sowie Induktion von Einstellungsambivalenz diskutiert.

Section I: General Introduction

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An attitude is “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (Eagly & Chaiken, 1993, p. 1). While this certainly constitutes one of the most widely accepted definitions, an alternative more pictorial suggestion is made by Fazio, Chen, McDonel, and Sherman (1982): specifically, they define attitudes as associations between an object and its summary evaluation. Relating variations in the strength of these associations to the accessibility of the corresponding attitude, this definition further provides a link to theories of attitude strength. It will thus prove especially interesting for the experimental sections of this thesis where associative strength and accessibility will be discussed in more detail.

In the 1930s, Allport (1935, p. 798) referred to attitudes as “the most distinctive and indispensable concept in American social psychology”. Another fifty years later, McGuire (1985) further strengthened this observation speaking of attitudes as one of the central elements of the field and identified three historical peaks of attitude research. The first peak in the 1920s and 1930s investigated the very nature of the concept and developed first – and partly still applied – approaches to measure attitudes. As attitudes cannot be observed directly but must be approximated from the observation of supposedly corresponding behavior, attitude measurement plays an outstanding role in the field. The second peak in the 1950s and 1960s mainly dealt with antecedents and consequences of attitude change, and the third peak investigated structural aspects of attitudes among others. More recently, a fourth peak has emerged that introduced so-called indirect attitude measures, which opened a whole new field with unforeknown possibilities. As will become evident in the course of this thesis, classical *direct* attitude measures refer to self-reports that rely on participants’ introspection regarding their own feelings and cognitions, and their ability and motivation to report these unbiasedly (Greenwald & Banaji, 1995; Nisbett & Wilson, 1977). *Indirect* attitude measures on the other hand, refrain from directly asking participants about their thoughts and feelings about the attitude object, but infer the underlying associative structure linked to an attitude object based on observed behavioral patterns such as reactions times or error rates. By introducing dual-process models of attitudes, the fourth peak additionally provided highly influential theoretical accounts on the conditions under which attitudes form, change, and affect subsequent behavior.

The following thesis investigates fundamental aspects of a special type of attitudes, namely ambivalent attitudes. While research on ambivalent attitudes produced a variety of definitions, most researchers agree with the idea that attitudes are ambivalent if they possess both positive and negative aspects that are both linked to the same attitude object. Among attitude objects that are typically found to possess an ambivalent attitude structure count health-related behaviors such as diets/unhealthy foods (Armitage & Conner, 2000; Berndsen & Van der Pligt, 2004; Conner et al., 2002; Gillebaart, Schneider, & De Ridder, 2015; Sparks, Conner, James, Shepherd, & Povey, 2001), smoking (e.g., Hohman, Crano, & Niedbala, 2016) and drug use (e.g., Conner, Sherlock, & Orbell, 1998; Costello, Rice, & Schoenfeld, 1974), and contraception (e.g., Sharma, Erramilli, Chung, & Sivakumaran, 2015). Further ambivalent attitude objects are morally demanding topics such as abortion (Priester & Petty, 1996; Schneider et al., 2015), organ donation (e.g., Van den Berg, Manstead, Van der Pligt, & Wigboldus, 2005), and euthanasia (Schneider et al., 2015). Among others, ambivalence is further found in the relation to the self (DeMarree, Morrison, Wheeler, & Petty, 2011), genders (e.g., Glick & Fiske, 1996) and ethnicities (e.g., Katz & Hass, 1988; Pacilli, Mucchi-Faina, Pagliaro, Mirisola, & Alparone, 2013), and a political (Abelson, Kinder, Peters, & Fiske, 1982; Fournier, 2005; Haddock, 2003; Lavine & Steenbergen, 2005; McGraw & Bartels, 2005), organizational (e.g., Ziegler, Schlett, Casel, & Diehl, 2012), and consumer context (Jonas, Diehl, & Broemer, 1997; Otnes, Lowrey, & Shrum, 1997; Pang, Keh, Li, & Maheswaran, 2017; Rocklage & Fazio, 2015; Van Harreveld, Van der Pligt, De Vries, Wenneker, & Verhue, 2004; Yang & Unnava, 2016).

While today it is known that many attitudes possess links to both positive and negative associations, early attitude research did not take this possibility into account. This state seems problematic since (as suggested in the above paragraph) many attitude objects are not pure in their associative structure but do possess associations that contradict the dominant valence. This circumstance is also mirrored in language. Multiple sayings among which “two sides of the same coin", "every cloud has a silver lining", "double-edged sword", or "you can't have a picnic without ants" vividly demonstrate the fact that in everyday life, too, positivity and negativity are often present in the same object or situation.

Why do researchers care whether attitudes are ambivalent or univalent? Ambivalent attitudes differ from non-ambivalent – that is univalent and neutral – attitudes in their consequences. As mentioned earlier, attitudes do not only play an outstanding role in psychological research because of their frequent occurrence and their impact on human perception. They are further predictive of behavioral intentions and actual behavior. That means, they do not only help explain past behavior, but they can be used to predict future behavior. In the case of ambivalent attitudes, this link with intentions (Conner, Povey, Sparks, James, & Shepherd, 2003; Sparks, Hedderley, & Shepherd, 1992) and actual behaviors (Conner et al., 2002, 2003; Lavine, Thomsen, Zanna, & Borgida, 1998; Moore, 1973, 1980) has been found to be attenuated, which makes it more difficult to predict behaviors following from ambivalent attitudes as compared to univalent attitudes. Although empirical evidence is mixed, there is indication that ambivalent attitudes are less stable over time – potentially due to varying contextual cues that may activate one evaluation/motivation or the other (Ainslie, 1992). In line with a decrease in stability, ambivalent attitudes tend to be more susceptible to persuasion attempts or attitude change manipulations (Armitage & Conner, 2000; Bassili, 1996; MacDonald & Zanna, 1998).

The encounter of ambivalent attitude objects is often associated with feelings of negativity or conflict. In order to resolve this negative state, information that is relevant for the attitude object of interest is processed more deeply (Briñol, Petty, & Wheeler, 2006; Maio, Bell, & Esses, 1996; Petty, Tormala, Briñol, & Jarvis, 2006), especially if the additional information comes with the chance that the perceived ambivalence may be reduced (Clark, Wegener, & Fabrigar, 2008).

The Present Dissertation

Like other psychological concepts, ambivalent attitudes can neither be observed nor measured directly. Instead, they must be approximated from self-reports and observed behaviors, which is both methodologically and conceptually challenging. As will be more closely elaborated on in the course of the General Introduction, conventional direct attitude measures are problematic for multiple reasons. Indirect attitude measures, i.e., measures that infer associations from behavioral patterns rather than relying on self-reports, may elude some of those problems. Despite this clear advantage, however, few attempts have been undertaken to assess ambivalence via indirect measures. Another aspect of attitude research that is of major relevance and will be discussed in more detail, is the experimental induction of attitudes as compared to their mere measurement. Although research on attitudinal ambivalence classically relies on the latter, the so-called correlational approach, an experimental induction should be preferred for it increases procedural control, comparability, and allows for stronger inferences. Targeting these two points, the main motivation of the present thesis is to progress the methods with which research on attitudinal ambivalence is conducted by systematically investigating (i.) ways to *measure* attitudinal ambivalence indirectly with an evaluative priming paradigm, and (ii.) two evaluative conditioning procedures to experimentally *induce* ambivalence. The application of these methods naturally requires strong theorizing regarding the concepts as well as the relation between the concepts. Throughout the five sections of this thesis, I will provide theoretical and empirical arguments for the importance of strong theories and methods to conduct better research.

In the General Introduction, I will explain in more detail the measurement and induction paradigms that are used in the here-reported studies, as well as the main advantages of these paradigms that led to the preference of these methods over alternative approaches.

Section II contains a manuscript that was written in collaboration with Prof. Dr. Mandy Hütter and Prof. Dr. Olivier Corneille. The theoretical work constitutes a critical review of the current state of research regarding the definition, measurement, and induction of attitudinal ambivalence. Besides highlighting major achievements in the field, it makes valuable suggestions for future research to enable further improvement.

In Section III, I will turn to empirical work that focusses on the (indirect) measurement of attitudinal ambivalence via sequential priming paradigms. The applied method further progresses our understanding of fundamental structural and procedural aspects of attitudinal ambivalence. The manuscript, which is the result of a collaboration with Prof. Dr. Mandy Hütter and Prof. Dr. Olivier Corneille and is currently revised for resubmission at the *Journal of Experimental Psychology: General*, investigates a common assumption inherent to the prevailing understanding of attitudinal ambivalence, namely that opposing associations can be activated simultaneously and automatically. Furthermore, the experiments reported in Section III are informative with regard to the correspondence of different direct measures of attitudinal ambivalence, as well as the link between direct and indirect measures.

While Section III uses ambivalent material that has been selected based on a pretest and thus follows a quasi-experimental design, the manuscript reported in Section IV contains two experiments that apply an evaluative conditioning paradigm with different procedural parameters to induce a state of attitudinal ambivalence. The effectiveness of the induction methods is validated with both direct and indirect attitude measures.

In the General Discussion (Section V), I will summarize the findings resulting from the theoretical and experimental sections of this thesis. The insights will be structured along the three overarching categories *Definition*, *Measurement*, and *Induction,* respectively. By doing so, I will constantly enrich these findings with theoretical and methodological considerations, and interweave suggestions for future research.

Evaluative Priming – An Indirect Measure of Ambivalence

Attitudes are classically measured using self-report based techniques in which participants report their feelings and cognitions regarding an attitude object. As discussed by multiple researchers (Greenwald & Banaji, 1995; Nisbett & Wilson, 1977; Orne, 1962), however, this technique requires (i.) participants' introspection with regard to their own feelings and cognitions and (ii.) cannot rule out the possibility that participants' answers fall prey to response tendencies, strategies, and demand effects. Consequently, more recently measures have been developed that are more independent of participants' ability to consciously access their attitudes and their potential motivation to alter their responses in a more favorable direction.

Those so-called *indirect attitude measures* are diverse in both, their assumptions and their implementation. For instance, disguised self-reports such as the information error test (Hammond, 1948), which appears to be a multiple choice questionnaire whose answers reflect various attitudes, or similarity techniques (Hendrick & Seyfried, 1974), which infer attitudes from the perceived similarity between the participant and fictitious people who express their attitudes, require participants to provide self-reports but conceal their purpose of assessing an attitude. Alternatively, behavioral indicators such as body position (Mehrabian, 1968) or physical distance to the attitude object (Byrne, Ervin, & Lamberth, 1970) may be informative regarding to attitudes while abstaining from self-reports.

Yet another cluster of indirect attitude measures, so-called priming paradigms, infer underlying associations from the comparison of latencies and error rate patterns across different experimental conditions. In the experiments reported in Sections III and IV of this thesis, we applied an evaluative priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) to indirectly get indication of participants' attitudes toward the applied stimuli. In this paradigm, participants classify clearly positive or negative target stimuli according to their valence by pressing one of two assigned keys. Critically, each target stimulus is shortly preceded by a prime stimulus that either shares the valence of the target *(congruent trial*), possesses the opposite valence (*incongruent trial*), or constitutes a neutral baseline condition. In the classic paradigm, one usually finds response acceleration (that is faster classifications) and fewer errors in congruent trials, and response deceleration (that is slower classifications) and more errors in incongruent trials compared to the baseline condition. This pattern is assumed to emerge due to the prime preactivating a valence that is either in line with or opposing the valence of the target stimulus. This preactivation is found to survive up to approximately 300ms (Klauer & Musch, 2003; Klauer, Teige-Mocigemba, & Spruyt, 2009) before it recedes and does not have systematic effects on target responses anymore.

Among indirect attitude measures, the evaluative priming paradigm is especially suited for the investigation of attitudinal ambivalence. On the one hand, the paradigm is perfectly standardized and allows for significant control over procedural parameters such as the type and number of stimuli and prime-target pairings, and the location, number and duration of stimulus presentations. Moreover, it allows for the separate assessment of the relation of ambivalence to subsequent positive and negative attitude objects, respectively. It is thus possible to differentiate between ambivalence-induced conflicts that occur in both, positive and negative contexts, and other conflicts such as incongruence between prime and target valence, semantic conflicts, or uncertainty (as observed with neutral attitude objects due to a lack of information). Section III further provides a discussion about alternative indirect attitude measures and arguments against the suitability of those approaches for an indirect measure of ambivalence. The evaluative priming paradigm is applied throughout the two empirical sections as an indirect counterpart for direct measures of attitudinal ambivalence thereby considerably extending our understanding of (partly undeliberate) processes elicited by attitudinal ambivalence.

At this point, the notion of implicit attitudes should be introduced and their relation to indirect attitude measures should be discussed. In the 1980s, the idea has emerged that attitudes may operate at two separate levels: explicit attitudes, which constitute controllable evaluations that are consciously accessible and may be deliberately altered, and implicit attitudes, which reflect automatically activated associations that may influence perceptions, feelings, thoughts and behaviors without the holder’s awareness (Fazio & Olson, 2003; Greenwald & Banaji, 1995). The concept of implicitness, however, is a multilayered concept that is - depending on the specific research question - defined flexibly in different research areas, lab groups, and studies. For instance, Bargh (1994) concludes that implicitness may refer to a lack of awareness, control, intention, or attentional resources. On an even more specific level, the term awareness may refer to the source of information, its content or its impact (Gawronski, Hofman, & Wilbur, 2006). It would be inadequate to assume that indirect attitude measures constitute the counterpart to implicit attitudes. Indirect attitude measures do not exclusively capture processes that operate beyond awareness or deliberation. They rather reflect associations that may or may not be deliberately accessible by the attitude-holder.

Evaluative Conditioning – A Learning Procedure to Induce Ambivalence

The majority of experiments on attitudinal ambivalence is quasi-experimental in nature; that is ambivalence is not manipulated but merely measured. This so-called correlational approach is problematic for at least three reasons. First, when refraining from the induction of a psychological concept but merely relying on its measurement one lacks control over relevant parameters that may underlie the formation of the concept. In an experimental approach, on the other hand, it is possible to control and systematically vary the nature of the stimulus material, or the number and duration of presentations. The experimenter thus gains deeper insight into the variation of the interesting concept as a function of the procedural parameters.

Second, correlational studies are not informative with regard to causal relations. Imagine the following example: a fictitious study found that participants who are highly ambivalent toward smoking scrutinize an information sheet on health-related risks of smoking more extensively than participants that are purely positive or purely negative toward smoking. A correlational design would not allow to draw inferences on whether the ambivalent participants scrutinize the available information more *because* they are ambivalent, or whether the deeper processing style and consequent encoding of more relevant information about smoking *causes* them to form an ambivalent attitude. While both explanations lie within the realm of possibility, an experimental design is required to make a statement on cause and effect within this scenario.

Third, while correlational settings do not require an extensive theoretical framework, experimental studies require the researcher to be extremely precise and theory-driven regarding the definition and measurement of the concept. Section II will further demonstrate the relative lack of experimental studies on attitudinal ambivalence and provide an overview of the state of the art.

In Section IV, I will present two studies that apply an evaluative conditioning paradigm to generate attitudinal ambivalence in the participants. Evaluative conditioning (EC) is a change in the liking of an originally neutral stimulus, the so-called conditioned stimulus or CS, due to its repeated co-occurrence with a valent (positive or negative) stimulus, the unconditioned stimulus or US (De Houwer, Thomas, & Baeyens, 2001). Since the introduction of the classical “picture-picture” paradigm in EC research (Levey & Martin, 1975), EC effects have further been demonstrated in other domains. For instance in the gustatory domain, Zellner, Rozin, Aron, and Kulish (1983) were the first to condition two different flavored teas with a sugar solution (constituting a positive unconditioned stimulus US_{+}) or plain water (constituting a neutral unconditioned stimulus US_{0}) and found a preference for the pure flavor that was formerly paired with the US_{+} as compared to the pure flavor that was formerly paired with the US_{0}. Correspondingly, valence shifts have been found in the haptic domain (e.g., Hammerl & Grabitz, 2000), or with biologically significant USs such as electrical shocks (e.g., Zanna, Kiesler, & Pilkonis, 1970) or food (e.g., Johnsrude, Owen, Zhao, & White, 1999). Beside within-domain experiments, a variety of studies has shown successful valence transfer across modalities. Especially auditory USs have been shown to transfer their valence on to visual CSs (Bierley, McSweeney, & Vannieuwkerk, 1985; Eifert, Craill, Carey, & O’Connor, 1988; Blair & Shimp, 1992; Gorn, 1982).

Another type of paradigms that shares the goal to induce (primarily positive) attitudes are persuasion paradigms. Persuasion paradigms openly communicate valent pieces of information that are relevant for the attitude object, and the intention to create a positive attitude toward the attitude object. In contrast, evaluative conditioning procedures are assumed to alter the associative structure of an attitude object without necessarily providing explicit relational information regarding CS-US pairings, and without requesting from the participants that they remember the presented stimuli or form an attitude about them. This procedural characteristic is beneficial as it decreases potential demand effects (Greenwald & Banaji, 1995; Nisbett & Wilson, 1977) and reactance tendencies (e.g., Burgoon, Alvaro, Grandpre, & Voulodakis, 2002), while allowing for the emergence of automaticity-related processes (e.g., Hütter & Sweldens, in press).

The two studies reported in Section IV make use of an EC paradigm with varying procedural parameters to induce positive, negative, neutral, and ambivalent attitudes, respectively. Evaluative conditioning has beneficial features. For instance, in contrast to the studies reported in Section III, which apply a quasi-experimental design with pre-selected ambivalent material, the two experiments in Section IV experimentally induce the respective attitudes thereby (i.) producing a greater amount of control and (ii.) enabling causal inferences.

Section II: Attitudinal ambivalence:

Definition, measurement, and induction

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The following chapter contains a review article that results from a cooperation between Katharina Theresa Berger (lead author), Prof. Dr. Mandy Hütter (second author), and Prof. Dr. Olivier Corneille (second author). The manuscript entitled "Ambivalence: Definition, Measurement, and Induction" is currently in preparation for submission. The three authors contributed equally to the research project. More specifically, each author contributed approximately 33% to the literature search, integration and critical appraisal, and paper writing, respectively.

Introduction

"What am I doing? Tearing myself. My usual occupation at most times."

— Charles Dickens

Attitudes are classically defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993, p. 1). As the quotation above suggests, however, people's evaluative tendencies are often less straightforward than this definition implies. This is typically the case when an attitude object is associated with *both* positive *and* negative evaluations, sometimes accompanied by the experience of ambivalent feelings. We refer to this specific type of attitudes as ambivalent attitudes (e.g., Kaplan, 1972; Priester & Petty, 1996; Scott, 1966; Thompson, Zanna, & Griffin, 1995). For instance, people may hold positive *and* negative thoughts and feelings about a specific food, a colleague, or the self.

Attitudinal ambivalence is highly relevant to psychological research for three main reasons. First, it relates to common psychological experiences that are captured by expressions such as "having mixed feelings" or "feeling ambivalent" about something or someone. Understanding how such puzzling experiences develop is a typical endeavor of psychological research. Second, attitudinal ambivalence is often experienced as aversive. As a consequence, it may influence later information processing in a way that serves to reduce that psychological tension. Both determinants of information processing and how people regulate feelings of ambivalence are of great interest for psychological researchers. Third, the question arises how ambivalence is encoded, represented, consolidated, retrieved, and changed in long-term memory, and to which extent ambivalent representations are consciously accessed. The latter questions are at the core of contemporary psychological research. Clearly, the practical and theoretical implications of attitudinal ambivalence make this topic relevant to a broad range of psychological domains, such as attitudes, interpersonal relations, intergroup relations, consumer psychology, self and identity, social cognition, cognition and emotion, consciousness, learning and memory.

As further explained below, the purpose of this review is to provide a critical overview of the current state of research, and how it defines, measures, and induces attitudinal ambivalence. By doing so, we highlight and acknowledge previous achievements of the field, while also revealing shortcomings and research gaps. In particular, we point to conceptual and methodological ambiguities, and make valuable suggestions for future directions. We further introduce a new measurement-driven terminology, which refrains from linking the concept with automaticity and process-related assumptions. Instead, we structure the review along measurement approaches while critically reflecting on the process-related claims that can actually be made.

A Preview of the State of the Art

Perhaps because of the cognitive and behavioral implications of ambivalent attitude objects, most of the research on attitudinal ambivalence has addressed its downstream consequences. It is noteworthy that it did so by relying mostly on correlational methods. In comparison, we will see in this review that research on attitudinal ambivalence still awaits integrative work at the conceptual and measurement levels, and that there is also a general lack of experimental research addressing the formation of attitudinal ambivalence. For instance, there is an extensive body of research on consequences of attitudinal ambivalence (for reviews, see Conner & Sparks, 2002; Jonas, Broemer, & Diehl, 2000; Van Harreveld, Nohlen, & Schneider, 2015). There are numerous applied fields conducting research based on different ambivalence-relevant concepts such as racism (e.g., Katz & Hass, 1988), sexism (e.g., Glick & Fiske, 1996), self-esteem (e.g., DeMarree, Morrison, Wheeler, & Petty, 2011), health-related attitudes (e.g., Armitage & Conner, 2000), and work-related attitudes (e.g., Ziegler, Schlett, Casel, & Diehl, 2012), while a consensus on how to experimentally operationalize or even manipulate and measure attitudinal ambivalence has not been reached yet.

As should become apparent throughout this review, this state of affairs is unfortunate. As for any psychological construct, ambivalent attitudes can only be inferred from observable indicators. This constraint makes it critical to share a common view on how ambivalent attitudes may be conceptualized, measured, and induced. Such common view is currently lacking, which we believe is essentially due to terminological pitfalls and to the scarcity of experimental research on the formation of ambivalent attitudes.

To illustrate, we may consider the term *implicit ambivalence*. Across publications, this term has referred to an association between beliefs and doubt in memory (Rydell, McConnell, & Mackie, 2008), discrepancies between implicit and explicit evaluations (Petty, Briñol, & Johnson, 2012), the absence of an explicitly perceived conflict between attitudes (Petty, Briñol, & DeMarree, 2007), and conflicts between a newly formed attitude and an old attitude (Conner & Armitage, 2008). Moreover, at the semantic level, implicit ambivalence is difficult to discriminate from ambivalence as assessed with an indirect measure (Berger, Hütter, & Corneille, 2018; De Liver, Van der Pligt, & Wigboldus, 2007). As a further concern, there is little experimental indication of how implicit ambivalence is acquired.

The goal of this article is to contribute building such a common ground, by providing the reader with a critical and comprehensive review of the definition and corresponding measurement, and induction of ambivalent attitudes. We furthermore introduce a new terminology, one that we think helps to reduce confusion by linking terminology to specific measurement approaches. In doing so, we also carve out open questions for future research.

Organization of the Present Review

Strong science is based on a common view of the concepts under investigation that should also be represented in language. At the same time, the concepts should be as free as possible from strong theoretical assumptions. Relating constructs to their measurement contributes to achieving this goal. We just alluded to the case of "implicit ambivalence." Here, it is not clear what the implicitness assumption refers to (e.g., unawareness at encoding, maintenance, retrieval of attitudes or the overlearned nature of attitudes), leading to inconsistent measures and induction procedures. Moreover, the implicitness of attitudinal phenomena is being strongly debated and is an important research question on its own (Corneille & Stahl, in press; Sweldens, Corneille, & Yzerbyt, 2014).

In order to overcome such pitfalls, we propose to adopt a method-driven approach that is agnostic to specific theoretical views, but nevertheless allows for stringent tests of substantive theories. Specifically, throughout this article, we will refer to the overarching concept as attitudinal ambivalence while making a twofold partition between *structural ambivalence* (within direct or indirect measures vs. between direct and indirect measures) and *experienced ambivalence* in the subordinate sections. Regarding structural ambivalence, i.e., the degree of positivity and negativity associated with an attitude object, we propose to go away from the usual explicit/implicit ambivalence terminology, and to rather distinguish between opposing evaluations within direct or indirect measures, or between a direct and an indirect measure. While the more classical direct attitude measures rely on self-reported thoughts and feelings, indirect attitude measures refrain from directly asking participants, but infer underlying associations from systematic behavioral patterns or neurophysiological correlates. We further distinguish structural ambivalence from the phenomenological experience that may accompany the encounter of ambivalent attitude objects (i.e., experienced ambivalence). The review is divided into three main sections that adhere to this twofold distinction between structural and experienced ambivalence:

Section I (i.e., Definitions and Corresponding Measures) serves to assembly definitions of attitudinal ambivalence and their corresponding direct and indirect measures. It first introduces structural ambivalence and its three potential manifestations: opposing evaluations within a direct measure, within an indirect measure, or between a direct and an indirect measure (often coined “implicit ambivalence”). Next, an alternative definition of attitudinal ambivalence is discussed that focuses on the perceived feelings of conflict that may arise when encountering attitude objects of ambivalent cognitive structure (i.e., experienced ambivalence).

Section II (i.e., Relations between Different Ambivalence Measures) reviews preliminary findings on the relationships between direct and indirect measures of structural ambivalence, as well as direct and indirect measures of experienced ambivalence. Subsequently, we discuss the relationships between structural and experienced ambivalence, both within and between direct and indirect measures.

Section III (i.e., Ambivalence Induction) starts with a critical discussion of the limitations of the correlational approach to investigating attitudinal ambivalence. Next, this section reviews current theorization about how structural ambivalence within and between direct/indirect measures, and experienced ambivalence are induced. Hence, this section covers the experimental approach to attitudinal ambivalence induction. Several paradigms are reviewed that were to some degree able to produce evidence of structural ambivalence or experienced ambivalence. In Section III, we also address determinants for successful attitudinal ambivalence induction, such as the resolvability of perceived ambivalence.

In the General Discussion, we conclude that it is necessary to conduct further research on both attitudinal ambivalence measurement and induction, in order to reach a common understanding of this multifaceted construct. While there is an extensive body of research on the consequences of attitudinal ambivalence, the present review emphasizes the lack of precise and common conceptualization about it, both in correlational and experimental approaches. Based on the various observations made in this review, we close this article by discussing a number of avenues for future research.

Attitudinal Ambivalence in its Broader Definitional Context

Before proceeding to our review proper, it is important to distinguish attitudinal ambivalence from a variety of related constructs. The distinctions highlight the specific features of attitudinal ambivalence measurement. Specifically, *inconsistency* differs from attitudinal ambivalence in that it describes the mere degree of dissimilarity between several attitude components or between an attitude component and the overall evaluation (Maio, Esses, & Bell, 2000). This amount of dissimilarity, however, does not need to stem from opposing evaluations. The same principle holds for *belief homogeneity* (Erber, Hodges, & Wilson, 1995), which captures the amount of variability in the valence of attitude components. The variability may be considerably high but still lie within the same valence domain. *Ambitendency* (Bleuler, 1911) indicates the simultaneous presence of contradictory behavioral intentions, and *dissonance* (Festinger, 1957) typically speaks to an inconsistency between cognitions and behavior.

A more difficult question is how attitudinal ambivalence can be distinguished from *uncertainty*. Klopfer and Madden (1980) investigated whether different labels for the mid-scale option of a Likert rating scale affect the frequency of usage of this option. They found that participants most often used the mid-scale option if it was labeled "ambivalent" while clearly refraining from its usage when the label indicated "uncertainty." The authors interpreted this finding as evidence that ambivalence and uncertainty are conceptually different.

In the following decades, ambivalent evaluations were often considered similar to uncertain or unconfident evaluations (e.g., Jonas, Diehl, & Broemer, 1997), or to be antecedents of uncertainty (Gross, Holtz, & Miller, 1995), while more recent research has provided considerable evidence for the idea of attitudinal ambivalence and uncertainty as independent constructs (Clarkson, Tormala, & Rucker, 2008; Luttrell, Stillman, Hasinski, & Cunningham, 2016; Olsen, 1999; Petrocelli, Tormala, & Rucker, 2007). For instance, Luttrell, Petty, and Briñol (2016) argue that: "whereas ambivalence represents the degree of conflict between positive and negative reactions to the same target, certainty is an overall judgment of the validity of one's evaluative reactions" (p. 57). Thus, one may be very certain about holding different attitudes independent of whether those attitudes are univalent or ambivalent. Consistent with this view, several studies found that manipulations of uncertainty leave structural ambivalence measures unaffected (e.g., Clarkson et al., 2008; Petrocelli et al., 2007), and that uncertainty remains consequential even when controlling for ambivalence (e.g., Bassili, 1996; Craig, Martinez, & Kane, 2005; Petrocelli et al., 2007). Crucially, conflicting attitudes may translate into uncertainty regarding a decision for approach or avoidance behaviors (Abelson & Levi, 1985), but not necessarily regarding the evaluation of an attitude object per se.

I. Ambivalence Definitions and their Corresponding Measures

Attitudes toward an attitude object are generally assumed to be either positive or negative. In many cases, however, this assumption does not seem to adequately represent the underlying associative attitude structure. While univalent attitudes are assumed to trigger more or less strong associations with just one valence (Fazio, 1995), many attitudes often consist of associations with *both* valences. Such attitudes are called ambivalent attitudes. Since the introduction of the term *ambitendency* by Swiss psychiatrist Eugen Bleuler in 1911, the understanding of attitudinal ambivalence has continuously evolved and led to various definitions. Most of those definitions can be assigned to one of two major clusters that are also reflected in the prevailing approaches to attitudinal ambivalence measurement: structural and phenomenological definitions of attitudinal ambivalence. We discuss them both in this section.

I.1 What is Structural Ambivalence and how is it Measured?

The first cluster focuses on the underlying cognitive structure of attitudinal ambivalence. In this cluster, attitudinal ambivalence is defined by the presence of positive and negative associations or evaluations of an attitude object; it is often accompanied by the assumption of an automatic and simultaneous activation of these associations (e.g., Kaplan, 1972; Priester & Petty, 1996; Scott, 1966; Thompson et al., 1995). While this approach depicts the most accepted and most widely shared understanding of attitudinal ambivalence, research has not yet been able to provide a clear answer as to whether opposing valences can be *simultaneously* perceived: some studies speak to a bipolar structure of affect (Green, Goldman, & Salovey, 1993), whilst others support the notion of positivity and negativity as independent constructs (Tellegen, Watson, & Clark, 1999).

Attitudinal ambivalence as defined with reference to the underlying associative structure can take three possible forms. First, attitudinal ambivalence may relate to associations of opposite valences with an attitude object within a direct measurement procedure (i.e., structural ambivalence *within* a *direct* measure). Second, associations of opposite valences with an attitude object may be revealed within an indirect measure (i.e., structural ambivalence *within* an *indirect* measure). In both cases, this measurement outcome may or may not be associated with the experience of ambivalent feelings. Third, an attitude structure consisting of both positive and negative evaluations may further translate to a *univalent* outcome on a direct measure and the opposite univalent outcome on an indirect attitude measure, respectively (i.e., structural ambivalence *between* direct and indirect measures). In this case (commonly coined "implicit ambivalence"), little and inconclusive research has evidenced whether participants actually experience ambivalent feelings. Of note, this understanding of ambivalence makes several tacit assumptions. First, it assumes that attitudes are representations that are stored in long-term memory. Attitude measures may reveal these existing representations thereby contrasting the view that attitudes are completely built from scratch every time they are needed (e.g., Schwarz, 2007; Schwarz & Bohner, 2001). Second, with each attitude object possessing a specific structure in long-term memory, ambivalence within versus between measures refers to the same attitude, while potentially translating to different outcomes on different measures due to response-related processes. Figure 1 depicts the cognitive structure and phenomenological experience related to structural ambivalence.

The distinction between structural ambivalence *within* direct and indirect measures on the one hand, and *between* direct and indirect measures on the other hand has several advantages. First, it goes away from current terminological inconsistencies that subsume two conceptually different forms of structural ambivalence - namely, ambivalence within an indirect measure, and ambivalence between direct/indirect measures - under the generic concept of "implicit ambivalence." Second, it stresses that a unique ambivalent attitude structure may translate either to evaluative discrepancies *within* a direct or indirect measurement procedure, or to diverging univalent attitudes on *a* direct and an indirect measurement procedure, respectively. Third, defining these concepts at the measurement level avoids making debatable assumptions about whether indirect and direct evaluative measures discriminate between two categories of processes or representations (i.e., explicit versus implicit). Fourth, it avoids applying a generic notion (i.e., the explicit/implicit distinction) to attitude-related processes that may arise at different stages of processing (e.g., acquisition, representation,

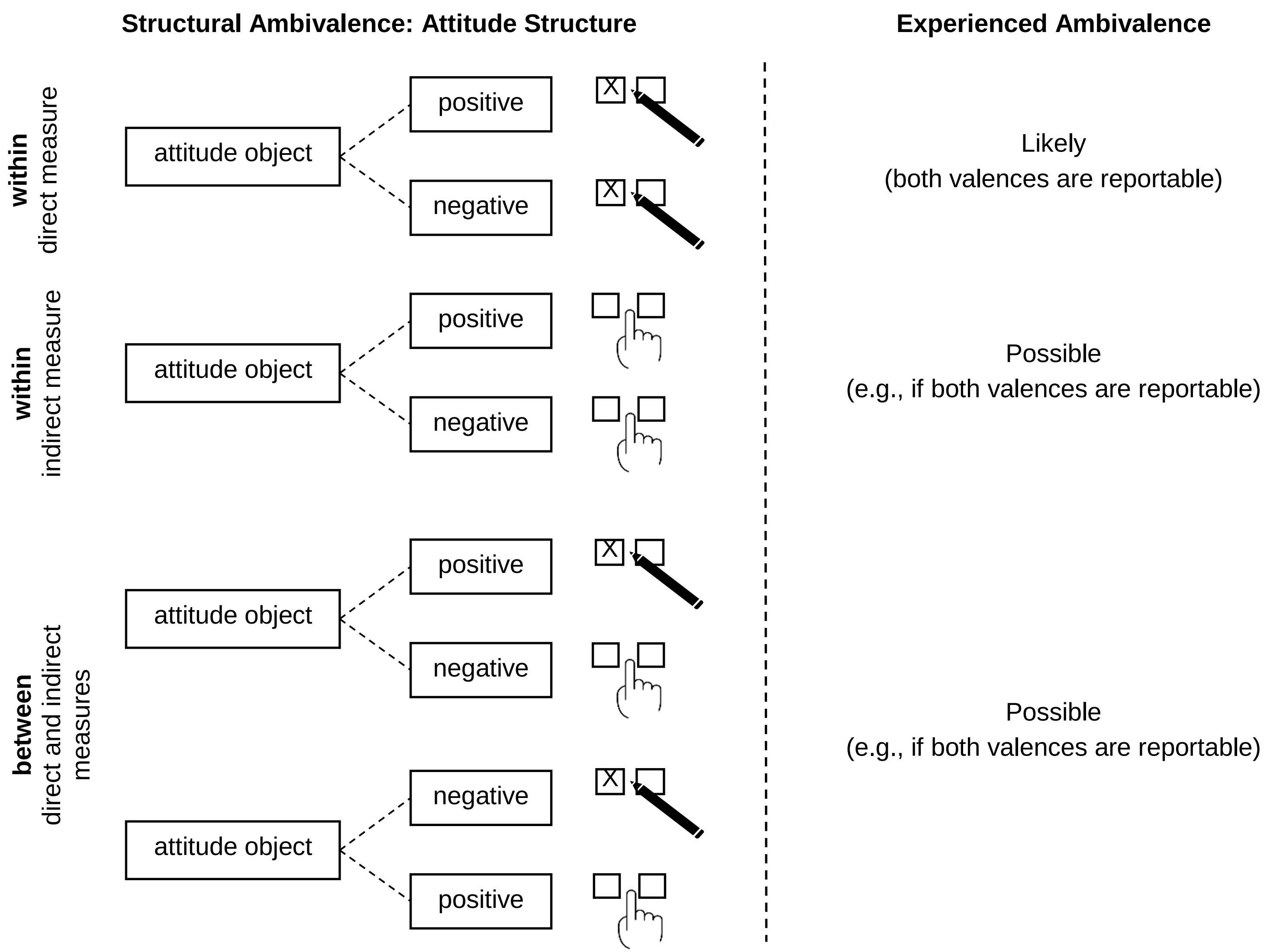

Figure 1. Schematic description of structural ambivalence *within* a direct or indirect measure, and *between* direct and indirect measures, respectively, and their relation to experienced ambivalence.

retrieval, or expression). Fifth, the terminology we propose here allows experienced ambivalence to arise in both forms of attitudinal ambivalence and using both types of measures. It recognizes, however, that experienced ambivalence is most likely to arise in the case of ambivalence observed on direct measures as compared to structural ambivalence arising on indirect measures or between direct and indirect measures (i.e., in the latter two cases, experienced ambivalence should only occur if the attitudinal structure on the indirect measure is also reportable).

I.1a Structural Ambivalence within a Direct Measure

Direct measures of structural ambivalence are based on the idea that positive and negative aspects of an attitude can be accessed and reported separately. The notion of statistically independent evaluations of opposing valence is supported by the observation that correlations between positive and negative attitude scales are only moderate on average (Cacioppo, Gardner, & Berntson, 1997). The classic way of measuring attitudes using a bipolar rating scale (Thurstone, 1928), however, does not allow for the separate assessment of different evaluations and thus leaves neutral and ambivalent attitudes inseparable (Kaplan, 1972). This is problematic for all psychological paradigms that use supposedly neutral stimulus material and draw conclusions from findings based on this material (e.g., Rocklage & Fazio, 2015; Schneider, Veenstra, Van Harreveld, Schwarz, & Koole, 2016).

Kaplan (1972) was the first to overcome this problem by introducing the concept of *potential ambivalence,* that is, a self-report measure of structural ambivalence. Participants are asked to separately rate the amount of positivity and negativity associated with an attitude object while ignoring all aspects of the opposing valence. That way, they can provide independent ratings varying in their degree of positivity *and* negativity. Additionally, they can provide ratings that are either neutral (that is, neither positive nor negative) or ambivalent (that is, both positive and negative).

There are different ways to generate these ratings of positivity and negativity. Van Harreveld, Van der Pligt, Vries, Wenneker, and Verhue (2004) applied a closed-ended belief-based measure and had their participants choose valent attributes from a list to assess their positive and negative associations with an attitude object. A widely applied technique relies on the use of semantic differential scales ranging from neutral to extremely valent (neutral to extremely good/ bad or neutral to extremely pleasant/ unpleasant etc.; e.g., Kaplan, 1972; Crites, Fabrigar, & Petty, 1994). In a next step, these ratings are combined into a mathematical formula that provides an ambivalence index.

Breckler (1994) suggested three axioms an ambivalence index should fulfill to adequately capture the nature of structural ambivalence as assessed with two univalent rating scales. First, ratings on the larger scale held constant, structural ambivalence should increase with increasing ratings on the scale with the smaller value. Second, the smaller value held constant, structural ambivalence should decrease with increasing ratings on the scale with the larger value. Third, if ratings on the two scales are approximately equal, structural ambivalence should increase with increasing ratings on both scales. Thus, structural ambivalence should increase (i.) the more similar the separate ratings are and (ii.) the more extreme these ratings are.

Several indices have been suggested, some of which fail to meet the second assumption, while others fail to fulfill the third one (for a useful overview and discussion of several ambivalence indices, see Priester & Petty, 1996). The most frequently applied index to meet all three criteria satisfactorily is the Griffin index of ambivalence (A; Thompson et al., 1995), which is defined as

$$A = (P + N) /2 - | P - N | \qquad (1)$$

with P indicating the positivity rating and N the negativity rating.

Priester and Petty (1996) developed a direct measure of ambivalence that is based on two open-ended format items that ask participants to reflect on their positive and negative feelings separately. The researcher then counts the number of positive and negative reactions, which allows determining the degree of dominance of one of the two valences (i.e., whether there are more positive than negative reactions, or vice versa) and the degree of conflict between the two valences (i.e., the number of reactions that conflict with the dominant valence). They also assessed experienced ambivalence using three questions that target the experienced consequences of this ambivalent structure (see Section I.2a for the details of this experienced ambivalence measure). From this information, they suggested to calculate ambivalence as follows:

$$A = 5C^{p} – D^{1/C} \quad (2)$$

D stands for the number of dominant pieces of information, C denotes the number of conflicting pieces of information, and p is the slope of the relation between the number of conflicting pieces of information and self-reported experienced ambivalence (in their studies *p* = .40). Hence, this measure combines structural and experienced ambivalence into one comprehensive measure and regarding only cognitions and feelings that participants list spontaneously (i.e., without external prompts). The authors argue that this procedure ensures that index of ambivalence only comprise cognitions, feelings, and behavioral tendencies that participants find personally relevant.

The combination of separate ratings into one index has several downsides. Some limitations are of general concern, while others refer to specific indices. The first limitation concerns the mathematical combination of participants' responses into one index. Specifically, many of the assumptions underlying the mathematical ambivalence formulas have not been empirically tested. For instance, little is known about how people weigh and balance their separate evaluations. A limitation of the Griffin index is that it makes it difficult to disentangle the impact of the separate valence scales and their mutual effects on the degree of structural ambivalence, because the weaker evaluative rating mainly or even exclusively predicts the index (Locke & Braun, 2009). Ullrich, Schermelleh-Engel, and Böttcher (2008) describe a similar confound between the index and its components, especially in designs that assume structural ambivalence to be a moderator or mediator variable (for instance of the attitude-intention link, the attitude-behavior link, or the relation between available information and processing scrutiny).

Turning to the index proposed by Priester and Petty (1996), it assumes that participants can verbalize all their positively and negatively colored reactions to a given attitude object. Sometimes, however, the sources of positive or negative feelings may remain vague and may therefore fail to be reported in the open-ended question. The index is thereby a highly cognitive and deliberate one that likely reflects only those aspects that are easily verbalized and appear subjectively plausible (e.g., Wilson, Dunn, Kraft, & Lisle, 1989; Wilson, Hodges, & LaFleur, 1995). While not entirely immune to the latter limitation, the implementation of two univalent rating scales may allow better capturing positive and negative reactions that participants may have a more difficult time accounting for.

Neighboring fields that assess the foundations of prejudice have also developed tools aimed at assessing ambivalent attitude structures. For instance, in their ambivalent sexism inventory, Glick and Fiske (1996) differentiate between benevolent (e.g., "Women should be cherished and protected by men.") and hostile sexism (e.g., "Women are too easily offended.") towards women assuming that those subscales "tap different poles of ambivalence" (p. 504). The valence associated with those items, however, is not definite but must be inferred, and may thus be subject to interpretational freedom.

In conclusion, direct measures of ambivalence are heterogeneous and each come with advantages and disadvantages. Therefore, researchers should reflect thoroughly on their choice of measure(s) as a function of their specific research objectives.

I.1b Structural Ambivalence within an Indirect Measure

Direct attitude measures are based on participants' self-reports and are consequently susceptible to various response tendencies, strategies, and demand effects (e.g., Greenwald & Banaji, 1995; Nisbett & Wilson, 1977; Orne, 1962). Indirect attitude measures try to overcome these shortcomings by avoiding direct self-reports and inferring attitudes from various self-report independent indicators such as body posture, neurophysiological markers, or behavioral responses in different conditions instead. Among the most popular indirect attitude measures in the latter category are the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), the evaluative priming task (Fazio, Sanbonmatsu, Powell, & Kardes, 1986), the semantic priming task (Wittenbrink, Judd, & Park, 1997), the Go/ No-Go Association Task (Nosek & Banaji, 2001), and the affective misattribution paradigm (Payne, Cheng, Govorun, & Stewart, 2005).

Ambivalent attitudes are thought to differ from univalent attitudes in that they entail the joint activation of both positive and negative associations to the attitude object. Indirect measures constitute a promising tool for investigating this assumption. De Liver and colleagues (2007) applied a single-target IAT (Wigboldus, Holland, & Van Knippenberg, 2004) to investigate the underlying associative structure of ambivalent attitude objects. In one block, participants were instructed to categorize the ambivalent target words using the key shared with positivity, while in another block they were instructed to categorize the ambivalent target words using the key shared with negativity. While they found different response patterns for univalent and ambivalent attitude objects, De Liver and colleagues could not differentiate between ambivalent and neutral attitude objects.

De Liver and colleagues (2007) also applied an evaluative priming task to investigate the strength of the associations with positivity and negativity. In this task, participants are asked to categorize as positive or negative valent target words that follow the brief presentation of a prime. The authors found response facilitation for ambivalent targets following both positive and negative primes while no facilitation was observed for neutral target words. These findings, however, are inconclusive regarding the *simultaneous* activation of positivity and negativity. As is the case when considering direct evaluative ratings, it may well be that ambivalent stimuli sequentially evoke positive or negative evaluations depending on the context (i.e., the prime in sequential priming or the shared key in an IAT; for further discussion of this paradigm, see Berger et al., 2018).

Priming studies relying on ambivalent primes (instead of ambivalent targets) are more informative regarding the simultaneous activation of positivity and negativity. Petty, Tormala, Briñol, and Jarvis (2006) used such a priming task after employing attitude reinforcement or attitude change. They obtained congruency-like response patterns for both positive and negative targets following ambivalent primes. Direct measures did not indicate structural ambivalence. They concluded from this pattern that their ambivalent material possessed both positive and negative associations that did not translate to self-report measures. While interpreting those findings as supportive of structural ambivalence on an indirect measure, we believe this interpretation is mitigated by two important limitations inherent to that study. First, the absence of neutral prime baseline did not allow drawing conclusions on the nature of the effect. Specifically looking at the pattern of means, the effect may have been due to a slowing down in responses on inconsistent prime-target sequences for *univalent* primes. Second, the stimulus onset asynchrony (SOA = 450 ms) was in a range that does not allow a reliable examination of affective priming effects (e.g., Klauer & Musch, 2003; Klauer, Teige-Mocigemba, & Spruyt, 2009).

Berger and colleagues (2018) conducted two evaluative priming studies with a short SOA of 150 ms, in which the ambivalent material served either as primes or as targets. Both priming paradigms were implemented within-participants. The authors obtained longer response latencies for the categorization of ambivalent targets, and also for the categorization of univalent targets when they were preceded by ambivalent primes. Hence, this research suggests a conflict resolution arising from the non-deliberate and simultaneous activation of both positive and negative associations that is generally slowing down responses.

In two additional studies, Berger and colleagues (2018) obtained evidence that indicates (i.) that the activation of opposing valences triggered by ambivalent primes is short-lived (i.e., it did not survive a longer SOA of 450 ms) and (ii.) that ambivalent stimuli elicit a conflict only if the task at hand requires a univalent categorization. Specifically, no evidence of cognitive conflict for ambivalent stimuli (considered either as primes or targets) was found in a variation of the evaluative priming paradigm that had participants categorize stimuli as valent/neutral instead of positive/negative (Werner & Rothermund, 2013). In sum, neither the mere activation nor the affective processing of the ambivalent primes is a sufficient condition for a conflict to arise. Rather, the conflict elicited by the unintentional and joint activation of opposite valences in ambivalent stimuli turned out to slow down responses only when the task requested to categorize stimuli as positive or negative.

While not corresponding to our definition of structural ambivalence, other measures have been developed that do not rely on self-report and may be interpreted as indirect indicators of ambivalence, but are not immediately informative about the attitude structure. We discuss them here for the sake of completeness. Schneider and colleagues (2015) used a mouse tracking task to investigate ambivalence-like behavior and the development of ambivalent attitudes over time. The mouse tracking paradigm is based on the idea that evaluations can manifest in motor behavior thereby circumventing the direct report of ambivalent attitudes. In the experimental setup, participants are instructed to click on one of two buttons labeled “positive” and “negative” to classify presented attitude objects according to their valence. One then records and analyses the mouse trajectory, such as its curvature, to draw conclusions about the development of the evaluation over time.

Employing ambivalent attitude objects, Schneider and colleagues found slower responses and less straight trajectories (“pull”) for ambivalent attitude objects as compared to non-ambivalent attitude objects. Furthermore, Schneider and colleagues (2013) linked ambivalent attitudes as compared to non-ambivalent attitudes to increased sideway movements on a WII ™ balance board. Specifically, they showed that an ambivalent newspaper article as compared to a univalent article increased sideway movements interpreted as another behavioral indicator of ambivalence that circumvents self-report. Assessing the correlations of mouse trajectories and latencies (Schneider et al., 2015) and side-to-side body movements (Schneider et al., 2013) with experienced ambivalence revealed moderately positive correlations.

Although interesting, the balance board technique is not suitable for assessing attitude structure and it is conceivable that weak attitudes and attitudes held with uncertainty produce similar patterns of results (Klopfer & Madden, 1980; Petrocelli et al., 2007).

Applying functional magnet resonance imagery, Cunningham, Johnson, Gatenby, Gore, and Banaji (2003) reported a significant correlation between activation in the ventrolateral prefrontal cortex, which is associated with the inhibition of irrelevant information in memory tasks, and structural ambivalence as measured with separate valence scales and combined into an ambivalence index. Activation in this area may suggest that opposing evaluations were activated, one of which was then suppressed in order to respond to the task. Similarly, Cunningham, Raye, and Johnson (2004) reported a correlation between structural ambivalence and the BOLD signal in the right inferior frontal cortex.

I.1c Structural Ambivalence between a Direct and an Indirect Measure

Analogous to structural ambivalence within a measure, structural ambivalence between direct/indirect measures is characterized by positive and negative associations with an attitude object. This type of structural ambivalence is unique, however, in that *opposing univalent evaluations* are expressed on direct and indirect measures, respectively (for a discussion of potential sources of discrepancies between direct/indirect measures, see Section III.1c). Hence, whereas either direct or indirect measures may be used to assess experienced ambivalence or structural ambivalence within measures, investigating structural ambivalence between direct/indirect measures requires the joint use of the two types of measures. While many studies on “implicit attitudes” investigated antecedents and consequences of differences on direct and indirect attitude measures, most of those report results that are neither informative (e.g., Briñol, Petty, & Wheeler, 2006; Dasgupta & Greenwald, 2001; Gawronski & Strack, 2004; Johnson, Petty, Briñol, & See, 2017) nor indicative of ambivalence between direct/indirect measures (e.g., Karpen, Jia, & Rydell, 2012; Petty et al., 2006). For instance, Briñol et al. (2006) investigated the impact of differences in directly and indirectly measured self-concepts (e.g., shyness). Their attitude measures, however, cannot be interpreted with regard to ambivalence for two reasons. First, the measured concepts do not allow for a clear assignment of positive or negative valence to an attitude score (a high or low level of shyness may be interpreted as positive, negative, or neutral). Second, the authors do not report absolute values of the two measures separately, but rather include the size of differences between the two measures in their analyses. Consequently, it is not clear if the two measures produced opposing evaluations or evaluations that both speak to the same valence and merely differ in their extremity.

Similarly, several studies conducted on self-esteem have investigated the consequences of discrepancies between direct and indirect self-esteem measures (e.g., Briñol et al., 2006; Gerstenberg et al., 2013; Schröder-Abé, Rudolph, & Schütz, 2007; Zeigler-Hill, 2006). Likewise, however, one cannot infer from the reported results whether those discrepancies reflect opposing evaluations of the self. This research typically uses the degree of inconsistency as a continuous predictor of other variables, allowing for the possibility that both values lie in the upper or lower part of the measures. This is not to say that this work has no merit. To the contrary, it was well designed for investigating downstream behavioral consequences of discrepancies between direct and indirect measures. The measures it relies on are however structurally unclear as to structural ambivalence, which in any case was not the target of that research.

There are some studies, however, that did find indication of structural ambivalence between measures, in the sense of *opposed* evaluations on direct and indirect attitude measures. All of those studies assessed attitudes directly via self-reports, typically using bipolar semantic rating scales (Gregg, Seibt, & Banaji, 2006; Rydell, McConnell, Mackie, & Strain, 2006; Rydell et al., 2008; Rydell, McConnell, Strain, Claypool, & Hugenberg, 2007). Sometimes, direct measures were complemented by a feeling thermometer in which evaluations are expressed as temperature between 0°C and 100°C (Rydell et al., 2006, 2007).

The most commonly applied indirect measure in the context of structural ambivalence between measures is the IAT. For instance, Rydell and colleagues (2006) applied a single-target IAT in which target stimuli depicting a fictitious person about whom participants had received valent information earlier on had to be categorized alongside the categorization of positive and negative attribute stimuli. A similar measure was used by Gregg et al. (2006) and Rydell et al. (2006, 2007). In contrast, Rydell et al. (2008) used an affective misattribution paradigm, in which attitude objects served as primes that preceded Chinese characters. The implicit preference for an attitude object was then defined as the percentage of times the Chinese character following the critical attitude object was judged to be more pleasant than an average Chinese character. In all of these studies, opposing evaluations on direct and indirect measures were observed.

We will discuss these studies and others in more detail in Section III (i.e., Ambivalence Induction) of this review, as most studies informative on structural ambivalence between direct/indirect measures experimentally induced it.

I.2 What is Experienced Ambivalence and how is it Measured?

Another widely used approach to assessing attitudinal ambivalence rests on the assumption that attitudinal ambivalence can be experienced. This aspect of ambivalent attitudes, referred to as experienced ambivalence, does not focus on the associative structure of ambivalent attitudes, but on the perceived cognitive, affective, and behavioral consequences evoked by structural attitudinal ambivalence.

Of note, a self-report measure of experienced ambivalence may be interpreted by a participant as a measure of certainty. For instance, Berger et al. (2018) found increased experienced ambivalence ratings not only for ambivalent words, but also for neutral words. We thus strongly recommend accompanying phenomenological measures of ambivalence by a structural measure of ambivalence or to induce structural ambivalence experimentally if one wants to argue that experienced ambivalence is a consequence of a specific attitude structure.

I.2a Experienced Ambivalence on Direct Measures

Participants' degree of experienced ambivalence is generally assessed using metacognitive questionnaires (e.g., Cacioppo et al., 1997; Jamieson, 1993; Lipkus, Green, Feaganes, & Sedikides, 2001; Priester & Petty, 1996) asking for various factors such as the perceived degree of conflict, tension, or indecision. For instance, Priester and Petty (1996) had participants complete scales with the endpoints labelled "feel no conflict at all"/ "feel maximum conflict", "feel no indecision at all"/ "feel maximum indecision", and "completely one-sided reactions"/ "completely mixed reactions" as measures of cognitive, affective, and behavioral consequences of structural ambivalence.

Experienced ambivalence has been associated with various personality traits. Research revealed a positive relationship between experienced ambivalence and preference for consistency (Newby-Clark, McGregor, & Zanna, 2002), need for cognition and personal fear of invalidity (Thompson & Zanna, 1995), schizophrenia and the schizotypal disorder (Trémeau et al., 2016), while yielding a negative relationship between experienced ambivalence and dialectical thinking (Pang, Keh, Li, & Maheswaran, 2017), and mindfulness (Haddock, Foad, Windsor-Shellard, Dummel, & Adarves-Yorno, 2017). Moreover, flexible, situational influences also seem to influence experienced ambivalence such as perceived arousal (Schneider et al., 2016).

I.2b Experienced Ambivalence on Indirect Measures

Analogous to the measures introduced in the section on structural, indirect measures of experienced ambivalence infer the phenomenological experience associated with ambivalent attitude objects from systematic behavioral patterns rather than asking participants to verbalize these experiences. Petty and colleagues (2006) included measures of certainty or doubt in their research to assess the phenomenological consequences of attitudinal ambivalence. Specifically, they adapted an IAT to assess the degree to which attitude objects whose evaluation was confirmed or changed in the course of the experiment were associated with the attributes 'confidence' versus 'doubt' (see also Rydell et al., 2008). They found ambivalent attitude objects as compared to univalent attitude objects to possess stronger associations with doubt. Importantly, however, as we discussed in the Introduction, experienced ambivalence is related to, but conceptually distinct from certainty (e.g., Clarkson et al., 2008; Luttrell, Petty et al., 2016; Luttrell, Stillman et al., 2016; Olsen, 1999; Petrocelli et al., 2007).

As the experience of ambivalence is linked to feelings of negativity (Hass, Katz, Rizzo, Bailey, & Moore, 1992), tension (e.g., Monteith, 1996), or conflicts (Priester & Petty, 1996), it is possible to draw on neurophysiological correlates, which measure physiological patterns such as brain activation or muscle tension associated with those feelings. Several imaging techniques have been applied to the investigation of the affective consequences of attitudinal ambivalence. Nohlen, Van Harreveld, Rotteveel, Lelieveld, and Crone (2014) found in a functional magnetic resonance imaging study that ambivalent attitudes are linked to an activation of brain regions that are classically associated with conflicts, and increased cognitive processing and control (i.e., left temporoparietal junction and precuneus/ posterior cingulate cortex).

Nohlen, van Harreveld, Rotteveel, Barends, and Larsen (2016) conducted a facial electromyography study to test whether muscular reactions to ambivalent stimuli are per default comparable to reactions to negative stimuli or whether those reactions depend on contextual cues. In their paradigm, the authors introduced fictitious persons that were described with one positive and one negative characteristic each. Nohlen and colleagues manipulated the resolvability of the ambivalence by creating scenarios in which either two behavioral descriptions were relevant for the decision (unresolvable, e.g., “X is friendly and lazy. Would you ask his help in solving a difficult puzzle?”) or only one behavioral description was diagnostic for the decision (resolvable, e.g., “X is friendly and lazy. Would you go to the movies with X?”). The authors found that ambivalent stimuli trigger both positive and negative affective reactions depending on the need to act upon the ambivalent stimuli and the resolvability of the ambivalence. In line with direct measures that linked perceived ambivalence to heightened tension and discomfort, Maio, Greenland, Bernard, and Esses (2001) tested the assumption that experienced ambivalence is mirrored in increased arousal as assessed via skin conductance. Contrasting their expectations, however, the authors found ambivalence to be linked to a decrease in arousal rather than an increase.

On a cautionary note, even though these studies reveal interesting insights about the antecedents and consequences of attitudinal ambivalence, they do not seem to be particularly suited to reveal differences in the associative structure of ambivalent as compared to non-ambivalent attitudes.

Notably, experienced ambivalence can be observed in the absence of an ambivalent attitude structure. DeMarree, Wheeler, Briñol, and Petty (2014) found a positive relationship between experienced ambivalence ratings and discrepancies in actual and desired attitudes even though those evaluations were not of opposing valence. Likewise, Gebauer, Maio, and Pakizeh (2013) found increased experienced ambivalence ratings in the case of semantic incongruency of the attitude object’s attributes. These findings again point at the low specificity of measures of experienced ambivalence.

II. Relations between Different Ambivalence Measures

In all domains of psychological research, a core criterion to judge the ability of different measures to assess the same psychological concept and to differentiate between different concepts, respectively, is construct validity. Specifically, different measures of the seemingly same psychological concept should have high convergent validity, i.e., should correlate highly, while different measures of unrelated concepts should have high discriminant validity (e.g., Campbell & Fiske, 1959). To get indication of the degree to which different ambivalence measures capture the same psychological construct, it is thus necessary to take a closer look at the relations between these measures. It is noteworthy, however, that low correlations can further result from low (i.) structural overlaps between different measures, and (ii.) reliability of measures. For instance, IATs only possess low to moderate test-retest reliability (e.g., Banse, Seise, & Zerbes, 2001; Bluemke & Friese, 2008; Nosek, Greenwald, & Banaji, 2007), thereby attesting to considerable variance in their scores over time.

II.1 Relations between Measures of Structural Ambivalence

Relations between direct measures. All direct measures of structural ambivalence are based on separate evaluations of the positive and negative aspects of an attitude object while differing in the mathematical formula that combines these two ratings. Consequently, the range in which the respective correlation lies highly depends on the similarity between the two formulas. Breckler (1994) investigated correlations between five prominent indices of structural ambivalence and found average correlations between r = .34 and r = .98. As researchers usually calculate just one index of structural ambivalence, we do not know of further studies that investigated the relation between different direct measures of structural ambivalence.

Relations between indirect measures. To date, for reasons elaborated on in Section I.1b, we consider the evaluative priming paradigm to be the only indirect measure to adequately capture an ambivalent attitude structure while not confounding it with neutral attitudes. Consequently, we do not know of other measures that meet this requirement and can be related to evaluative priming paradigms. Further research is required to fill in this gap.

Relations between direct and indirect measures. While only a small number of studies applied indirect measures to assess structural ambivalence, an even smaller portion compared direct and indirect measures. Bargh, Chaiken, Govender, and Pratto (1992) correlated latencies regarding the categorization of targets with ratings of structural ambivalence (as computed from the separate ratings for positivity P and negativity N via (P + N) - |P – N|) provided by a second group of participants. In their research, higher indices of ambivalence on a direct measure predicted longer latencies in the evaluative priming task.

Schneider et al. (2015) reported correlations between directly measured structural ambivalence and both the trajectory of the mouse and the latency of the response, also indicating slower and more conflicted responses with higher ambivalence on direct measures. However, we saw that mouse tracking measures, although interesting, rely on direct evaluations of stimuli.

In two experiments, Berger and colleagues (2018) used evaluative priming paradigms that employed ambivalent stimuli as targets on the one hand, and as primes on the other hand in a within-participants design. They found that directly assessed structural ambivalence was positively correlated with latencies when primes were used as targets (i.e., the stronger the self-reported structural ambivalence, the slower the categorization of the target), a finding that is in line with Bargh and colleagues (1992) and Schneider and colleagues (2015). Interestingly, however, Berger and colleagues found no correlation with latencies when ambivalent stimuli were used as primes. These patterns of results were consistent across the two experiments.

In summary, at present only few studies assessed the relationship between direct and indirect measures of structural ambivalence. In addition, the integration of results is impeded by the reliance on heterogeneous methods in investigating this relation. In particular, correlations were assessed or data were split for post-hoc comparisons along a direct measure of structural ambivalence. The scarce research nevertheless suggests a parsimonious interpretation. First, direct and indirect measures of ambivalence show considerable overlap when in the indirect measure, too, participants respond to ambivalent stimuli. Second, as shown by Berger and colleagues (2018) the activation of ambivalence measured by evaluative priming tasks that employ ambivalent stimuli as primes does not indicate correlations with direct measures of ambivalence. The latter suggests that indirect measures that consider effects of ambivalent stimuli as primes may involve cognitive processes that differ from those involved in the direct evaluation of ambivalent target stimuli. Because evidence on this topic is scarce, however, we conclude that more research is needed for drawing a more comprehensive picture of structural ambivalence, as assessed with direct versus indirect measures. Needless to say, any further study interested in this relation should capitalize on insights from research dealing with moderators of direct and indirect attitude correlations (e.g., Nosek, 2005; Ranganath, Smith & Nosek, 2008).

II.2 Relations between Measures of Experienced Ambivalence

As became obvious in Section I.2, few studies have measured experienced ambivalence with indirect measures. Specifically, Petty and colleagues (2006) applied a confidence IAT as an indirect measure of experienced ambivalence and two items adapted from Priester and Petty (1996) as a measure of self-reported experienced ambivalence. Unfortunately, however, no correlation between the two measures was reported. Nohlen and colleagues (2014) reported negative correlations of $r = -.42$ (left temporal parietal junction) and $r = -.45$ (precuneus/posterior cingulate cortex) between the activation in social-cognitive brain regions and direct measures of experienced ambivalence. Of note, with direct measures being assessed *after* the evaluative tasks, the authors note that the pattern may suggest that ambivalence was successfully resolved in the course of the decision process mirrored in a decrease in brain activation in the respective brain areas.

II.3 Relations between Structural and Experienced Ambivalence

II.3a On Direct Measures

The correlation between direct measures of structural and experienced ambivalence has been reported to be of moderate strength by several research groups (e.g., Newby-Clark et al., 2002; Priester & Petty, 1996; Riketta, 2000; Thompson et al., 1995). Nevertheless, several moderators of this relationship have been identified. Potentially opposing evaluations are not necessarily perceived simultaneously and aversive, but only if the attitudinal ambivalence is particularly salient (Hass et al., 1992; Newby-Clark et al., 2002), implies negative consequences (Cooper & Fazio, 1984), threatens self-integrity (Steele, 1988), or if individuals are forced to act upon the attitude object (Van Harreveld, Rutjens, Rotteveel, Nordgren, & Van der Pligt, 2009; see also Section III.3). Of note, structural ambivalence may also be perceived positively. In situations with uncertain outcomes, for instance, structural ambivalence may prevent disappointment if a desired outcome cannot be achieved (Reich & Wheeler, 2016). Moreover, by meeting norms in controversial situations, the expression of ambivalence may be helpful to achieve or maintain a positive self-presentation (Pillaud, Cavazza, & Butera, 2013).

II.3b On Indirect Measures

We do not know of any study that has systematically compared indirect measures of structural and experienced ambivalence. Further research in this area is strongly required to gain a better understanding of the concept.

II.3c Intermixed between Direct and Indirect Measures

Experienced ambivalence on direct measures/structural ambivalence on indirect measures. In the previous section, we discussed a study by De Liver et al. (2007; Exp. 2) that considered ambivalent attitude objects as targets. In this study, participants also indicated to which degree they felt conflicted, were both positive and negative, and had conflicting thoughts about the attitude objects. The mean experienced ambivalence score derived from these ratings was used to select the three least ambivalent and the three most ambivalent stimuli per participant. A post-hoc analysis then assessed the priming effect separately for these stimulus sets. De Liver and colleagues found significant priming effects only for the most ambivalent stimuli, but not for the least ambivalent ones.

As discussed above, however, the use of ambivalent stimuli as targets required participants to directly respond to the ambivalent stimuli. In addition, the use of ambivalent target stimuli does not allow for an assessment of the simultaneous activation of both positive and negative valence. Therefore, this study provides only limited insights into the relation between direct and indirect measures of structural ambivalence.

Berger et al. (2018) found response latencies in ambivalent targets to be correlated with experienced ambivalence. In other words, the time taken to categorize an ambivalent stimulus as positive or negative was associated with the conscious experience of ambivalence it elicits. However, these effects were specific to the direct categorization of the targets.

Experienced ambivalence was not correlated with latencies when ambivalent words acted as primes. However, because ambivalent stimuli were pre-selected based on direct measures of structural and experienced ambivalence, more experimental research is needed to clarify this issue. Whether experienced ambivalence can be found when structural ambivalence is present only on an indirect measure represents an empirical question of major theoretical importance (for a discussion of dual-process models of attitudes and experienced ambivalence, see Sections III.1c and III.2, respectively).

Structural ambivalence on direct measures/experienced ambivalence on indirect measures. Maio and colleagues (2001) assessed skin conductance as a measure of ambivalence-associated arousal and structural ambivalence on direct measures. Contradicting their expectations, the authors found a negative correlation of r = -.17 between the direct and indirect measure. The authors suggest that the relation between arousal and ambivalence may be moderated by situational factors. More precisely, especially in social contexts, ambivalence may constitute a more balanced and less extreme attitude, which is more socially accepted. Nohlen and colleagues (2016) used an EMG to assess the activation of facial muscles that are linked to the experience of positive (zygomaticus) and negative (corrugator) affect, respectively, when participants were either merely exposed to univalent or ambivalent information about fictitious persons, or when they had to make choice regarding those persons. Although the authors separately assessed ratings for positivity and negativity associated with the fictitious persons and calculated an index of structural ambivalence (Thompson et al., 1995), no correlations between the direct and indirect measures were reported.

Structural ambivalence between direct/indirect measures and experienced ambivalence on direct or indirect measures. Although structural ambivalence between direct/indirect measures is generally not assumed to be associated with experienced ambivalence, some dual-process models of attitudes allow for this possibility (but see our critical discussion of these models and their interpretation in the General Discussion). In their systems of evaluation model (SEM), Rydell and McConnell (2006) postulate that different types of information are processed by relatively independent learning systems, potentially leading to diverging attitudinal representations regarding the same attitude object. While they assume that only information from the rule-based system is available for deliberate consideration, they allow for the possibility that the output of the associative system can be experienced (McConnell & Rydell, 2014). Thus, both attitudes might be simultaneously accessed and so perceived as conflicting. As a consequence, ambivalence may be experienced.

Rydell and colleagues (2008) investigated the affective consequences of ambivalence between direct/indirect measures in two different ways. First, they assessed the degree to which participants felt uncomfortable, uneasy, and bothered with regard to the attitude object. Second, they assessed associated feelings of doubt and confidence, respectively, with a confidence IAT. Supporting the SEM, they found both measures to increase with increasing degrees of ambivalence between direct/indirect measures. However, as also acknowledged by these authors, while the two concepts measured here are to some extend related to the notion of experienced ambivalence, they did not perfectly cover it.

In an unpublished manuscript, Smith and Nosek (2012) investigated the relation between ambivalence between direct/indirect measures and different direct measures of attitudinal ambivalence. They assessed structural ambivalence on direct measures, gut-actual discrepancy (as realized via separate ratings for “gut reactions” and “actual feelings” on a scale ranging from “very negative” to “very positive”), affective-cognitive discrepancy (as realized via separate ratings for “feelings and emotions” and “thoughts and beliefs” on a scale ranging from “very negative” to “very positive”), and experienced ambivalence. In four studies, they found no relation between ambivalence between direct/indirect measures and any of these structural and experiential measures.

Further research to investigate the relationship between structural ambivalence between direct/indirect measures, and experienced ambivalence is certainly required to gain a clearer understanding of their association. We elaborate further on this relation in the General Discussion.

III. Ambivalence Induction

Besides issues emerging from the conceptualization and measurement of attitudinal ambivalence, three delicate characteristics of the correlational approach should be discussed. First, the mere measurement as compared to the induction of attitudinal ambivalence does not allow for inferences regarding the causal direction of the relationship between variables. For instance, imagine one measured the degree of structural ambivalence towards alcohol and the processing depth of an informative text on the health consequences of alcohol consumption. A possible finding is that the higher the participants' degree of structural ambivalence in the attitude toward alcohol, the deeper they process the text. From this finding, however, we cannot tell whether higher degrees of ambivalence cause deeper processing or whether the contrary is true, namely a more thorough processing style generates structurally ambivalent attitudes.

Second, when using a correlational approach one lacks control over core determinants of the concept of interest. In contrast to the experimental approach, the correlational approach does not allow for the precise manipulation of determinants like the amount, valence, presentation time, or number of repetitions of attitude-relevant information. This lack of control over the concept of interest not only prevents a systematic investigation of the concept, it also threatens meaningful replications.

Third, attitude induction may also have a higher epistemic value as compared to mere measurement because designing induction methods requires the researcher to develop a strong theory about the determinants of a given phenomenon. The importance of this point should not be taken lightly. As will be discussed below, it remains theoretically unclear how and why some forms of structural ambivalence between direct/indirect measures may be elicited.

For these reasons, ambivalence research should – just like any other field of psychological research – rely on experimental designs whenever possible. Critically, experimental designs manipulate variables of interest rather than merely measuring them. It is thus possible to investigate changes in psychological concepts *as a function* of systematic experimental variations, thereby resulting in more extensive insights regarding the concept.

III.1 Induction of Structural Ambivalence

III.1a Inducing Structural Ambivalence within Direct Measures

Theoretical assumptions. The induction of structural ambivalence of whatever form (i.e., direct or indirect) implies the creation of a unique attitude link to both positive and negative associations. Induction of structural ambivalence on direct measures is probably the most straightforward case. All attitude models would allow for the acquisition of evaluations of opposite valence about an attitude object that are reportable (e.g., Chaiken, 1980; Fishbein, 1963; Kruglanski & Thompson, 1999; Petty & Cacioppo, 1986). This may for instance be the case when an individual knows she enjoys smoking, yet is aware of the negative impact of smoking on her health.

Experimental induction. Several attempts have been undertaken to induce structural ambivalence on direct measures, most of which included the presentation of contradicting evaluative information concerning an attitude object. Priester and Petty (1996) presented participants with both positive and negative traits describing a hypothetical person and observed increasing structural and experienced ambivalence ratings with an increasing number of conflicting traits. Likewise, in persuasion research, ambivalence is classically induced by providing participants with a two-sided (as compared to one-sided) message about an attitude object (e.g., Clarkson et al., 2008; Jonas et al., 1997; Van Harreveld, Rutjens et al., 2009).

Next to typical persuasion paradigms, structural ambivalence may also be induced by an evaluative conditioning (EC) paradigm. Evaluative conditioning (EC) refers to a change in the liking of a stimulus (CS) due to its repeated pairing with a valent stimulus (US; De Houwer, Thomas, & Baeyens, 2001). In comparison to classic persuasion paradigms, conditioning paradigms are characterized by a more subtle communication concerning the study purpose and task instructions. This property is not only beneficial with regard to demand effects (e.g., Greenwald & Banaji, 1995; Nisbett & Wilson, 1977), but also allows investigating the automaticity of attitude acquisition (e.g., Hütter & Sweldens, in press; Corneille & Stahl, in press). Another advantage of conditioning paradigms is that they allow for a more systematic control and manipulation of relevant parameters such as the amount and intensity of information, presentation time, and the number of repetitions.

Glaser, Woud, Iskander, Schmalenstroth, & Vo (2018) successfully induced ambivalence in neutral polygons (CSs) by pairing them with mixed-valence USs that consisted of a positive and a negative picture that were combined into one compound. Specifically, they found positivity and negativity ratings significantly different from zero for CSs that were paired with mixed-valence USs. Petty et al. (2006) designed a study that involved the induction of structural ambivalence using an EC paradigm, in which two conditioned stimuli (CSs) were repeatedly paired with positive or negative images (unconditioned stimuli, USs). Those evaluations were then either confirmed or changed by a similarity induction. In the attitude-confirmed condition, participants learned that the positive (negative) CS is similar (dissimilar) to them. In the attitude-changed condition, these assignments were reversed. Unexpectedly, this procedure did not have an effect on structural ambivalence on a direct measure. Nevertheless, Petty and colleagues found some indirect indication of ambivalence, such as stronger associations with doubt in a confidence IAT and deeper information processing for ambivalent material as compared to non-ambivalent material.

Berger and Hütter (2018) also tried to induce structural ambivalence via an EC procedure. The authors reasoned that structural ambivalence may be created by pairing an initially neutral CS with both positive and negative US images. While some CSs were paired with neutral images, other were paired with both positive and negative images. In a subsequent conditioning phase, CSs were paired with either only positive or only negative images. Neither structural ambivalence nor experienced ambivalence assessed after the initial conditioning phase differed between ambivalent and neutral CSs, indicating that the induction was not successful. However, Berger and Hütter observed significantly better memory for the CS-US pairs presented in the second phase in CSs from the ambivalent rather than the neutral condition. This finding suggests a deeper processing of ambivalent information while lacking indication for structural ambivalence on direct measures.

There are at least two conclusions that may be drawn from these studies. First, inducing ambivalence on direct measures using conditioning procedures is more difficult than one may think. Second, efficient EC procedures for inducing ambivalence may strongly depend on the method used. The reason for this may be found in the nature of the EC procedure. Participants are not presented with arguments that they have to weigh in order to derive their attitude, but are rather presented with affective experiences that are either pleasant or unpleasant (even though some theories regard them as minimal arguments; Kruglanski & Thompson, 1999). It is unclear (a) whether these affective experiences are stored as separate associations in memory (cf. McConnell & Rydell, 2014) and (b) providing such discrete associations exist, whether they can be detected with measures that require the deliberate weighting of information (cf. Berger et al., 2018). Participants may actually register the conditional probability of positive and negative events given a specific CS (i.e., metaphorically speaking, participants may keep a counter of positive encounters divided by all occurrences of this stimulus) and this stored conditional probability may be used as an index of uncertainty that guides future information processing, thereby eliciting the well-known consequences of attitudinal ambivalence.

III.1b Inducing Structural Ambivalence within Indirect Measures

Theoretical assumptions. To the degree that indirect measures reflect the same underlying cognitions, feelings, and behavioral reactions as direct measures, we should observe structural ambivalence also on indirect measures. Previous research has demonstrated effects of propositional information on indirect attitude scores (e.g., De Houwer, 2006a; Kurdi & Banaji, 2017). Alternatively, to the degree that these measures access different memory contents, we need to turn to theories of the origin of the memory content that is reflected in indirect measures.

Whether current attitude models allow for structural ambivalence on these measures is not entirely clear. On the one hand, dual-attitude models allow for the creation of both positive and negative evaluative links with an attitude object (e.g., Gawronski & Bodenhausen, 2014;

Rydell & McConnell, 2006). On the other hand, however, these models generally conceptualize attitudes as evaluative summaries, such that ambivalence may be lost in the process (e.g., Fazio, 2007; for a discussion, see e.g., McConnell & Rydell, 2014). Applying various manipulations such as mere exposure, persuasion, or conditioning procedures, many studies successfully altered indirect attitude measures in a univalent direction (e.g., De Houwer, 2006b; Van Dessel, Mertens, Smith, & De Houwer, 2017; Olson & Fazio, 2001). Furthermore, structural ambivalence is found on indirect attitude measures (Berger et al., 2018). It is thus conceivable that an induction of structural ambivalence on indirect measures is feasible. However, both further theorizing and empirical research are required to gain a better understanding of the induction of structural ambivalence on indirect measures.

Experimental induction. We know of only one study attempting to induce structural ambivalence on an indirect measure. Petty and colleagues (2006) found evidence of structural ambivalence in an evaluative priming paradigm following an attitude change manipulation. As discussed in Section I.1b, however, that study relied on a problematic SOA and involved no neutral baseline. Hence, more research is certainly needed to understand how induction methods affect the memory content reflected in indirect measures (assuming this memory content differs from that reflected on direct measures).

III.1c Inducing Structural Ambivalence between Direct and Indirect Measures

Theoretical assumptions. Models that can be drawn on to explain the origins of structural ambivalence between direct/indirect measures can be assigned to the contemporary dual-attitude models or to models usually associated with them. Accounts like the associative-propositional evaluation model (APE model; Gawronski & Bodenhausen, 2006), the dual-attitudes model (Wilson, Lindsey, & Schooler, 2000), the metacognitive model (MCM; Petty & Briñol, 2006, 2009; Petty et al., 2007), the systems of evaluation model (SEM; Rydell & McConnell, 2006), and the motivation and opportunity as determinants model (MODE model; Fazio, 1995, 2007; Fazio & Olson, 2003), distinguish between spontaneously reported attitudes and attitudes that are reported after some degree of deliberation. This distinction is generally mapped on indirect and direct measures. Depending on the specific model, ambivalence between direct/indirect measures can arise from three different processes.

First, as suggested by the SEM and the APE, different learning pathways, in which information handled by different processes (APE model) or learning systems (SEM) may translate into diverging implicit and explicit evaluative reactions. It is thus assumed that implicit and explicit evaluations may form in parallel. As one of the most radical dual-process models, the SEM (e.g., Rydell & McConnell, 2006) assumes that direct and indirect evaluations preferably stem from dual-learning systems and are represented separately. According to the SEM, the formation of implicit attitudes (as measured by indirect measures) is prone to the automatic registration of mere associations, while explicit attitudes (as measured by direct measures) are based on symbolic forms of information that are governed by rules such as verbal or mathematical information (e.g., Johnson et al., 2017; Rydell et al., 2006, 2007). Consequently, explicit and implicit evaluations are thought to occasionally dissociate: people may simultaneously form evaluations of opposite valence at two different attitudinal levels.

Second, an attitude may be acquired that is subsequently changed, and direct versus indirect measures may differently capture the “old” attitude and its more recent change. The dual-attitudes model (Wilson et al., 2000) assumes that attitude change does not replace the old attitude, but the new attitude comes to exist next to the old attitude. The dual-attitudes model introduced the notion of *overriding*. That is, the new attitude will be reported on direct measures, overriding the influence of the old attitude. Overriding is an effortful process that consists in a deliberate application of valid propositions when one is aware of the implicit attitude. Due to the deliberate nature of this overriding process, the new attitude will be reflected in direct attitude measures, only if both motivation and resources to exert cognitive control are high. Conversely, the old attitude can be reflected in indirect measures that limit participants’ control over their response. Interestingly, the authors also argue that overriding may occur in an automatic fashion as long as individuals have the capacity to retrieve the new attitude. It may then be the case that individuals do not even experience their old attitude, so that no conflict is triggered in the first place and direct and indirect measures converge in the attitude that is assessed.

Relatedly, Petty (2006) proposed in the PAST model ("past attitudes still there") that attitude change does not result in an extinction of old attitudes due to an overwriting with new ones, but in a mere extension of the associative structure. Consequently, attitude change may not lead to feelings of ambivalence, because the post-change attitude is considered valid. However, the pre-change attitude is invalidated, because it is outdated, resulting in opposing univalent evaluations between direct/indirect measures. This view was later expanded in the MCM (e.g., Petty 2006; Petty & Briñol, 2006, 2009), which assumes that evaluations are equipped with a meta-cognitive validity tag that marks them as either correct or incorrect. All evaluations are equipped with such a tag, independent of whether they are associative or propositional in nature, but the tag is always propositional in nature. Thus, opposing evaluations may not produce feelings of ambivalence, if one of the evaluations is marked incorrect. It may be the case, however, that under time pressure or cognitive restraints only the associative response - and not the propositional validity tag - is retrieved, thereby potentially resulting in opposite evaluations on direct and indirect measures.

Third, as proposed for instance by the APE, a unique attitude may be represented in memory that results in different outcomes on indirect and direct measures, because of different processes operating only at expression. In the APE model, Gawronski and Bodenhausen (2006) suggest that the encounter of attitude objects automatically activates affective reactions, while propositional information may produce "syllogistic inferences" (p. 694). In this model, the degree of cognitive elaboration determines how many propositions are considered in addition to the automatically activated associations. Attitudes assessed with direct and indirect measures may diverge and result in discrepancies that are not perceived as conflicting due to the implicit nature of the associative reactions.

Also focusing on the expression stage, the MODE model (Fazio, 1995, 2007; Fazio & Olson, 2003) is a model that was developed to explain relationships between attitudes and judgment and behavior. This model focuses on motivation and opportunity to monitor and override automatically activated attitudes by a deliberate reflection process. If motivation and opportunity (i.e., time and resources) are not available at a certain point in time, judgments and behavior will be based on spontaneously activated attitudes. Thus, in this model the degree of deliberation determines whether or not automatically activated attitudes can be suppressed in judgment and behavior. As the MODE model assumes that the automatic activation of attitudes may operate in the absence of any awareness of its activation or influence on judgment and behavior, discrepancies between direct and indirect measures may not be experienced.

Both the APE and the MODE models predict that the degree of deliberation is an important determinant of whether or not implicit attitudes are visible in attitude measures. This perspective is in line with the observation that direct and indirect measures tend to converge when a spontaneous judgment is produced in a direct evaluative task, either by instructing participants to report their gut feelings or by requesting a judgment under time pressure (Ranganath et al., 2008). These findings emphasize that the use of direct or indirect measures does not necessarily speak to the explicitness or implicitness of the attitudes assessed and suggests that even direct measures that request participants' rating of an attitude object can be devised in a way that more spontaneous attitudes are assessed. This research challenges the mapping of implicit attitudes on indirect measures and explicit attitudes on direct measures as discussed at the outset of this review.

Experimental induction. Any study inducing univalent attitudes of opposite valences on direct and indirect measures would qualify as an experiment successfully inducing structural ambivalence between direct/indirect measures. Of those, some were targeted at creating ambivalence between direct/indirect measures, while others were not. We illustrate here both lines of evidence.

Relying on the radical SEM model of dual-attitude learning, Rydell and colleagues (2006, 2007) used an EC paradigm to create structural ambivalence. They paired an attitude object with behavioral descriptors that were presented long enough to be clearly visible. Additionally, the attitude object was paired with words of opposite valence presented under suboptimal (i.e., presumably subliminal) conditions. Structural ambivalence became apparent in a discrepancy between direct and indirect measures: Whereas participants' self-reported attitudes matched the valence of the verbally presented information, the IAT score matched the valence of the subliminally presented words. This general pattern was further replicated in two studies with modifications regarding both the induction and indirect measurement of attitudes. Rydell and colleagues (2008) obtained the same divergence in direct and indirect attitude measures when (presumably) applying parafoveal subliminal priming to induce attitudes, and an affective misattribution paradigm to indirectly measure them. It is unclear, however, whether the effect is as robust as originally assumed. A recent registered replication of the research reported by Rydell et al. (2006) failed to support the notion of opposing univalent evaluations on direct and indirect measures, respectively, in two studies. Instead, the IAT pattern was consistently in line with the verbally presented explicit information (Heycke, Gehrmann, Haaf, & Stahl, in press). Finally, the studies by Rydell and colleagues raise a number of questions at both the methodological and theoretical levels (for a discussion, see Corneille & Stahl, in press).

Other studies, this time not connected to attitudinal ambivalence and using evaluative conditioning paradigms to test assumptions of dual-process models of attitude acquisition and change, compared the impact of associations versus relational information on direct and indirect measures. Some of these procedures observed evaluative dissociations on direct and indirect measures (i.e., studies obtaining a neutral evaluation on one measure were not included in this review). For instance, Moran and Bar-Anan (2013) had CSs either starting or stopping a pleasant or an unpleasant US. Stopping a stimulus has valence implications for the CS that are opposite to the US valence presented (e.g., a CS that removes a likeable stimulus is negative). Moran and Bar-Anan observed this reversal only on direct measures, but not on indirect ones. Hence, they observed structural ambivalence between direct/indirect measures in the stopping condition.

Hu, Gawronski, and Balas (2017a) conducted a similar study in which they informed participants that the CS either caused or prevented the US. Hu et al. (2017a) sometimes found a pattern of structural ambivalence between measures in the “prevent” condition, but only if the relational qualifier referred to all pairings and was provided before the conditioning phase.

When relational qualifiers varied between CSs and were presented only at onset of the CS-US pair, they moderated evaluations on both direct and indirect measures. The findings of structural ambivalence between measures can thus be explained by direct and indirect measures being differentially sensitive to rules encoded prior to the learning phase, rather than assuming that the different measures reflect qualitatively different learning processes (see Hu et al., 2017a, for further discussion of this issue).

Structural ambivalence between measures may also be induced by altering a univalent attitude. Within the EC paradigm, counterconditioning instructions have been shown to have this effect (Hu, Gawronski, & Balas, 2017b). After an initial conditioning phase, participants were given instructions that the CSs would be paired with USs of the opposite valence. While actual pairings reversed EC effects on both a self-report and an evaluative priming measure, counterconditioning instructions reversed the effects only on the direct, but not on the indirect measure, creating a state of structural ambivalence between the measures in this condition.

Gregg et al. (2006) conducted four experiments in which they investigated how directly and indirectly measured attitudes can be formed (Studies 1 and 2) and changed (Studies 3 and 4). In Studies 3 and 4, univalent attitudes were first induced via a sequential combination of a narrative information presentation and a supraliminal priming procedure. They were later either changed with supposed (Study 3) or actual (Study 4) counterattitudinal information, or left unchanged (control group). In detail, half of the participants in Study 3 were led to believe that the valent information they had received about the two attitude groups were accidentally interchanged due to a programming error. In Study 4, half of the participants received plausible opposing new information. Interestingly, both Studies 3 and 4 revealed that in contrast to evaluative ratings, IAT scores did not change as a function of counterattitudinal information, indicating a state of structural ambivalence between direct/indirect measures in the attitude change condition.

Gawronski and Strack (2004) applied an induced compliance paradigm to assess the effects of cognitive dissonance on evaluations on direct and indirect measures. Their participants were instructed to write a counterattitudinal essay, which led to attitude changes on the direct measure in the counterattitudinal direction, while the outcome of the indirect measure, an IAT, remained unaffected. Consequently, even though this research was not targeted at investigating ambivalence, a pattern of structural ambivalence between measures was induced using this paradigm.

As can be seen, two types of research strategies induced structural ambivalence between measures, which relate to different theoretical views on the acquisition of attitudinal ambivalence and of its representation in long-term memory. One strategy is aimed at creating from scratch two evaluations through different learning and expression routes, which is in line with dual-attitudes models such as the SEM (Rydell & McConnell, 2006) and the APE model (Gawronski & Bodenhausen, 2006). Another relied on a strategy of altering univalent attitudes by using a single re-learning procedure, which is in line with the assumptions made in the MCM (Petty 2006; Petty & Briñol, 2006, 2009).

III.2 Induction of Experienced Ambivalence

III.2a Inducing Experienced Ambivalence on Direct Measures

Theoretical assumptions. In contrast to the induction of structural ambivalence within and between direct and indirect measures, the induction of experienced ambivalence does not focus on the alteration of an underlying cognitive structure, but on increasing the phenomenological experience of ambivalence. At the same time, these two aspects of attitudes cannot be considered independent (see Section II.3). Consequently, while many researchers assume that experienced ambivalence can be induced by inducing ambivalent cognitions, others have theorized that self-reported experienced ambivalence may also be generated by incidental states that are independent of altering the underlying attitudinal structure. For instance, studies on embodiment have shown that feelings of ambivalence may be triggered through motor behaviors such as side-to-side movements (e.g., Schneider et al., 2013).

An interesting question is whether structural ambivalence has the same potential to be experienced when assessed on a direct versus indirect measure. If one assumes that both of these measures assess consciously accessible attitudes, they should not differ in this phenomenological aspect. In contrast, if one assumes that indirect measures preferably assess implicit attitudes, one may draw on dual-process models of attitudes to derive predictions. We summarize these considerations in Figure 1, by referring to the reportability of an ambivalent or bivalent attitude structure as a necessary condition for experiencing ambivalence. We further elaborate on this question in the General Discussion.

Experimental induction. Many researchers have successfully induced experienced ambivalence by inducing an ambivalent attitude structure. For instance, Van Harreveld, Rutjens et al. (2009) induced experienced ambivalence by presenting participants with two-sided (rather than one-sided) messages about an attitude object. Nohlen et al. (2016) successfully found increased experienced ambivalence ratings when male names were presented with a positive and a negative character trait as compared to when male names were presented with two character traits of the same valence. Likewise, Priester and Petty (1996) induced self-reported experienced ambivalence by systematically manipulating the number of conflicting pieces of information about a hypothetical person. They presented participants with zero to seven positive and zero to seven negative pieces of information. This factor was manipulated orthogonally, so that participants could receive no information, univalent profiles, or ambivalent profiles with different degrees of conflict (i.e., one piece of information of one valence and seven of the other valence vs. seven pieces of information from both valences). Interestingly, when participants received only one conflicting piece of information, only the amount of information predicted experienced ambivalence in a negative way (i.e., the more information participants had, the less ambivalent they felt). However, when the number of conflicting pieces exceeded one, only the number of conflicting pieces determined the phenomenological experience of ambivalence (see also Section II.1).

Glaser and colleagues (2018) applied an evaluative conditioning paradigm in which neutral polygons were paired with mixed-valence USs, which consisted of a positive and a negative picture each, whose transition was blended. Beside increased positivity and negativity ratings for CSs that were paired with ambivalent USs, the authors further found those CSs to be higher on self-reported experienced ambivalence as compared to univalent and neutral CSs.

Schneider and colleagues (2013) also tried to manipulate experienced ambivalence both by changing the attitudinal structure and by creating an incidental state. First, these authors created a newspaper article that either discussed exclusively positive arguments regarding an attitude object or provided two-sided communication. The authors found increased experienced ambivalence ratings in the case of the article that discussed pro and contra arguments. In a second study, Schneider and colleagues found increased experienced ambivalence ratings after participants had to move from side to side while filling in a questionnaire about a self-generated ambivalent topic as compared to participants who were instructed to move up and down, or stand still while filling in the questionnaire.

III.2b Inducing Experienced Ambivalence on Indirect Measures

Theoretical assumptions. Experienced ambivalence is characterized by the perception of negative affect, conflict, or discomfort. While these experiences may translate to corresponding indirect attitude measures, one should keep in mind that they do not necessarily stem from an ambivalent attitude structure, but may further result from various antecedents such as semantic conflicts (e.g., Gebauer et al., 2013) or low integrativity (Estes & Jones, 2009). In order to be certain that negativity or conflicts reflected on indirect measures can be traced back to experienced ambivalence, it is necessary to create an ambivalent attitude structure, i.e., associations with both positivity and negativity. Of note, Section III.3 discusses potential moderators affecting the success of such induction attempts.

Experimental induction. Petty and colleagues (2006) induced univalent positive or negative attitudes via evaluative conditioning, and either reinforced or changed that attitude with a subsequent similarity manipulation. Ambivalence was expected in stimuli that were paired positively (negatively) in the conditioning phase and described as being dissimilar (similar) to the participants. Notably, while ambivalent und univalent stimuli did not differ on direct measures of confidence, participants did show decreased associations with confidence for ambivalent stimuli on a confidence IAT. Rydell and colleagues (2008), too, applied an adapted IAT linking attitude objects to feelings of confidence and doubt, respectively, as a self-report independent measure of experienced ambivalence. In their design, they provided valent information related to human faces with subliminal masked primes that were presented parafoveally on the one hand, and supraliminal verbal descriptions on the other hand. Those two types of information either matched or mismatched in valence thereby creating univalent or ambivalent attitudes toward the faces. In line with the pattern obtained by Petty and colleagues (2006), the authors found increased associations with doubt for ambivalent faces as compared to univalent faces.

Nohlen and colleagues (2016) presented human faces together with two character traits that either matched or diverged in valence, thereby creating univalent or ambivalent attitudes toward those faces. They subsequently measured muscle activation in two facial muscles that are associated with positive and negative affect, respectively. The authors further manipulated (i.) whether the participants merely watched the stimuli or whether they had to make dichotomous choices on the attitude persons, and (ii.) whether ambivalence constituted a conflict or whether it was resolvable in that specific decision context. While they did not find different activation patterns in univalent and ambivalent stimuli if participants were merely exposed to the stimuli, they did find increased activation that is indicative of negative affect for ambivalent faces as soon as participants had to make dichotomous decisions on the stimuli – and even stronger activation if the ambivalence was unresolvable in the specific context.

III.3 Moderators of Attitudinal Ambivalence Acquisition

In the review of the induction methods and results, we have seen that it is sometimes difficult to experimentally induce structural ambivalence on direct measures. While some authors report a successful manipulation on direct measures, others did not find differences between ambivalent and non-ambivalent material on direct measures, but only ambivalence-like behaviors. It is thus worthwhile to reflect on potential boundary conditions of inducing ambivalence.

Regarding the induction of experienced ambivalence, not only the number of conflicting cognitions, as Priester and Petty (1996) have shown, seems to matter. Newby-Clark and colleagues (2002) found a positive relationship between the salience of inconsistency of the attitude structure (i.e., assessed as the latency with which both positive and negative evaluations can be reported) and felt ambivalence. Consequently, stronger feelings of tension should arise with increased salience of inconsistencies in cognitions.

Van Harreveld, Rutjens et al. (2009) demonstrated that structural ambivalence does only have negative affective consequences, when individuals are forced to take a side. They provided participants with either univalent or ambivalent messages about an attitude object and either assigned participants to a specific side for an essay or asked them to choose whether they wanted to argue in favor or disfavor of the attitude object. Indicators of discomfort (self-reported, but also skin-conductance levels) were most pronounced in the condition in which participants received two-sided communication and had to choose one of the sides for their essays.

Moreover, Nohlen and colleagues (2016) found that ambivalence is only perceived negatively if its conflicting evaluations are not *resolvable*. Thus, if for the task at hand only one evaluation is relevant (e.g., “X is unathletic and intelligent. Do you want to work with X on a group project?”), no ambivalence is perceived, because the focus merely lies on one of the evaluative aspects. Unsurprisingly, this suggests that structural ambivalence may be induced most successfully when the opposing evaluations are not easily resolvable.

A discussion of these factors—salience of conflict and resolvability— may supplement our discussion of the discrepancies observed between EC procedures and classical persuasion paradigms (i.e., presenting characteristics of an attitude object). Recall that so far EC paradigms have not been successful at inducing structural and experienced ambivalence on direct measures. The CSs are usually paired with randomly selected valent pictures (e.g., landscapes, animals, social situations) that do not have an obvious relation to the CSs. If stimulus pairs are not meaningfully linked to another and therefore, do not result in psychologically salient evaluative conflicts, participants may not feel ambivalent about the CSs. If so, increasing stimulus specificity in EC paradigms, for instance by working with a more CS-specific US selection or by including relational qualifiers in the pairings, such that “the CS likes the US” or “the CS dislikes the US” (see for instance Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2012), may be more successful in inducing structural and experienced ambivalence on direct measures. The subtlety of the standard EC paradigm, on the other hand, also constitutes a valuable advantage, namely the very nature of the paradigm produces little suspicion or reactance with regard to the attitude formation process while creating robust evaluative effects and affecting the associative structure of attitudes as assessed with indirect measures (e.g., Hu et al., 2017a, b).

The present analysis suggests that a number of aspects need to be addressed in further research in order to reach a more comprehensive understanding of the induction of attitudinal ambivalence. First, in order to develop paradigms that allow for a successful induction, it is essential to reflect on similarities and differences of existing paradigms to advance our understanding of the critical determinants of a successful induction. At the same time, induction paradigms should be based on theoretical considerations to allow for tests of theories. Currently, however, none of the influencing factors discussed above (i.e., salience, resolvability) is constituent of theories of attitudinal ambivalence.

General Discussion

In order to prevent elusive conclusions and to increase both validity and comparability, the bases of every psychological concept should be precisely defined and agreed upon. The present contribution is aimed at paving the way for such a common understanding of attitudinal ambivalence by providing a comprehensive review on definitions, measurements, and induction of this overarching construct. Below, we provide a short summary of the main points raised in this review. We then discuss the theoretical and methodological implications, as well as the limitations of the present review. In doing so, we regularly point at avenues for future research.

State of the Art of Ambivalence Research

The definition of ambivalence. In reviewing the common definitions of attitudinal ambivalence constructs, we introduced a new terminology referring to unitary constructs (e.g., structural ambivalence within vs. between direct and indirect measures) rather than conserving the current conceptual ambiguities in the ambivalence literature. As discussed above, these conceptual imprecisions impede the emergence of a coordinated investigation of attitudinal ambivalence. Of importance, we refrain from defining ambivalence phenomena by automaticity standards, which are often subsumed under the terms “explicit” versus “implicit”. Instead, we proposed to adopt a measurement-based approach to attitudinal ambivalence. We proposed a new taxonomy that proved helpful not only in organizing previous research efforts, but also in identifying new insights and in generating open questions for future research regarding the measurement and induction of attitudinal ambivalence, as elaborated on below.

It is noteworthy that in several subdomains of attitudinal ambivalence research, we found that cognitive or behavioral conflict emerges from structural ambivalence only when individuals have to categorize ambivalent stimuli along a positive-negative dimension. An evaluative conflict arises only when participants are requested to take a clear stance on an attitudinal topic (Van Harreveld, Rutjens et al., 2009), when they have to categorize targets as positive or negative that follow an ambivalent prime in an evaluative priming task, or when they have to categorize an ambivalent target stimulus as such (Berger et al., 2018).

As a consequence, we suggest that evaluative conflict, tension, or indecision should not constitute a defining element of structural ambivalence. Clearly, an attribute cannot be a definitional part of a construct and a potential consequence of it. This point is potentially problematic when using indirect measurement paradigms for assessing structural ambivalence. For instance, in Berger et al. (2018) structural ambivalence was evidenced by the existence of a response conflict in the evaluative priming task. The same attitude objects did not slow down response latencies anymore when positive/negative categorizations were replaced by valent/neutral categorizations. Hence, the structural properties of an attitude object held perfectly constant, the task at hand influenced whether this structure created a conflict or not. Just because the categorization task removed the conflict does not mean that the structural properties of the attitude had changed. It may be noted, however, that in this particular case, ambivalent materials were selected based on direct ratings, such that the authors had external evidence for the existence of structural ambivalence.

Of further importance, the fact that in some indirect measurement paradigms structural ambivalence becomes apparent only in the form of an evaluative conflict (i.e., in the evaluative priming paradigm implemented by Berger et al., 2018) does not imply that conflict is the single or standard operational definition of structural ambivalence in indirect measurement. It may very well be the case that in other indirect measurement procedures response facilitation is observed. In other words, while operational definitions must rely on the behavioral consequences of structural ambivalence in indirect measures, these consequences may vary independently from the structural definition of the concept itself across different measurement types. The theoretical and operational levels of definition of attitudinal ambivalence should not be fused.

The measurement of ambivalence. Our review made apparent that while direct measures of structural ambivalence are well established, we have only started developing indirect measures of this important construct. As illustrated, of the possibilities for structural ambivalence between direct and indirect measures are manifold. The difficulty in this specific type of structural ambivalence is rather that the researcher has many degrees of freedom in combining different direct measures with different indirect measures. The measurement of structural ambivalence between direct/indirect measures will co-evolve with our understanding of indirect measures (for comprehensive discussions, see Gawronski & De Houwer, 2014; Gawronski, LeBel, & Peters, 2007).

Due to its phenomenological nature, experienced ambivalence has largely been assessed using direct measurement, having participants report about their cognitions, feelings, and behavioral tendencies resulting from structural ambivalence. Few attempts have been made to assess experienced ambivalence without relying on self-reports. Notable exceptions are the confidence IAT applied by Petty and colleagues (2006) and Rydell and colleagues (2008), and neurophysiological studies (Maio et al., 2001; Nohlen et al., 2014; Nohlen et al., 2016). While we discussed the conceptual limitations of measuring uncertainty in this domain, this IAT is an intriguing measure, especially in combination with the experimental induction of ambivalence.

The induction of ambivalence. In our review, we combined literature from different fields. Specifically, we related basic and applied fields and integrated findings from the evaluative learning literature relevant to ambivalence phenomena. From the research overview, the picture emerged that there is a general scarcity of research that tries to gain experimental control over structural ambivalence within or between direct and indirect measures, rather than merely selecting ambivalent stimuli. We discussed the many shortcomings of this purely correlational account and want to encourage more experimental work in this important research topic.

In line with the lack of indirect measurement, we did not find a single study inducing structural ambivalence on an indirect measure. Regarding the induction of structural ambivalence on direct measures, we found successful induction via classical persuasion paradigms that inform participants about positive and negative characteristics of an attitude object. A few studies attempted to induce structural ambivalence using EC procedures, but failed to find indication of structural ambivalence on direct measures. The comparison of these two types of paradigms on a theoretical and empirical level seems promising for gaining a clearer understanding of these induction methods on the one hand and structural ambivalence as assessed with direct and indirect measures on the other hand.

Relations between ambivalence constructs. Mirroring the lack of research on indirect measures, we know of no study that investigated relations within different indirect measures of structural ambivalence, as well as different indirect measures of experienced ambivalence. Moreover, except for a set of unpublished studies (Smith & Nosek, 2012), no research exists that investigated the relation of measures of structural ambivalence within measures, and between direct/indirect measures, respectively. Finally, the relationships of indirectly assessed structural ambivalence within measures (but see Berger et al., 2018) and structural ambivalence between measures (but see Rydell et al., 2008) to experienced ambivalence is also under-researched. It is currently unclear whether evaluative inconsistencies on indirect measures lead to similar phenomenological, cognitive, and behavioral consequences as structural ambivalence as assessed with direct measures (see also below).

Theoretical Implications

From the comprehensive assessment of existing research on attitudinal ambivalence, we gained interesting insights relevant to current theorizing on attitudinal ambivalence.

Dual-process models of attitudes. The investigation of structural ambivalence between direct/indirect measures and its constituting conditions allows shedding light on the validity of dual-attitudes models. Some classes of dual-process models received more support than others. For instance, the notion that structural ambivalence between direct/indirect measures arises from dual-learning systems (e.g., Rydell et al., 2006, 2008) awaits stronger empirical validation (e.g., Corneille & Stahl, in press; Heycke et al., in press). In contrast, dual-process theories that conceptualize attitude acquisition and attitude change as the sources of indirectly and directly measured attitudes, such as the dual-attitudes model (Wilson et al., 2000) and the MCM (Petty 2006; Petty & Briñol, 2006, 2009) received comparably more support. Several research groups induced opposing evaluations between direct and indirect measures by applying attitude change procedures (Gregg et al., 2006; Hu et al., 2017b; Strack & Deutsch, 2004). We assume that relational qualifiers that have been applied to EC procedures serve a similar function, with the CS-US pair being assessed first and then validated or invalidated according to instructions (Hu et al., 2017a; Moran & Bar-Anan, 2013; see also Zanon, De Houwer, Gast, & Smith, 2014).

Another question pertinent to dual-attitude models is whether structural ambivalence as measured by indirect measures and as measured with direct and indirect measures, respectively, can be experienced. To a large extent, the answer to that question boils down to whether representations assessed by indirect measures (commonly referred to as “implicit attitudes” assessed by “implicit measures”) can be consciously accessed. Dual-process models may vary (or change over time) as to whether they allow conscious access to representations assessed by indirect measures. Most, if not all, dual-process models assume that implicit attitudes can be the subject of control exerted by deliberate processes (Fazio, 1995, 2007; Gawronski & Bodenhausen, 2006, 2009; Petty 2006; Petty & Briñol, 2006, 2009; Wilson et al., 2000). As alluded to earlier (cf. Section III.2a), even the strictest dual-process model, the SEM, allows for the experience of the output of the associative system (McConnell & Rydell, 2014). However, many of these models tend to equate the outcome of indirect measures with non-reportable representations (as suggested by the wording "implicit attitudes").

It is worth discussing separately the case of indirectly measured ambivalence and ambivalence between direct/indirect measures when addressing this question. Regarding indirectly measured ambivalence, it should logically not be assumed to elicit experienced ambivalence by dual-process models claiming the existence of dual representations in long-term memory. For instance, Rydell et al. (2006) posit that:

> "Implicit attitudes (i.e., attitudes to which people do not initially have conscious access and whose activation cannot be controlled) can be distinguished from explicit attitudes (i.e., attitudes that people can report and whose expression can be consciously controlled)." (Rydell et al., 2006, p. 954).

If indirectly measured evaluative representations are not consciously accessible, it is unclear why these representations should be related to a conscious experience of ambivalence. In turn, "indirect" ambivalence should not elicit behavioral or cognitive consequences aimed at reducing tension or indecision. As we saw, there is currently no evidence that structural ambivalence as measured by indirect tasks elicits experienced ambivalence.

Turning to structural ambivalence between measures, it is perhaps even less likely to be phenomenological consequential. This is because the "implicit" evaluative representation is now also dominated by a consciously reportable attitude. Yet, many dual-process models allow for experienced ambivalence in case of opposing evaluations between direct and indirect measures. For instance, in interpreting ambivalence between direct/indirect measures elicited by subliminal information versus behavioral descriptors, Rydell et al. (2006) explain:

> "(…) it is not surprising that sometimes a woman has negative evaluations about a man she met at a party despite the fact that everything she can articulate about him is positive. Although she might not be able to ''put her finger on'' why he is at some level both likable and unlikable, the current work suggests that the answer lies in dissociations between a slow-learning, association-grounded evaluative system and a fast-learning, verbally oriented evaluative system." (Rydell et al., 2006, p. 957).

It now seems, however, that the unconscious representation is consciously experienced and reportable (i.e., the woman feels consciously negative despite holding only positive thoughts) but that its origins cannot be articulated (i.e., her finger cannot be put on why she dislikes him). This is intuitively plausible. It is critically important, however, to specify attitude models in a way that clarifies at which stage and for what contents unconsciousness or implicitness is assumed.

Problems that arise from the lack of specification of dual-process models are also acute in personality research interested in discrepancies between direct and indirect measures. For instance, self-esteem research has been interested in discrepancies between indirect and direct self-esteem measures and their implication for personality stability and narcissism. Based on his analysis of dual-process models, Zeigler-Hill (2006) proposes:

> "In general, dual-process models propose that humans possess two modes of information processing, one of which is cognitive (rational, deliberative, and conscious), the other experiential (affective, automatic, and nonconscious). Explicit self-esteem may largely be a product of the cognitive system, which is based to some extent on logical analyses of self-relevant feedback and information, whereas implicit self-esteem may have its origins in the experiential system and be derived primarily from the automatic and holistic processing of affective experiences" (p. 120)

It is striking that the experiential system is now equated with one that cannot be consciously experienced. Yet, contrary to this difficult view, the author makes it very clear that discrepancies in direct and indirect measures are related to phenomenological experiences:

> "The finding that individuals with discrepant high self-esteem possess the highest levels of narcissism is consistent with classic views of narcissists as possessing self-doubts and insecurities underlying their grandiosity." (Zeigler-Hill, 2006, p. 136)

Whether ambivalence within an indirect measure or between direct/indirect measures induce a phenomenological experience of ambivalence is an important question for attitude research to address. This is because ambivalence theories generally assume that negative affective experiences stemming from attitudinal ambivalence motivate cognitive and behavioral consequences. To keep on with our example from personality research, Schröder-

Abé and colleagues (2007) note:

> "(…) accounts of narcissism describe individuals with overtly positive self-views who unconsciously evaluate themselves negatively and engage in defensive behavior when their fragile self-esteem is threatened. In accordance with these theories, it has been found that this discrepancy (high explicit and low implicit self-esteem) is connected with self-enhancement (…), defensiveness (…), and prejudice (…)." (p. 320).

The question arises whether people scoring high on narcissism do experience a sense of fragility (and if they do, why, considering their discrepant implicit self-esteem is not consciously accessible to them). Or, alternatively, whether defense mechanisms are triggered in the absence of any subjective experience of personal fragility (and, if so, what type of psychological process motivates these protective mechanisms). At the core of such fascinating debates are questions centering on how attitudes may be dually learned, dually represented, and dually accessed (for a recent discussion, see e.g., Corneille & Stahl, in press). We emphasize the need for inducing ambivalence instead of merely measuring it (see also below). Only induction methods can provide enough confidence in the causal antecedents of psychological phenomena, thereby contributing to the implementation of successful (e.g., guidance, counseling or psychotherapeutic) practices.

Ambivalence and attitude strength. Across the studies we reviewed, we saw that structural and experienced ambivalence per se cannot serve as indicators of weak attitudes. The concept of attitudinal ambivalence is frequently investigated in the context of attitude strength (Bassili, 1996; Krosnick & Petty, 1995). Ambivalence is sometimes regarded an indicator of weak attitudes alongside other variables such as extremity, accessibility, and the strength of the attitude-behavior link (Conner et al., 2002; Petty & Krosnick, 1995).

While ambivalent attitudes are generally said to "show many signs of weakness" (Conner & Armitage, 2008, p. 241), findings are not as consistent as one might expect. Structural ambivalence as assessed on direct measures has been found to be associated with an attenuated attitude-behavior link (Armitage & Conner, 2000; Conner, Povey, Sparks, James, Shepherd, 2003; Dormandy, Hankins, & Marteau, 2006; Greene, 2005) and less extreme attitudes (Maio, Bell, & Esses, 1996). Moreover, ambivalent attitudes as assessed via direct measures of structural and experienced ambivalence have been shown to be less accessible than univalent attitudes (Bargh et al., 1992; Bassili, 1996). Accessibility is thereby typically assessed as the latency of responding to a univalent question. For instance, Bargh and colleagues (1992) measured response latencies of word classifications as positive versus negative. Bassili (1996) measured the delay of responding on bipolar attitude questions that required a “yes” or “no” response (e.g., "Do you think that it should be against the law to write or speak in a way that promotes hatred toward a particular racial or religious group?”). However, in ambivalent attitudes, such measures likely assess the degree of conflict that needs to be overcome in order to arrive at a univalent response.

Newby-Clark et al. (2002) assessed response latencies for the two univalent scales in a direct measure of structural ambivalence to arrive at an index of *simultaneous accessibility*. Because associations have not to be weighed against each other, response conflict does not play a role in this task. This research shows that ambivalent attitudes can differ in their simultaneous accessibility. Moreover, Newby-Clark et al. (2002) observed a stronger relation between direct measures of structural and experienced ambivalence when both valences were equally and easily accessible.

Berger et al. (2018) have provided more direct evidence for the accessibility of ambivalent attitudes on the one hand and the role of response conflict for the latencies observed in dichotomous categorization tasks. In a sequential priming paradigm developed to assess structural ambivalence indirectly, we found equally strong inhibition for incongruent trials and trials including ambivalent primes. This finding points to comparably strong interferences produced by opposing associations *between* stimuli (incongruent trials) and *within* stimuli (ambivalent primes).

With regard to temporal stability, too, evidence is mixed. While attitudinal ambivalence is generally assumed to be linked to lower temporal stability (Bargh et al., 1992; Craig et al., 2005; Jonas et al., 2000), several studies did not find such a relationship in the context of hiring quotas (Bassili, 1996), diets (Armitage & Conner, 2000), and alcohol consumption (Karpen et al., 2012). In order to explain these diverging findings, Luttrell, Petty and colleagues (2016) tested the assumption that an ambivalence × uncertainty interaction may predict temporal stability. The authors found a positive correlation between the two concepts indicating the least attitude change over varying periods of time if both, ambivalence and uncertainty were low, and if both were high, respectively.

As a final comment, it may be noted that we do not know yet how bivalent attitudes compare to univalent or ambivalent attitudes. It may be that discrepancies between directly and indirectly assessed attitudes lead to evaluations that are less accessible, less stable, and less persistent to persuasion attempts. Future research needs to investigate this issue.

The role of experienced ambivalence in producing behavior. Attitudinal ambivalence has been linked to specific behavioral aspects such as increased information search and processing (Hänze, 2001; Maio et al., 1996), response amplification depending on contextual cues (Bell & Esses, 2002; Carver, Gibbons, Stephan, Glass, & Katz, 1979), and a weakened attitude-behavior link (Armitage & Conner, 2000; Conner et al., 2003; Dormandy et al., 2006; Greene, 2005). From the current state of research, however, it is not clear whether an ambivalent associative structure alone is consequential if not accompanied by feelings of ambivalence (see also above). As obvious from the positive correlations between direct measures of structural ambivalence and experienced ambivalence, the two conceptual aspects are not independent and are difficult to disentangle. Evidence regarding consequences of ambivalent associations alone, that is isolated from negative affect, is scarce. We do not know of any study that identified attitude objects possessing a significant ambivalent structure as assessed with direct or indirect measures in the absence of a self-reported experience of ambivalence. Considering this difficulty, the question arises whether the consequences typically associated with the encounter of ambivalent attitude objects can be broken down into consequences of uncertainty (Tiedens & Linton, 2001), or negative affect in general (for a review, see Schwarz & Clore, 1996).

Ambivalence between direct/indirect measures too, is found to be associated with increased information processing (Briñol et al., 2006; Rydell et al., 2008). First support for the assumption that the consequences of structural ambivalence are the result of its experience can be derived from this field of research. Rydell and colleagues (2008) found that the link between ambivalence between measures and increased information processing is mediated by feelings of discomfort (Exp. 1), and vanishes if feelings of discomfort are eliminated (Exp. 2). In order to address this question more systematically, future research should develop a paradigm that allows disentangling an ambivalent attitude structure and the phenomenological experience of it.

Methodological Implications

The relation between definition and measurement. The definitions of attitudinal ambivalence found in the social psychological literature refer to either a constellation of positive and negative associations in memory or to a phenomenological state that assumes an experience of indecision or tension stemming from such structural ambivalence. While the first definition does not require evidence for an experience of conflict or negative affect, the second definition is not based on a specific cognitive structure. As a consequence, it is not sufficient to exclusively measure or induce experienced ambivalence, because perceived conflict does not have to be the result of conflicting evaluations, but can for instance be due to semantic conflicts (e.g., Gebauer et al., 2013), low integrativity (Estes & Jones, 2009), or even uncertainty (Berger et al., 2018). Consequently, the associative attitudinal structure should always be assessed or induced in order to assess whether the phenomenological state of experienced ambivalence is indeed based on an ambivalent attitude structure (Petty et al., 2006).

Regarding the “implicitness” of structural ambivalence within an indirect measure or between direct/indirect measures, sometimes equated to “automaticity”, it is important to define the criteria by which the automaticity of an attitude can be determined. In favor of full transparency and development of theories, we suggest that the term “implicit,” which is fraught with many different meanings, is avoided in the definition of ambivalence constructs and that researchers delineate prior to carrying out experiments which automaticity criterion guides their research and why. These considerations should in turn guide the selection of appropriate measures.

However, as the test of implicitness claims often requires the use of indirect measures, acquired findings are vulnerable to problems regarding the interpretation of indirect measurement scores. Indirect measures are assumed to tap into associatively learned and retrieved responses (e.g., Rydell & McConnell, 2006). Recent research, however, has debated whether indirect measures assess attitudes or rather reveal people's world knowledge (e.g., Arkes & Tetlock, 2004; Karpinski & Hilton, 2001) or the structure of language (Lynott, Kansal, Connell, & O'Brien, 2012; Bluemke & Fiedler, 2009). Thus, research on the implicitness of ambivalence is bounded by the limitations of indirect measures designed to measure implicit attitudes (e.g., low or unclear construct validity) and would profit from an experimental approach to investigating the conditions under which attitudes are characterized by automaticity (Corneille & Stahl, in press; Sweldens, Tuk, & Hütter, 2017).

Limitations of the commonly used task dissociation approach. The investigation of structural ambivalence between measures naturally constitutes a task dissociation approach, by which performance on different tasks is compared as a means to investigate implicit processes. This approach suffers from a number of shortcomings. First, it equates direct and indirect measures with explicit and implicit attitudes, respectively. Such an approach thereby largely neglects evidence questioning both the fully controllable nature of direct measures (Hütter & Sweldens, in press) and the fully automatic nature of indirect measures (De Houwer, 2006; Hahn, Judd, Hirsh, & Blair, 2014). By contrast, both direct and indirect measures may reflect both implicit and explicit attitude components to varying degrees.

Second, as the goal of this approach is to demonstrate discrepancies between direct and indirect measures, it is important to note that the maximum correlation between two measures is not only a reflection of the processes related to attitudes, but is bounded by the lack of structural overlap between direct and indirect measures. Such structural features relate, for instance, to whether evaluative judgments are assessed or not, whether responses are speeded or not, and whether the response scale requires interpretation on the side of the participants or not. On average, the structural overlap between direct and indirect measures is lower than the overlap within measurement domains (Payne, Burkley, & Stokes, 2008).

Comparing different tasks comes with the risk of confounding test features with the concepts supposed to be measured (e.g., Payne, 2001; Payne, Jacoby, & Lambert, 2005; for an overview, see also Hütter & Klauer, 2016). It is thus not clear whether discrepancies between measures can be interpreted as discrepancies in implicit and explicit attitudes.

We believe that the distinction between constructs and their measures should receive more attention than it currently does in the ambivalence literature in order to advance both theory and method. Only by conceptually separating the level of cognitive processing from the level of measurement and strictly testing whether and how these are related, theoretical and methodological advancement can be made.

The relation between theory and induction of attitudinal ambivalence. Strong research is guided by theory. Thus, theories of structural ambivalence within and between direct/indirect measures, or experienced ambivalence should guide induction methods, allowing for stringent tests of theories. As laid out in the third section of our review, there are a number of theories converging in some assumptions and differing in others, but a unitary theoretical framework of attitudinal ambivalence is yet lacking. Some theories focus on the conditions at learning, while others focus on the conditions at retrieval that produce states of structural ambivalence within or between measures.

Almost all theories focus on ambivalence between direct and indirect measures rather than within a direct or an indirect measure. Consequently, there is a lack of research testing the prevalent assumption present in definitions of ambivalence that positive and negative associations can be activated *simultaneously* (for an exception, see Berger et al., 2018). Moreover, we know very little about the conditions under which structural ambivalence can be induced via information-based paradigms and evaluative conditioning (but see Glaser et al., 2018).

There is relatively more research on the induction of structural ambivalence between direct and indirect measures. The existing research demonstrates that such states may indeed exist. The present research, however, is inconclusive regarding the central assumption of some dual-process models, namely that ambivalence between direct/indirect measures is the result of different learning processes or systems (SEM; Rydell & McConnell, 2006; McConnell & Rydell, 2014). More generally, the widespread assumption for the existence of dual-attitude learning has been questioned lately, with regards to both operating conditions and principles commonly associated with these learning pathways (for a recent discussion, see Corneille & Stahl, in press). There is relatively more evidence speaking to the role of the relearning of attitudes and the relative sensitivity of direct and indirect measures to new and old attitudes (MCM; Petty & Briñol, 2006, 2009; Petty et al., 2007).

As a further note of caution, it is not only problematic that theoretical work is scarce. It is also problematic that existing theories make strong claims that were hardly put under empirical scrutiny. For instance, claims regarding the implicitness of ambivalence between direct and indirect measures have hardly been addressed. That is, is it indeed the case that participants cannot report on this state of structural ambivalence (i.e., unawareness of the cognitive structure)? Is it indeed the case that structural ambivalence between measures as compared to within direct measures does not lead to a phenomenological state of discomfort (i.e., unawareness of tension or negative affect)? Is it the case that the state of discomfort in *both* structural ambivalence within and between measures is only induced by the goal of making a decision (i.e., goal-independency)?

Selection of stimulus materials. Further methodological notes of caution are in order with regard to the selection of stimulus materials. First, it is important to regard aggregation levels as attitudes vary considerably between individuals. While structural ambivalence within or between direct/indirect measures may be observed on the participant level, there may be no structural ambivalence within or between measures at the level of individual stimuli. Furthermore, participants may only hold univalent attitudes, but differ in the sign of this attitude, creating ambivalence on the level of the participant group only. Such constellations threaten the internal validity of an experiment. Consequently, stringent research requires either (a) the idiosyncratic selection of ambivalent or bivalent materials, or (b) the statistical control via respective ratings on the participant and stimulus level, or (c) the experimental induction of structural ambivalence. Methods (a) and (b) should be based on definitions of ambivalence focusing either on structural or structural and phenomenological criteria. Method (c) requires a strong theory about the induction of structural ambivalence within or between measures (see below).

Limitations of the Present Review

We organized our review along measurement-driven definitions of ambivalence. Defining ambivalence concepts at the level of measurement avoids making debatable assumptions about the implicitness or explicitness of evaluations assessed with a specific measure. We chose to refer here to direct versus indirect measures because these classes of measures refer relatively clearly to procedures relying on or circumventing the self-reported evaluation of the attitude object. This terminology acknowledges that all types of measures may assess both explicit and implicit attitude components to varying degrees. It also avoids making a-priori assumptions on what stage of processing is actually explicit or implicit. When referring to “implicit measures,” researchers may refer to specific learning mechanisms underlying the evaluations being assessed, or evaluations that are stored in a specific memory system, or to evaluations being not necessarily accessible to consciousness, or merely that their expression is less easily controlled. Our measurement-based distinction encourages the experimental investigation of such automaticity features at different processing stages.

Nevertheless, our distinction of direct and indirect measurement is not entirely free from assumptions. Foremost, we assume that the indirect measurement that circumvents self-report and deliberations does lead to different results. Moreover, as apparent from our review, the distinction between direct and indirect measures is not clear-cut, but rather continuous. For instance, using an evaluative priming task is similar to direct evaluative measures if ambivalent stimuli serve as targets. Moreover, the outcomes of direct measures more closely resemble indirect measures when responses are speeded (Ranganath et al., 2008). Finally, the classes of direct and indirect measures are highly heterogeneous. For instance, an evaluative priming measure applies a measurement procedure different from an IAT, which again is very different from an affective misattribution procedure. The choice of measure even within direct and indirect measurement classes have been shown to have a strong impact on the results obtained (e.g., Payne et al. 2005; Van Dessel et al., 2017). Our distinction between direct and indirect measurement should therefore be considered a preliminary step in fostering common understanding and collaborative efforts in the investigation of attitudinal ambivalence.

Conclusion

Research on attitudinal ambivalence has important practical and theoretical implications for a wide range of psychological domains. This research is also characterized by a number of remarkable theoretical and empirical contributions. At a more collective level, however, it has traditionally relied on a theoretically fuzzy and inconsistent terminology, and from a lack of experimental research aimed at better understanding how attitudinal ambivalence is acquired. By proposing a measurement-based terminology and by pointing at clear directions for future research, we hope the present review proves conducive to better communication and more coordinated research efforts. These should contribute to advancing our understanding of how ambivalent attitudes are acquired, stored, retrieved from memory, and changed, but also when and how attitudinal ambivalence is affectively, cognitively, and behaviorally consequential at the individual, interpersonal, and intergroup level.

Section III: Investigating Ambivalence via Sequential Priming:

A Window to Ambivalent Attitude Structure

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The following chapter contains a manuscript that is the result of a cooperation between Katharina Theresa Berger (lead author), Prof. Dr. Mandy Hütter (second author), and Prof. Dr. Olivier Corneille (second author). The manuscript entitled "Investigating Ambivalence via Sequential Priming: A Window to Ambivalent Attitude Structure" is currently revised and prepared for re-submission at the *Journal of Experimental Psychology: General*. The three authors contributed equally to the research project. More specifically, each author contributed approximately 33% to the generation of scientific ideas, data generation, analysis and interpretation, and paper writing, respectively.

Introduction

Ambivalent attitudes differ from univalent attitudes in their attitudinal structure. Univalent (positive or negative) attitudes are characterized by either positive *or* negative associations (Fazio, 1995). In contrast, ambivalent attitudes are thought to involve the presence of both positive *and* negative associations (e.g., Kaplan, 1972; Priester & Petty, 1996; Scott, 1966; Thompson, Zanna, & Griffin, 1995). Different definitions of ambivalence have been proposed in attitude research. Most of them, however, refer to the *simultaneous* activation of positive and negative evaluations elicited by ambivalent attitude objects (Ajzen, 2001; Bargh, Chaiken, Govender, & Pratto, 1992; Conner & Sparks, 2002; Petty & Briñol, 2009; Petty, Briñol, & DeMarree, 2007) and point to feelings of conflict resulting from this joint activation (Priester & Petty, 1996).

To our knowledge, however, no study has demonstrated yet that ambivalent attitude objects simultaneously trigger evaluations of opposite valence. Hence, the core structural assumption endorsed by contemporary attitude models has not been empirically backed-up yet. Moreover, at present it is unclear whether a simultaneous activation would occur even in the absence of an intention to process and resolve the opposing valences of an ambivalent stimulus (for instance, when the ambivalent stimuli are task-irrelevant and occur only briefly). In the first part of the introduction, we discuss the limitations of previous empirical studies that addressed this question, and we explain how we think these limitations may be overcome. In the second part, we derive the hypotheses put to test in the present research.

Previous Research and its Limitations

Previous research commonly measured *potential ambivalence* (Kaplan, 1972) or *felt ambivalence* (e.g. Cacioppo, Gardner, & Berntson, 1997; Priester & Petty, 1996) to assess the structure of ambivalent attitudes. In potential ambivalence measures, participants separately report the intensity of their positive and negative reaction toward attitude objects. In felt ambivalence measures, participants report the degree of tension or conflicted thoughts experienced when encountering attitude objects. Although potential and felt ambivalence measures are important attitudinal indicators and have predictive value (for reviews, see Conner & Sparks, 2002; Jonas, Broemer, & Diehl, 2000), they neither allow addressing the simultaneity assumption nor the unintentionality of activation. In particular, instead of stemming from the simultaneous and unintentional activation of opposite evaluations, high ambivalence scores on these measures may likewise arise from fast attentional shifts between positive and negative features of an attitude object, which may occur sequentially and intentionally.

Newby-Clark, McGregor, and Zanna (2002) investigated the relationship between the relative accessibility of opposing evaluations about an attitude object and both potential and felt ambivalence measures. These authors operationalized accessibility as the speed at which a rating on unipolar attitude scales was given. The authors' reasoning was that the larger the correlation between potential ambivalence and felt ambivalence, the faster and equally fast both positive and negative evaluations should come to mind. As expected, the relative accessibility of these evaluations moderated the relationship between potential and felt ambivalence. That is, potential and felt ambivalence were positively correlated when both positive and negative evaluations were highly and equally accessible, whereas no such relationship was obtained when one or both of the opposite evaluations were low in accessibility. While this work provides interesting insights with regard to the phenomenological consequences of the speed at which opposing evaluations are accessed, it speaks neither to the simultaneity nor the automaticity of the activation of ambivalent attitudes. The reason is that positive and negative evaluations can only be assessed sequentially (and likely reflect the intentions of the respondent) when using univalent rating scales.

Petty, Tormala, Briñol, and Jarvis (2006) relied on a different strategy to infer the underlying structure of attitude objects. They considered a state of so-called "implicit ambivalence" that is due to diverging past and present evaluations of an attitude object, as compared to attitude reinforcement where the same attitude is confirmed by subsequent learning. Petty and colleagues (2006) used the evaluative priming paradigm developed by Fazio, Sanbonmatsu, Powell, and Kardes (1986). The paradigm rests on the assumption that reactions to targets that share their valence with the primes (i.e., congruent trials) are facilitated and reactions to targets that are incongruent with the primes' valence are inhibited. In Petty et al.'s design, ambivalent attitude objects served as primes and preceded univalent or neutral targets. Their priming paradigm revealed equally fast responses for both positive and negative targets following ambivalent primes as compared to strongly univalent primes. Response times in incongruent trials were longer.

This experiment, however, has two important limitations. First, the absence of a neutral baseline only allows for a relative interpretation of the results. As a matter of fact, the pattern of means reported by these authors may be due to deceleration in the incongruent conditions, rather than acceleration in the congruent and ambivalent conditions.[1] Second, effects were observed with a stimulus-onset asynchrony (SOA) of 450ms, which precludes valid conclusions about the automaticity of the effect. Numerous experiments found evaluative priming tasks to only produce reliable priming effects with SOAs well below 300ms (Hermans, De Houwer, & Eelen, 2001; Klauer & Musch, 2003; Klauer, Roßnagel, & Musch, 1997). Because of these two limitations, this experiment does not provide conclusive support to the hypothesis that ambivalent attitude objects elicit the joint activation of opposite evaluations.

De Liver, Van der Pligt, and Wigboldus (2007) also used an evaluative priming paradigm. In contrast to Petty et al. (2006), however, ambivalent stimuli served as targets instead of primes. Contradicting the findings reported by Petty et al. (2006) they found that

[1] The terms "acceleration" and "deceleration" are used as neutral descriptors of relative response patterns and are free from theoretical explanations for the respective patterns.

response latencies for trials including ambivalent targets were consistently longer than latencies in congruent or incongruent trials. De Liver et al. (2007) also found that both positive and negative primes accelerated the evaluative categorization of ambivalent targets as compared to neutral targets. This acceleration effect was even obtained when response and prime valence did not match. De Liver and colleagues (2007) suggested that this finding speaks to the simultaneous activation of positive and negative valence in ambivalent stimuli. However, employing ambivalent stimuli as targets and not as primes compromises this conclusion. That is, drawing conclusions about the simultaneous activation of positivity and negativity upon being exposed to ambivalent stimuli requires examining effects elicited by ambivalent primes rather than those observed on ambivalent targets. The findings of De Liver et al. (2007) rather suggest that different associations in ambivalent objects may be activated depending on which valence has been pre-activated by univalent primes.[2]

Sequential Priming and Ambivalence at Short Stimulus Onset Asynchronies

Together with Petty et al. (2006) and De Liver et al. (2007), however, we believe that sequential priming paradigms are most informative for shedding light on the current research question. Sequential evaluative priming paradigms were developed as a helpful method to study the cognitive structure of attitudes (Fazio et al., 1986). While there are many variations of sequential priming, the standard task that produces the most robust effects is the evaluative priming task that orthogonally varies positive and negative valence in primes and targets and requires participants to categorize targets as 'positive' or 'negative.' Trials on which the prime and the target stimulus match (mismatch) in valence are typically referred to as congruent (incongruent) trials. To the degree that slower responses are observed in incongruent than in neutral trials and faster responses in congruent than in neutral trials, we can conclude that the presentation of the prime activates evaluative contents in memory (Fazio et al., 1986). In turn, these automatic congruency effects, typically observed at short SOAs, that is, very fast

[2] The Implicit Association Test used in Experiment 1 of De Liver et al. (2007) has the same limitation.

successions of prime and target, allow inferring the structure of the associative network activated by the prime (Voss, Rothermund, Gast, & Wentura 2013; Wentura & Rothermund, 2014).

To test whether positivity and negativity are activated simultaneously and unintentionally in ambivalent stimuli, we employed ambivalent stimuli as primes. We considered three possible patterns of results in this research paradigm. First, ambivalent primes may produce acceleration effects (like congruent primes) as they entail an overlap between the prime and target valences. Second, because ambivalent primes also entail valence that is incongruent with the target, they may also cause deceleration effects. Third, ambivalent primes may behave like neutral primes if positive and negative activation cancel each other out. Assuming that, with short SOAs, prime and target are assimilated, no model of priming predicts acceleration effects when both valences are concurrently activated (for an overview on accounts, see Wentura & Rothermund, 2014). Rather, response deceleration due to evaluative conflict should be observed. Therefore, and contrary to Petty et al.'s (2006) rationale, we hypothesized that ambivalent primes, just like incongruent trials, are associated with *slower* responses at short SOAs, because positive and negative associations are activated concurrently and so potentially entail an evaluative conflict (Bargh et al., 1992). We now discuss at which stage such conflict may arise and how this question can be addressed empirically.

Evaluative Conflicts at Exposure versus Response Expression

In a typical sequential priming paradigm, primes and targets are not only congruent or incongruent with regard to their valence, but also with regard to the response they require. Specifically, participants have to categorize targets as 'positive' and 'negative', respectively. As a consequence, a positive (negative) prime pre-activates the 'positive' ('negative') response, leading to acceleration effects in positive (negative) targets and deceleration effects in negative (positive) targets. The primes and the targets are related to each other via the mapping of the evaluative dimension on the response categories and effects generally occur via a mechanism of response priming (Wentura & Degner, 2010).

A number of variants of the sequential priming paradigm remove the mapping of the evaluative dimension and the response categories. This is achieved by varying the evaluative relatedness of primes and targets orthogonally to the response categories. For instance, participants categorize positive and negative targets along semantic dimensions (e.g., living vs. nonliving; Voss et al., 2013) or their lexical status (lexical decision task; e.g., Neely, 1977), or they simply pronounce the target (pronunciation task; e.g., Meyer, Schvaneveldt, & Ruddy, 1974; Hermans, De Houwer, & Eelen, 1994). In these tasks, evaluative priming effects are assumed to occur via spreading activation in a semantic network (Collins & Loftus, 1975; Voss et al., 2013). However, evaluative priming effects in these paradigms are unreliable and often fail to obtain (e.g., De Houwer, Hermans, Rothermund, & Wentura, 2002; Klauer & Musch, 2003; Klinger, Burton, & Pitts, 2000).

Of particular interest here is the valent/neutral categorization task, in which participants categorize stimuli as either valent or neutral. In this task, there is no evidence of evaluative priming effects even though valence needs to be processed (Rothermund & Werner, 2014; Spruyt, De Houwer, Hermans, & Eelen, 2007; Spruyt, De Houwer, & Hermans, 2009; Werner & Rothermund, 2013). This absence of evaluative priming effects is by no means indicative of the absence of evaluative activation. Rather, it points to the critical role played by conflicts at the response execution stage (which are removed in this task). Therefore, in the context of the current project, the reliance on the valent/neutral task allows examining whether the unintentional co-activation of opposite evaluations by ambivalent stimuli elicits a generalized slowing down in further information processing. If it does, this would suggest that an evaluative conflict is spontaneously elicited upon exposure to ambivalent stimuli. If it does not, this would suggest that an evaluative conflict arises only at the response production stage.

Hypotheses and Overview of the Present Research

The present research was mainly concerned (i.) with an examination of the joint activation hypothesis and (ii.) with a clarification of the stage at which this co-activation results in an evaluative conflict. We implemented different priming paradigms that aimed at more adequately investigating the structure of ambivalent attitudes. In this section, we present the hypotheses tested in the present research and relate them to the experiments we conducted. Table 1 provides an overview of all hypotheses for both paradigms and all four experiments. The data and variable codes are publicly available at https://zenodo.org/ under the digital object identifier 10.5281/zenodo.1287629.

***Predictions for the ambivalent primes paradigm*.** In the first three experiments, two variants of the evaluative priming paradigm were used. In the first variant, the *ambivalent primes paradigm,* ambivalent stimuli served as primes while targets were positive or negative. By using ambivalent attitude objects as primes (as compared to targets as realized by De Liver and colleagues) and by assessing their effects on responses towards univalent targets, we were able to adequately test the widely assumed simultaneous activation of opposite valences triggered by ambivalent stimuli. If positive and negative associations are activated concurrently, ambivalent primes should cause a response conflict. Consequently, latencies should be slower on trials involving ambivalent primes as compared to congruent ($H1_{primes}$) and neutral primes ($H2_{primes}$), and they should be as slow as on trials involving incongruent primes ($H3_{primes}$).

Another important asset of the ambivalent primes paradigm is that it is informative with regard to an important automaticity feature, namely intentionality (Bargh, 1994, Fazio et al., 1986).

Any effect of the prime on responding is unintentional as participants are told that the primes are irrelevant and are asked to respond only to the targets. If we observed effects of ambivalence only in the ambivalent targets paradigm (see below), the most parsimonious explanation would attribute these effects to an intentional retrieval and resolution of conflicting positive and negative associations. In contrast, if we (also) observed the predicted effects in the ambivalent primes paradigm, the slowing of responses could be attributed to the unintentional activation of conflicting associations, because the ambivalent primes paradigm does not require the processing and resolving of the opposing valences of the primes. To the contrary, because the processing of ambivalent primes interferes with the categorization of the target, making responses slower and more error-prone, processing the primes opposes participants' goal to complete the task as quickly and accurately as possible.

Table 1

Overview and results of all hypotheses tested in Experiments 1 to 4.

	Hypothesis	Relevant experiment(s)	Inference
AMBIVALENT PRIMES PARADIGM	**Deceleration effects on trials containing ambivalent primes**		
	$H1_{primes}$: RT(ambivalent) > RT(congruent)	Exp. 1 Exp. 2	supported supported
	$H2_{primes}$: RT(ambivalent) > RT(neutral)	Exp. 1 Exp. 2	supported rejected
	$H3_{primes}$: RT(ambivalent) = RT(incongruent)	Exp. 1 Exp. 2	supported supported
	No deceleration effects on trials containing ambivalent primes with long SOA		
	$H4_{primes}$: RT(ambivalent) = RT(congruent) RT(ambivalent) = RT(neutral) RT(ambivalent) = RT (incongruent)	Exp. 3	supported
	Automatic instigation of evaluative conflict?		
	$H5a_{primes}$: RT(ambivalent) = RT(congruent)	Exp. 4	supported
	$H5b_{primes}$: RT(ambivalent) > RT(congruent)	Exp. 4	rejected

	Hypothesis	Relevant experiment(s)	Inference
AMBIVALENT TARGETS PARADIGM	**Deceleration effects on trials containing ambivalent targets**		
	$H1_{targets}$: RT(ambivalent) > RT(congruent)	Exp. 1 Exp. 2	supported supported
	$H2_{targets}$: RT(ambivalent) = RT(incongruent)	Exp. 1 Exp. 2	supported supported
	Facilitation on ambivalent trials by univalent primes as compared to neutral primes?		
	$H3a_{targets}$: RT(valent prime | ambivalent) < RT(neutral prime | ambivalent)	Exp. 1 Exp. 2	rejected rejected
	$H3b_{targets}$: RT(valent prime | ambivalent) = RT(neutral prime | ambivalent)	Exp. 1 Exp. 2	supported supported
	Deceleration effects persist with long SOA		
	$H4_{targets}$: RT(ambivalent) > RT(congruent) RT(ambivalent) = RT(incongruent)	Exp. 3 Exp. 3	supported supported
	Facilitation by prime-congruent responding		
	$H5_{targets}$: categorization(ambivalent) ~ prime valence	Exp. 1 Exp. 2 Exp. 3	rejected partially supported rejected
	$H6_{targets}$: RT(prime valence | ambivalent) < RT(opposite valence | ambivalent)	Exp. 1 Exp. 2 Exp. 3	rejected partially supported rejected

Note. RT = response time.

While Experiments 1 and 2 tested the joint and unintentional activation of opposite valences in ambivalent stimuli, Experiment 3 provided another test of the automaticity of this effect. As outlined above, evaluative priming effects are generally interpreted as evidence for the automatic activation of evaluations. Such automatic activation of evaluation decays quickly (Murphy & Zajonc, 1993). As a result, evaluative priming effects should not occur with long SOAs. Evaluative priming effects should still occur under such conditions, however, if the activation of valence is due to deliberate and strategic processes (Klauer et al., 1997). In order to provide evidence relevant to this question, Experiment 3 turned to a long SOA of 450ms. We hypothesized that the slowing down observed in the ambivalent primes paradigm is due to automatic activation processes. If so, the ambivalence priming effects observed in Experiments 1 and 2 for the ambivalent prime paradigm should vanish when using this longer SOA ($H4_{primes}$).

Whereas Experiment 3 examines the automaticity of the effects, Experiment 4 examines the stage at which the joint activation process induces a slowing down. Evidence gathered using the Emotional Stroop task (Watts, McKenna, Sharrock, & Trezise, 1986), for instance, provided indication that dominant information may interfere with the main task and induce longer response latencies. Following the same reasoning, the mere exposure to ambivalent primes may trigger extra processing that slows down the processing of later information. If this is the case, then this slowing down should be observed irrespective of the target-related decision. Conversely, it may be that a slowing down is due to response conflict that needs to be resolved, which requires time. If so, the deceleration effect should disappear when the task-related decision does not involve such response conflict.

To provide a direct test of the latter question, Experiment 4 again employed the ambivalent primes paradigm, but this time with a valent/neutral categorization task instead of a positive/negative categorization task (Werner & Rothermund, 2013). In the valent/neutral task, target words are either univalent or neutral and have to be classified as either '*positive or negative*' or '*neither positive nor negative*'. Thereby, response conflicts between primes and targets are removed for valent stimuli. In the evaluative priming paradigm, ambivalent primes potentially activate two evaluations that preactivate different responses. If response conflict is responsible for the deceleration effects following ambivalent primes, the deceleration effects should disappear in this task ($H5a_{primes}$), because opposite evaluations triggered by ambivalent primes converge in producing the same response (i.e., 'positive or negative'). If, in contrast, the mere encounter of ambivalent associations leads to an experience of conflict, deceleration effects should still be observed ($H5b_{primes}$). In sum, Experiment 4 allowed investigating whether ambivalent stimuli generally trigger an evaluative conflict or whether a conflict emerging only at the response execution stage accounts for the patterns observed in Experiments 1 and 2.

***Predictions for the ambivalent targets paradigm*.** Experiments 1 to 3 also implemented an *ambivalent targets paradigm* for the purpose of a conceptual replication of the priming paradigm used by de Liver et al. (2007). As the name suggests, the ambivalent targets paradigm employed ambivalent words as targets and compared them with univalent targets. Primes were univalent or neutral, but never ambivalent. This paradigm allowed examining the following hypotheses. First, we hypothesize that the categorization of ambivalent target words as positive or negative produces a conflict that results in increased latencies as compared to congruent trials ($H1_{targets}$) and in latencies comparable to those in incongruent trials ($H2_{targets}$). Second, this paradigm enables us to test the assumption held by De Liver and colleagues (2007) that categorizing ambivalent stimuli is facilitated by univalent primes as compared to neutral primes ($H3a_{targets}$) against our own assumption that ambivalent stimuli entail an evaluative conflict and are immune to facilitation by univalent primes ($H3b_{targets}$). Specifically, mirroring our reasoning for the ambivalent primes paradigm, we assume that ambivalent trials (i.e., trails containing an ambivalent target) are functionally equivalent to incongruent trials, in the sense that positive and negative valence are concurrently activated, leading to slower responses independent of the valence of the prime (cf. Bargh et al., 1992; Wentura & Rothermund, 2014). Moreover, in contrast to the ambivalent primes paradigm, we hypothesized that the slowing down observed in the ambivalent targets paradigm is due to deliberate processes instigated at target onset; if so, the deceleration effects for ambivalent targets in Experiments 1 and 2 should still be observed when using a longer SOA in Experiment

3 ($H4_{targets}$).

The ambivalent targets paradigm made it possible to examine two additional hypotheses. Ambivalent attitudes are associated with stronger information scrutiny given that conflicting evaluations have to be resolved before one can reasonably act upon them (Maio, Esses, & Bell, 2000). Consequently, individuals are particularly motivated to resolve ambivalence (Nohlen, Van Harreveld, Rotteveel, Barends, & Larsen, 2016; Van Harreveld, Rutjens, Rotteveel, Nordgren, & Van der Pligt, 2009). In the ambivalent targets paradigm, the valence of the primes may be utilized to resolve this conflict. If so, we should observe more evaluative responses that are in line with rather than opposite to the prime valence ($H5_{targets}$). In addition, we further tested whether categorization of ambivalent targets in line with (rather than opposite to) prime valence leads to faster responses in this paradigm, as observed by De Liver et al. (2007; $H6_{targets}$).

Finally, in addition to investigating the nature of valence activation using priming tasks, we were also interested in the correspondence of these measures with widely-used direct measures of ambivalence. For this reason, all experiments except for Experiment 1 also included standard self-report measures of ambivalence. While the relation between different direct measures of attitudinal ambivalence has been reported frequently (Priester & Petty, 1996; Riketta, 2000; Thompson et al., 1995), comparisons between direct and indirect measures are scarce. As an additional asset, the current research thus also contributes to closing this gap by systematically investigating the correspondence between those measures and by contributing to theorizing on implicit and explicit ambivalence.

Experiment 1

Experiment 1 introduces the ambivalent primes paradigm to test the simultaneous activation assumption and the unintentionality of this activation ($H1_{primes}$, $H2_{primes}$, and $H3_{primes}$). The ambivalent targets paradigm is introduced to test whether the univalent categorization of ambivalent targets lead to slowing down in this task ($H1_{targets}$, $H2_{targets}$), whether univalent primes facilitate the categorization of ambivalent targets ($H3a_{targets}$ and $H3b_{targets}$), and whether their categorization reflects and benefits from the valence of the primes ($H5_{targets}$ and $H6_{targets}$).

Method

Participants. Sample size was determined a-priori using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). As effect sizes in our paradigm were unknown, we based our calculations on small effects (f = .10). As there is no clear guideline for power analyses regarding multilevel modeling performed on the present data, we based our calculation on repeated measures ANOVAs with a desired statistical power of $1 - \beta = .80$, $\alpha = .05$. Required sample size was N = 60. We continued data collection beyond this point, because more participants were available. In total, we collected data of 77 university students of different majors in exchange for course credit or 3.00 EUR (approx. 3.50 USD). The sample consisted of 16 males and 61 females with age ranging from 18 to 46 years (M = 22.75, SD = 4.65).

Design. Participants subsequently completed two evaluative priming tasks that differed in the role of the ambivalent material (prime or target). The sequence of these tasks was counterbalanced across participants. The ambivalent primes paradigm employed a 4 (prime type: ambivalent vs. neutral vs. positive vs. negative) × 2 (target type: positive vs. negative) design. The ambivalent targets paradigm employed a 3 (prime type: neutral vs. positive vs. negative) × 3 (target type: ambivalent vs. positive vs. negative) design.

Materials. Verbal materials were used either as prime or target words depending on the priming paradigm (Appendix A). We selected four positive and four negative nouns and eight positive and eight negative adjectives from Fiedler, Bluemke, and Unkelbach (2011). Eight non-words serving as neutral attitude objects were created by a simple algorithm. Specifically, we sampled letters from an array containing all letters of the alphabet respecting natural frequencies of occurrence in German words. The mean length of the non-words corresponded to the mean length of valent words. Eight ambivalent nouns were selected based on pretesting. An online sample of N = 235 participants rated 28 potentially ambivalent nouns as well as four positive and four negative filler nouns on two separate valence scales for positivity and negativity (Kaplan, 1972), and one felt ambivalence scale (“To what degree do you feel torn regarding the connotation of this word?”) in a pretest. To identify the eight most ambivalent words, an index of potential ambivalence (Thompson et al., 1995) was calculated for each word and each participant, and subsequently averaged across participants. To ensure both potential and perceived ambivalence in the words, we selected the words with the highest ambivalence indices and mean felt ambivalence ratings above the median.[3]

In the ambivalent primes paradigm, ambivalent and univalent nouns as well as non-words served as primes, while positive and negative adjectives served as targets. In the ambivalent targets paradigm, univalent adjectives and non-words served as primes. Targets were univalent and ambivalent nouns. In the ambivalent primes paradigm, each of the 24 prime words was used with two stimuli of each target type. In the ambivalent targets paradigm, each of the 16 target nouns was combined twice with each type of prime. Both paradigms consisted of 96 trials.

Procedure. All instructions and tasks were administered by a customized Visual Basic program. Participants were asked to categorize the targets as positive or negative as fast and accurately as possible. Participants were informed that each target word would be preceded by another word. They were informed that the first word's presentation time was so short that they might not be able to identify it and that they may simply ignore it. Participants were instructed to press one of two keys to categorize a target as positive or negative. Key assignment (A = positive and L = negative vs. A = negative and L = positive on a QWERTZ keyboard) was counterbalanced across participants.

Primes and targets were presented at the center of a white screen with labels in the top left and top right corner reminding the participants of the key assignment. Each trial started with the presentation of a fixation cross (500ms), after which primes were presented for 150ms. Masking the primes, targets were presented in capital letters and remained on the screen until one of the assigned keys was pressed. If responses were slower than 1,500ms, a red text field labelled "faster" appeared for the duration of the inter-trial interval (ITI, 1,500ms). The SOA of 150ms is considered a short SOA that produces reliable evaluative priming effects (Klauer et

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[3] Ambivalent and univalent nouns also matched on word frequency (p = .25) according to the SUBTLEX-DE (Brysbaert et al., 2011).

al., 1997).

After a short practice block of nine (ambivalent primes paradigm) or eight (ambivalent targets paradigm) trials, the experimental block of the first paradigm started. Subsequently, participants underwent the second set of practice and experimental block with the reversed role of the ambivalent material. After finishing the indirect attitude measures, participants answered three questions about each of the sixteen nouns used in the priming paradigms. The first two questions served to separately assess the degree of positivity and negativity associated with the meaning of the word. Participants were asked to rate the positivity (negativity) while ignoring all negative (positive) aspects of the word. The third item, which aimed at assessing felt ambivalence, asked for the degree to which participants felt torn with regard to the valuation of the word. All questions were answered using a slide bar ranging from 0 = "not at all positive"/ "not at all negative"/ "not at all torn" to 100 = "very positive"/ "very negative"/ "very torn".

As evaluative priming procedures are not immune to strategic intentions (e.g., Degner, 2009), we decided to consistently assess the evaluative priming tasks first. While we thus cannot rule out the possibility that the self-reported ambivalence ratings may be affected by meta-cognitive observations during the sequential priming task (cf. Tormala, Clarkson, & Henderson, 2011), this methodological decision assures that our main measure is not influenced by the direct ambivalence ratings.

Unfortunately, due to a programming error, none of the direct ratings were saved correctly in this first experiment. Following demographic questions, participants were thanked, given an opportunity for debriefing, and dismissed.

Results

Data were analyzed using multilevel models to assess relationships on a trial level (Judd, Westfall, & Kenny, 2012). All models contained random intercepts for participants, while the effects of the predictors were always fixed. Models were calculated using the *lmer*-command from the *lme4*-package (Bates, Maechler, Bolker, & Walker, 2015) in RStudio (R Core Team, 2018).

Our testing strategy was the same in all analyses. To assess significance of the effects, we conducted model comparisons in which we assessed whether a model including a factor specifying the trial types that were compared fit better than the null model, which predicts the grand mean with random intercepts for participants. Model comparisons were conducted using the *PBmodcomp* command from the *pbkrtest* package (Halekoh & Højsgaard, 2014) and the function *mixed* from the *afex* package (Singmann, Bolker, Westfall, & Aust, 2018) due to their ability to handle large data sets. This procedure computes model comparisons of nested models using parametric bootstrapping. *P*-values (type II) were computed based on 1000 bootstrap replicates each. We also report the regression weights, standard errors, and *t*-statistics for all tested effects. Baayen, Davidson, and Bates (2008) consider *t*-statistics exceeding the absolute value of 2 to be interpretable in a meaningful way. In virtually all cases, the parametric bootstrapping and the *t*-statistic converge in their evaluation of significance. All statistics are provided in corresponding tables for reasons of clarity and comparability.

In line with De Liver et al. (2007), we excluded responses faster than 300ms (0.19%) and slower than 3,000ms (0.11%) for all analyses.

Standard evaluative priming effects

As a means of validating the sequential priming paradigm, we first assessed the standard evaluative priming effect. For all latency analyses, we excluded incorrect classifications (4.72%; i.e., positive responses to negative targets or negative responses to positive targets) resulting in 14,043 trials for analysis. To validate the two priming paradigms, a first analysis assessed the standard evaluative priming effect, that is, response facilitation for congruent trials compared to incongruent trials. For this purpose, all trials containing ambivalent stimuli were excluded from the data set. To correct for a skewed latency distribution, latencies were log-transformed for all latency analyses. We conducted a comparison of the null model (random intercept for participants) with the model including congruency as a predictor for response latencies. The comparison revealed a significantly better model fit of the more complex model in both priming paradigms. The better fitting model consistently showed significantly shorter latencies for congruent trials as compared to incongruent trials (see upper panel of Table 2).

Ambivalent primes paradigm

Latencies. To investigate whether latencies increased in trials including ambivalent primes as compared to congruent trials, we compared the null model with a model including a predictor coded *zero* for ambivalent trials and *one* for congruent trials. The more complex model described the data significantly better. Trials with ambivalent primes slowed down responses compared to congruent trials. The same pattern of significantly increased latencies for ambivalent trials was found when comparing the null model with a model including a predictor for ambivalent versus neutral primes. The null model and a model comparing latencies for ambivalent and incongruent trials did not differ in model fit. Latencies for trials with ambivalent primes did not differ significantly from latencies for incongruent trials. The upper panel of Table 3 shows the weights, standard errors, *t*-values, the PB-test statistic and *p*-value of the relevant comparisons. See Figure 2 for mean latencies and standard errors.[4]

Ambivalent targets paradigm

Latencies. Figure 3 presents mean latencies and standard errors for all conditions. The lower panel of Table 3 displays the results of the multilevel analyses and model comparisons.

A first analysis served to investigate whether latencies for ambivalent targets are comparable to those obtained in congruent trials, independent of prime valence. A model including a factor that was dummy-coded *zero* in the case of ambivalent trials and *one* in the

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[4] We performed analogous tests on the error rates. Note that for ambivalent targets no errors are defined. Consequently, an error analysis including ambivalent material is only possible for the ambivalent primes paradigm. The first model comparison of the null model with the model including a factor coded *zero* for ambivalent trials and *one* for congruent trials did not show differences in model fit, PB-test(1) = .10, p = .78. Moreover, there was no difference between the null model and the model comparing ambivalent and neutral trials, PB-test(1) = .96, p = .34, and the model comparing ambivalent and incongruent trials, PB-test(1) = 2.15, p = .13.

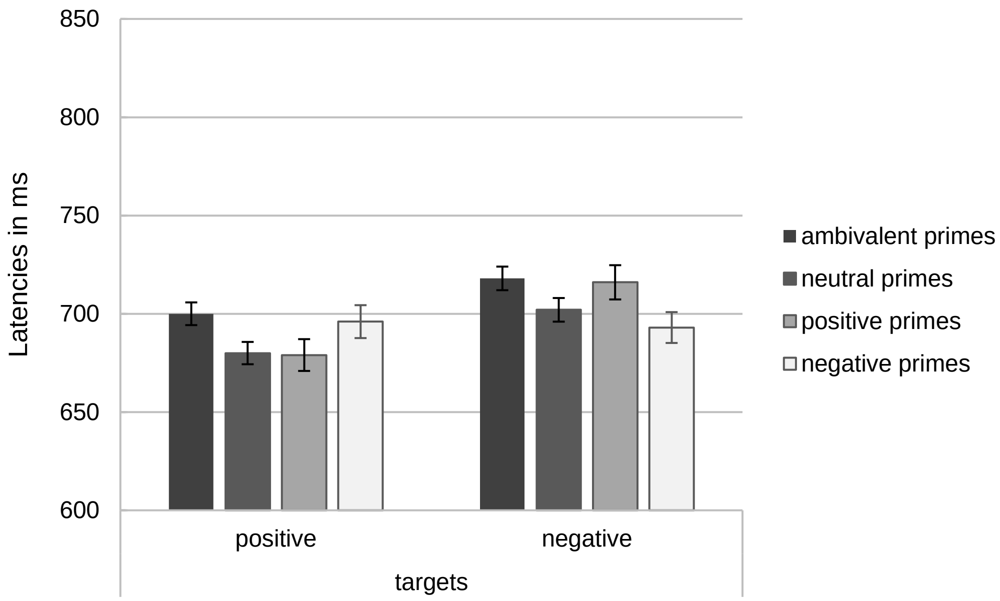

Figure 2. Mean latencies and standard errors in Experiment 1 depending on prime type and target type in the ambivalent primes paradigm.

case of congruent trials showed a better model fit than the null model. This effect revealed a significant increase in latencies for ambivalent trials compared to congruent trials. Similarly, the model including a factor dummy-coded *zero* for ambivalent trials and *one* for incongruent trials fit significantly better than the null model. This effect indicated that latencies for ambivalent trials were even higher than latencies for incongruent trials. To test whether valent primes lead to acceleration in the ambivalent target trials, we compared latencies for ambivalent targets following univalent and neutral primes. The more complex model did not fit better than the null model. That is, univalent as compared to neutral primes neither accelerated nor decelerated responding towards ambivalent targets.

Response frequencies for ambivalent targets. An analysis of frequency distributions revealed comparable frequencies for positive and negative classifications of ambivalent targets, $t(3675) = 1.58$, $p = .11$. Ambivalent targets were classified as negative in 48.69% of the trials and as positive in 51.31% of the trials. Model comparison did not show differences in model fit between the null model and the model including prime type as a predictor for the classification

Table 2

Effect of congruency on response latencies in milliseconds separately for Experiment 1, 2 and 3.

	Incongruent trials	*Congruent trials*	*Multilevel Models*			*Model comparisons*	
	M (SD)	*M (SD)*	*B*	*SE*	*t*	PB-test(1)	*p*
Experiment 1							
Ambivalent primes paradigm	706 (205)	687 (192)	-.03	.01	-3.30	11.18	.001
Ambivalent targets paradigm	695 (192)	684 (207)	-.02	.01	-2.20	4.90	.03
Experiment 2							
Ambivalent primes paradigm	746 (196)	736 (231)	-.02	.01	-2.15	4.63	.03
Ambivalent targets paradigm	769 (240)	730 (198)	-.05	.01	-5.52	30.26	.001
Experiment 3							
Ambivalent primes paradigm	664 (224)	667 (204)	-.01	.01	-1.02	1.03	.32
Ambivalent targets paradigm	696 (212)	690 (223)	-.01	.01	-.92	.84	.34

Note. All statistics are based on the analysis of log-transformed latencies.

Table 3

Results from the multilevel models and model comparisons estimated to test our hypotheses in Experiment 1

Paradigm	Comparison		*Multilevel models*			*Model comparisons*	
	Condition 1 (M, SD, number of observations)	Condition 2 (M, SD, number of observations)	*B*	*SE*	*t*	PB-test(1)	*p*
ambivalent primes paradigm	ambivalent trials (709, 201, 2317)	congruent trials (687, 192, 1163)	-.03	.01	-4.24	17.93	.001
	ambivalent trials (709, 201, 2317)	neutral trials (691, 200, 2337)	-.02	.01	-4.08	16.63	.001
	ambivalent trials (709, 201, 2317)	incongruent trials (706, 205, 1145)	-.00	.01	-.39	.15	.70
ambivalent targets paradigm	ambivalent trials (778, 266, 3676)	congruent trials (684, 207, 1150)	-.12	.01	-13.80	186.72	.001
	ambivalent trials (778, 266, 3676)	incongruent trials (695, 192, 1118)	-.10	.01	-11.52	130.98	.001
	valent primes – ambivalent targets (778, 274, 2454)	neutral primes – ambivalent targets (777, 251, 1222)	-.01	.01	-.55	.30	.58

Note. All statistics are based on the analysis of log-transformed latencies.

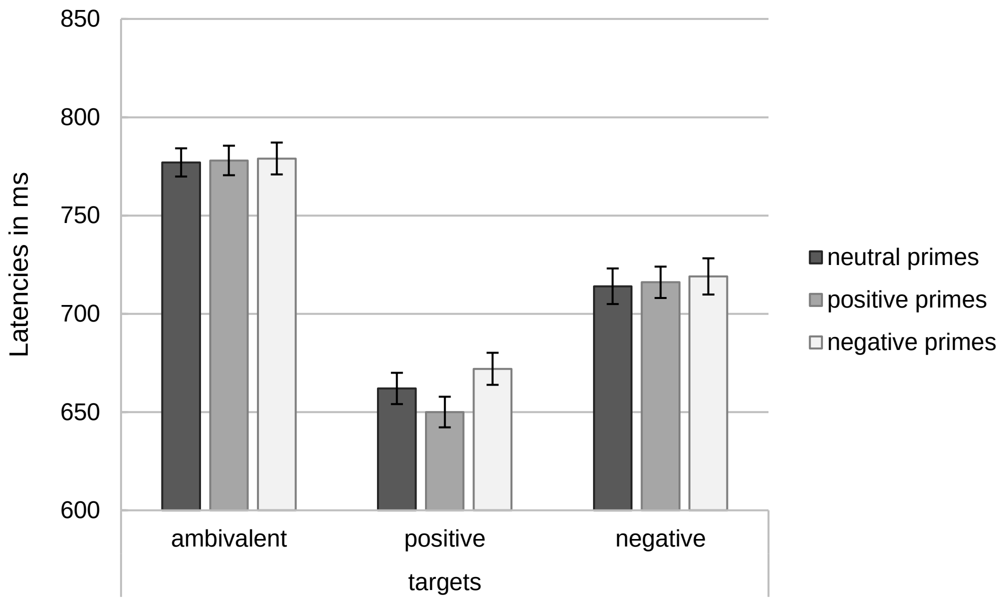

Figure 3. Mean latencies and standard errors in Experiment 1 depending on prime type and target type in the ambivalent targets paradigm.

of ambivalent targets, PB-test(1) = 1.96, p = .15. This finding was confirmed by a multilevel analysis indicating that prime type did not predict the valence classification in ambivalent targets, B = .01, SE = .01, t = 1.40.

Discussion

The present research investigated whether evaluations of opposite valence are activated simultaneously in ambivalent stimuli. By implementing two evaluative priming paradigms in which ambivalent stimuli either served as targets or as primes, we found that trials including ambivalent stimuli were consistently slower than congruent (support for $H1_{primes}$ and $H1_{targets}$) and neutral trials (support for $H2_{primes}$) and were as slow (support for $H3_{primes}$; ambivalent primes paradigm) or slower (supports $H2_{targets}$; ambivalent targets paradigm) than incongruent trials. The ambivalent primes paradigm is particularly informative regarding the automatic activation of ambivalent evaluations. As responses toward both positive and negative targets were slowed down following ambivalent to-be-ignored primes, we gathered first evidence that ambivalent stimuli are associated with the joint and unintentional activation of positive and negative valence.

In the ambivalent targets paradigm, prime valence did not predict the categorization of ambivalent targets (support for $H3b_{targets}$ and rejection of $H3a_{targets}$, no support for $H5_{targets}$ and $H6_{targets}$). Consequently, we did not obtain evidence for the notion that ambivalence is automatically resolved by attending to other valent cues present in the environment (here, those provided by the primes).

Although constituting an informative first step, Experiment 1 has several shortcomings. First, while conducting an extensive pretest for the ambivalent material and controlling for word frequency, ambivalent and univalent material systematically differed in word length. Thus, we cannot rule out that the observed pattern of results is an artifact of ambivalent words being longer than univalent words. Moreover, as the experimental software did not save the specific words presented on each trial, our analyses could not control for stimulus-specific differences as recommended by Judd and colleagues (2012). Experiment 2 aims at replicating Experiment 1 while overcoming these methodological limitations.

Experiment 2

Experiment 2 was designed to rule out the methodological limitations of Experiment 1 to enable a more valid interpretation of the observed pattern of results. While using the same set of ambivalent words, we used a new set of univalent words and nonwords in Experiment 2, in order to control for both word frequency and word length. Experiment 2 also allows for random intercepts for prime and target material in multilevel analyses. Moreover, we collected direct attitude ratings to investigate the relationship between direct and indirect measures of attitudes.

Method

Participants. We collected data of N = 80 university students, of which 54 were female. Participants on average were M = 23.79 years old (SD = 5.73 years) and participated in exchange for course credit or 3.00 EUR (approx. 3.50 USD).

Design, materials, and procedure. Design and procedure were identical to Experiment 1. The ambivalent words were identical to the ones used in Experiment 1. In order to control for word length and frequency, new univalent and neutral material was generated.

Word frequency was estimated separately for univalent and ambivalent words based on the SUBTLEX-DE (Brysbaert et al., 2011). Ambivalent and univalent nouns matched in frequency, $t(9.22) = .08$, $p = .94$, and word length, $t(11.52) = .13$, $p = .90$. Nonwords were created according to the algorithm described in Experiment 1 and matched to ambivalent words with regard to word length (Appendix B).

Results

Data in Experiment 2 were analyzed analogously to Experiment 1. We estimated effects using multilevel models with random intercepts for participants, and prime and target words. We excluded responses faster than 300ms (1.09%) and slower than 3,000ms (0.11%) resulting in 15,176 trials for analysis. To investigate differences in latencies across specific trials types, we conducted model comparisons of the null model estimating the grand mean with random intercepts for participants, prime, and target word, and a more complex model including a factor specifying the trial types of interest.

Standard evaluative priming effects

For all latency analyses, we excluded incorrect classifications (6.06%) resulting in 14,257 trials left for analysis. To correct for a skewed latency distribution, latencies were log-transformed. The model including congruency as a predictor for latencies had a significantly better model fit than the null model, both in the ambivalent primes paradigm and in the ambivalent targets paradigm. Latencies were significantly shorter for congruent trials in which prime and target valence matched as compared to incongruent trials in which prime and valence did not match. All statistics of the estimated multilevel models and model comparisons are displayed in the middle panel of Table 2.

Ambivalent primes paradigm

Latencies. The upper panel of Table 4 shows the results of the multilevel models and model comparisons. In a first step, we compared trials including ambivalent primes with congruent trials, that is, trials in which both prime and target were positive, or both prime and target were negative. The model including a factor coded zero for ambivalent trials and one for congruent trials to predict latencies had a marginally better model fit than the null model.

Participants were significantly slower to respond to trials including ambivalent primes as compared to congruent trials. Next, we compared trials including ambivalent trials with those including neutral primes. There was no difference in model fit between the more complex model containing a factor coded *zero* for ambivalent trials and *one* for neutral trials, and the null model. Thus, latencies for ambivalent trials did not differ significantly from trials including neutral primes. Similarly, there was no difference in the model including a predictor coded *zero* for ambivalent trials and *one* for incongruent trials, and the null model. The effect indicates that participants were equally slow in responding to ambivalent and incongruent trials. Mean latencies and standard errors can be found in Figure 4.[5]

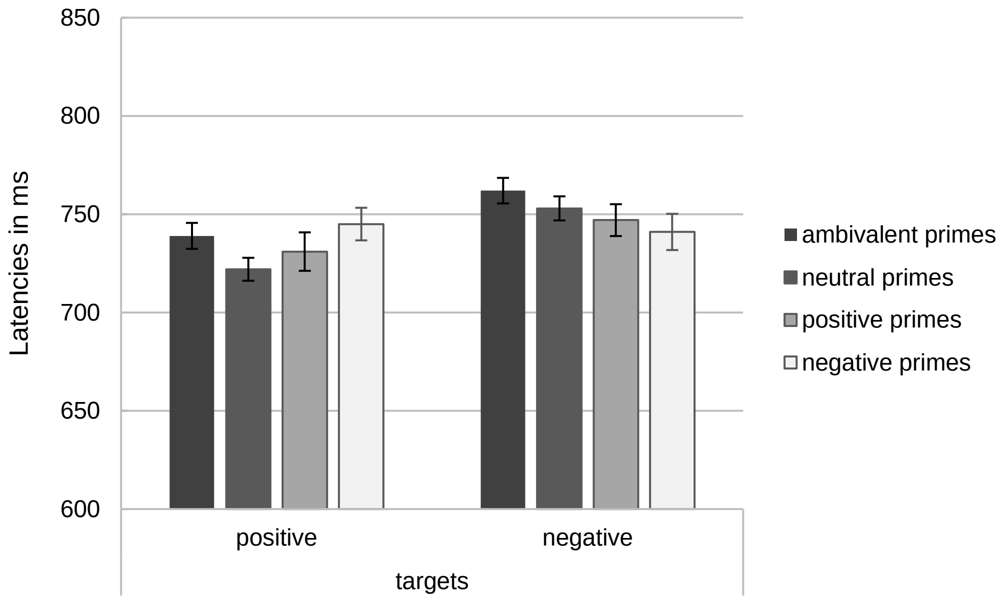

Figure 4. Mean latencies and standard errors in Experiment 2 depending on prime type and target type in the ambivalent primes paradigm.

[5] We performed analogous tests on the error rates. We compared a model including a factor coded zero for ambivalent trials and one for congruent trials with the null model. The two models did not differ in model fit, PB-test(1) = .38, p = .56, indicating that error rates did not differ for ambivalent and congruent trials. Similarly, no difference was found between the null model and a model comparing ambivalent and neutral trials, PB-test(1) = .01, p = .93. In contrast, a model including a factor coded zero for ambivalent trials and one for incongruent trials had a significantly better model fit than the null model, PB-test(1) = 4.96, p = .03, indicating that error rates were higher for incongruent as compared to ambivalent trials, B = .02, SE = .01, t = 2.27.

Ambivalent targets paradigm

Latencies. Figure 5 shows mean latencies and standard errors for all trials. We first tested whether latencies for ambivalent trials were higher than latencies for congruent trials. The more complex model including a factor coded *zero* for ambivalent trials and *one* for congruent trials predicted the data significantly better than the null model. Participants were significantly faster at classifying targets in congruent trials as compared to ambivalent trials. A model including a factor coded *zero* for ambivalent trials and *one* for incongruent trials fitted the data marginally better than the null model. The more complex model revealed that latencies in trials including ambivalent targets were marginally higher than in incongruent trials. In a next step, we checked whether latencies for ambivalent targets differed depending on whether a valent or a neutral prime preceded the target. The model including a factor coded *zero* for trials in which ambivalent targets were preceded by neutral primes and *one* for trials in which ambivalent targets followed valent primes did not differ from the null model in terms of model fit. Analogously, latencies did not differ for ambivalent targets depending on the preceding prime type. The bottom panel of Table 4 provides an overview on weights, standard errors, and *t*-values of the estimated multilevel models, as well as the results of the model comparisons in the ambivalent targets paradigm.

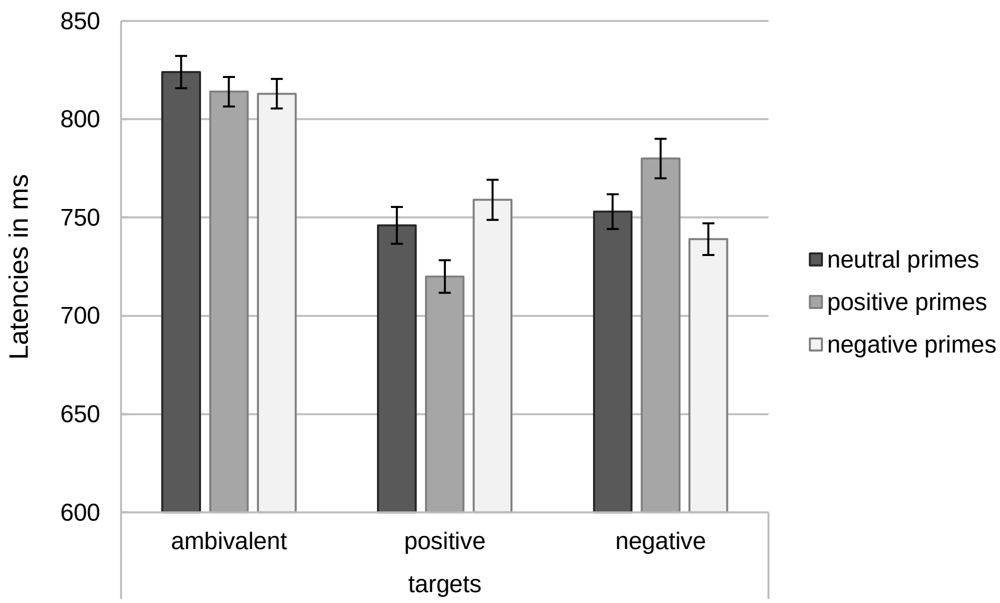

Figure 5. Mean latencies and standard errors in Experiment 2 depending on prime type and target type in the ambivalent targets paradigm.

Table 4
Results from the multilevel models and model comparisons estimated to test our hypotheses in Experiment 2

Paradigm	Comparison		*Multilevel models*			*Model comparisons*	
	Condition 1 (M, SD, number of observations)	Condition 2 (M, SD, number of observations)	*B*	*SE*	*t*	PB-test(1)	*p*
ambivalent primes paradigm	ambivalent trials (750, 224, 2338)	congruent trials (736, 231, 1181)	-.02	.01	-2.06	4.04	.05
	ambivalent trials (750, 224, 2338)	neutral trials (737, 205, 2337)	-.01	.01	-1.58	2.47	.15
	ambivalent trials (750, 224, 2338)	incongruent trials (746, 196, 1146)	-.00	.01	-.03	.00	.98
ambivalent targets paradigm	ambivalent trials (817, 276, 3800)	congruent trials (730, 198, 1166)	-.10	.03	-3.79	11.03	.01
	ambivalent trials (817, 276, 3800)	incongruent trials (769, 240, 1125)	-.05	.03	-1.98	3.82	.06
	valent primes – ambivalent targets (824, 292, 1267)	neutral primes – ambivalent targets (814, 267, 2533)	-.01	.01	.07	.81	.39

Note. All statistics are based on the analysis of log-transformed latencies.

Response frequencies. Ambivalent targets were equally often categorized as positive and negative, t(3799) = .39, p = .70. Ambivalent targets were classified as positive in 50.32% of the trials and as negative in 49.68% of the trials. A model including the factor prime type to predict categorization of ambivalent targets had a significantly better model fit than the null model, PB-test(1) = 3.70, p = .04. Prime type predicted the categorization of ambivalent targets in the direction that ambivalent targets were more often categorized as being positive if they were preceded by a positive prime and vice versa, B = .03, SE = .02, t = 1.92. Moreover, the model including a factor coded *zero* for when the categorization of ambivalent targets did not match the prime valence, and *one* for when the categorization was in line with the prime valence, predicted latencies marginally better than the null model, PB-test(1) = 3.24, p = .08. Responses tended to be faster if the categorization of the ambivalent target was in line with the prime valence, B = -.02, SE = .01, t = -1.80.

The relation between direct and indirect measures

Table 5 shows means and standard deviations for the direct attitude ratings. In order to attain a measure for potential ambivalence, ratings for positivity and negativity were combined into the Griffin index (Thompson et al., 1995) of the form (P + N)/2 – |P – N|, where P is the rating for positivity and N is the rating for negativity. Higher values of the index indicate higher degrees of potential ambivalence, values around zero indicate neutrality and negative values indicate univalence.

Ambivalent primes paradigm. We analogously checked whether latencies can be predicted from the potential and felt ambivalence measures in the ambivalent primes paradigm. Model fit did not improve after stepwise inclusion of the Griffin index, PB-test(1) = .81, p = .41, felt ambivalence ratings, PB-test(1) = .20, p = .65, and their interaction, PB-test(1) = 1.03, p = .32.

Ambivalent targets paradigm. To investigate whether latencies in the ambivalent targets paradigm can be predicted from direct potential and felt ambivalence measures, respectively, we applied parametric bootstrapping. The full model including main effects for the z-standardized Griffin index and felt ambivalence ratings, and their interaction, proved to have the best model fit, PB-test(1) = 8.43, $p < .01$. The model revealed significant main effects for both direct ambivalence measures, and a significant interaction. Latencies increased significantly with increasing values of the Griffin index, $B = .02$, $SE = .00$, $t = 3.48$, indicating that the stronger the opposing valent associations of an attitude objects are, the slower were responses in the priming task. Similarly to the potential ambivalence measure, latencies increased significantly with increasing values of self-reported felt ambivalence, $B = .02$, $SE = .00$, $t = 3.69$.[6] We also observed a significant interaction between potential and felt ambivalence that indicates a mutual reinforcement of these self-reported measures of ambivalence, $B = .01$, $SE = .00$, $t = 2.92$.

Table 5

Means (standard deviations) for positivity ratings, negativity ratings, Griffin index as an indicator for potential ambivalence, and felt ambivalence in Experiment 2.

Stimulus type	Positivity rating	Negativity rating	Potential ambivalence	Felt ambivalence
ambivalent	54.26 (32.22)	51.38 (30.55)	16.66 (38.42)	50.42 (31.11)
positive	95.29 (11.58)	9.56 (18.37)	-33.77 (26.66)	12.67 (23.68)
negative	19.92 (26.99)	81.47 (24.83)	-15.22 (40.18)	25.30 (29.94)

Discussion

Experiment 2 overcame the methodological limitations of Experiment 1, and again found consistently higher latencies for ambivalent trials as compared to congruent trials in both paradigms (support for $H1_{primes}$ and $H1_{targets}$), therefore indicating response deceleration rather than acceleration. Furthermore, latencies in ambivalent trials were marginally higher than

[6] We also calculated correlation coefficients to allow comparability with related papers. The analyses for the ambivalent targets paradigm yielded highly significant positive correlations between the Griffin index and mean latencies, $r(1270) = .20$, $p < .001$, self-reported felt ambivalence and mean latencies, $r(1270) = .20$, $p < .001$, and the two direct ambivalence measures, $r(1278) = .62$, $p < .001$.

(support for $H2_{targets}$; ambivalent targets paradigm) or comparable to (support for $H3_{primes}$; ambivalent primes paradigm) those in incongruent trials. Latencies were comparable for ambivalent and neutral primes in the ambivalent primes paradigm (no support for $H2_{primes}$). Participants were not faster to categorize ambivalent targets in general (support for $H3b_{targets}$ and rejection of $H3a_{targets}$). However, this time they tended to base their categorization of ambivalent targets on the prime valence (some support for $H5_{targets}$), which marginally decreased their latencies in those trials (some support for $H6_{targets}$). This finding can be considered weak evidence that the interpretation of ambivalent stimuli is indeed flexible with regard to contextual cues helping to resolve the ambivalence.

Experiment 2 also investigated the relation between self-reported ambivalence measures and priming data. In the ambivalent targets paradigm, latencies were strongly predicted by both potential and felt ambivalence measures. Specifically, latencies increased with increasing ambivalence on direct measures. In contrast, no relation was found between the direct ambivalence ratings and latencies when the ambivalent words served as primes.

Experiment 3

Experiments 1 and 2 provided evidence for the unintentional, simultaneous activation of positive and negative associations in ambivalent stimuli (ambivalent primes paradigm). Experiment 3 served to further strengthen the automaticity assumption by repeating Experiment 2, but this time with a longer SOA of 450ms. As automatic activation is generally short-lived, no reliable priming effects are expected to occur using an SOA of this length (e.g., Klauer & Musch, 2003). We therefore did not expect evaluative priming effects in this experiment. Consequently, we expected response deceleration in ambivalent trials to disappear in the ambivalent primes paradigm ($H4_{primes}$). In contrast, however, we still expected to find increased latencies when categorizing ambivalent trials in the ambivalent targets paradigm ($H4_{targets}$). This is because, in order to deliberately categorize ambivalent targets, the valence conflict still has to be resolved (Garner, 1962; Katz, 1981).

Method

Participants. We determined the required sample size a-priori using G*Power (Faul et al., 2007). Power analysis was based on the standard evaluative priming effect in Experiment 2, for which effect size was estimated with a repeated-measures ANOVA. The effect size was small with f = .10, so that we applied the same considerations as in the previous experiments. We collected data of N = 77 participants (59 female) to reach a sample size comparable to Experiments 1 and 2. On average, participants were M = 23.38 years old (SD = 6.08) and participated in exchange for course credit or 3.00 EUR (approx. 3.50 USD).

Design, materials, and procedure. Design and materials were identical to Experiment 2. The only procedural difference was a prolonged SOA of 450ms. We implemented this long SOA by including a blank screen of 300ms following the prime and preceding the target, while keeping the presentation time of the prime word constant at 150ms.

Results

Data collected in Experiment 3 were analyzed as in the previous experiments. We excluded responses faster than 300ms (1.83 %) and slower than 3,000ms (0.14 %), resulting in 14,492 trials for analysis.

Standard evaluative priming effects

We again excluded incorrect classifications (5.31%) for latency analyses resulting in 13,722 trials. Latencies were log-transformed. The model including congruency as a predictor for latencies did not differ from the null model, neither in the ambivalent primes paradigm, nor in the ambivalent targets paradigm. That is, latencies did not differ anymore between congruent and incongruent trials, under the now longer SOA. The lower panel of Table 2 provides the statistics of the estimated multilevel models and model comparisons.

Ambivalent primes paradigm

Latencies. Figure 6 depicts mean latencies and standard errors for all trial types. None of the more complex models differed from the null model in terms of model fit, indicating that there were no differences in latencies between trials including ambivalent primes and

Table 6

Results from the multilevel models and model comparisons estimated to test our hypotheses in Experiment 3

Paradigm	Comparison		Multilevel models			Model comparisons	
	Condition 1 (M, SD, number of observations)	Condition 2 (M, SD, number of observations)	*B*	*SE*	*t*	PB-test(1)	*p*
ambivalent primes paradigm	ambivalent trials (661, 206, 2261)	congruent trials (664, 224, 1142)	-.00	.01	-.24	.06	.81
	ambivalent trials (661, 206, 2261)	neutral trials (661, 202, 2292)	.00	.01	.27	.08	.80
	ambivalent trials (661, 206, 2261)	incongruent trials (667, 204, 1120)	.01	.01	.85	.74	.39
ambivalent targets paradigm	ambivalent trials (773, 271, 3590)	congruent trials (690, 223, 1092)	-.10	.03	-3.85	11.29	.01
	ambivalent trials (773, 271, 3590)	incongruent trials (696, 212, 1099)	-.10	.03	-3.48	9.71	.01
	valent primes – ambivalent targets (772, 271, 2376)	neutral primes – ambivalent targets (776, 272, 1214)	-.01	.01	-1.02	1.05	.28

Note. All statistics are based on the analysis of log-transformed latencies.

trials, trials including ambivalent primes and neutral trials, and trials including ambivalent primes and incongruent trials. The results of the multilevel models and the model comparisons can be found in the upper panel of Table 6.[7]

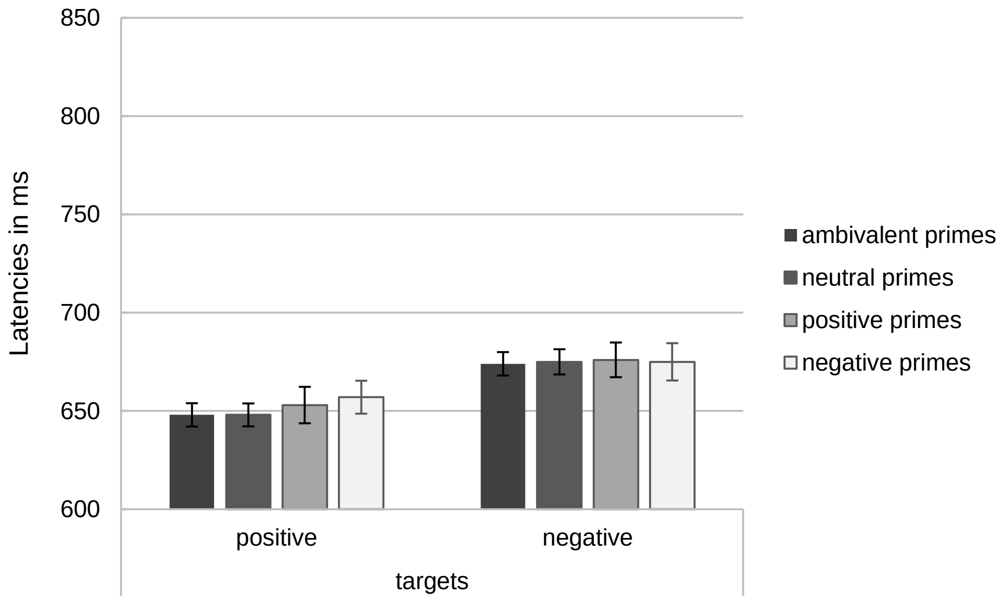

Figure 6. Mean latencies and standard errors in Experiment 3 depending on prime type and target type in the ambivalent primes paradigm.

Ambivalent targets paradigm

Latencies. Figure 7 shows mean latencies and standard errors for all trials. Parametric bootstrapping revealed that the more complex model including a factor coded *zero* for ambivalent trials and *one* for congruent trials predicted the data significantly better than the null model. Participants were significantly faster at classifying targets in congruent trials as compared to ambivalent trials. Similarly, a model including a factor coded *zero* for ambivalent trials and *one* for incongruent trials predicted the data significantly better than the null model. The more complex model revealed that latencies in trials including ambivalent targets were

[7] Analyses of the error rates in the ambivalent primes paradigm revealed no differences between ambivalent and congruent trials, PB-test(1) = .38, p = .56, no difference between ambivalent and neutral trials, PB-test(1) = .01, p = .93, but a significantly significant difference between ambivalent and incongruent trials, PB-test(1) = 4.96, p = .03. Participants committed significantly more errors in incongruent as compared to ambivalent trials, B = .02, SE = .01, t = 2.27.

marginally higher than in incongruent trials. Again, we investigated whether a valent versus neutral prime affected latencies for ambivalent targets. The more complex model did not differ from the null model, indicating that latencies in the two conditions were comparable. The results of the multilevel models and the model comparisons are displayed in the lower panel of Table 6.

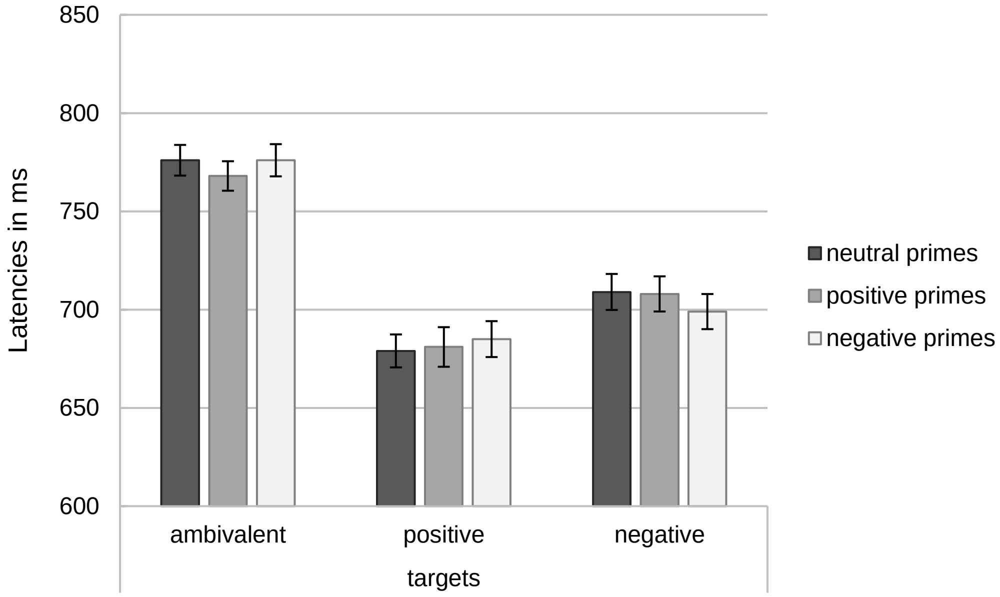

Figure 7. Mean latencies and standard errors in Experiment 3 depending on prime type and target type in the ambivalent targets paradigm.

Response frequencies. Ambivalent targets were categorized as “positive” more often than “negative,” $t(3589) = 3.04$, $p < .01$. Ambivalent targets were classified as being positive in 52.53% of the trials and as being negative in 47.47% of the trials. A model including the factor prime type to predict categorization of ambivalent targets did not differ significantly from the null model, PB-test(1) = 2.10, $p = .15$.That is, prime valence did not predict the categorization of ambivalent targets.

Effect comparison across Experiments 1, 2 and 3

To further investigate the null effect of ambivalent trials as compared to congruent trials obtained in the ambivalent primes paradigm in this experiment, we ran an additional analysis across Experiments 1, 2, and 3. We conducted stepwise model comparisons of the null model with the models including the trial type (coded *zero* for ambivalent trials and *one* for congruent trials), the SOA (coded *zero* for 150ms and *one* for 450ms), and their interaction. The model including the two main effects and the interaction had the best model fit, PB-test(1) = 4.25, p = .04. A main effect of trial type indicated that across the three experiments, latencies for ambivalent trials were higher than those for congruent trials, B = -.02, SE = .01, t = -4.05. Moreover, latencies were significantly higher in the experiments implementing a short SOA of 150ms as compared to a long SOA of 450ms, B = -.10, SE = .01, t = -16.10. Most importantly, a significant interaction between trial type and SOA indicated a larger difference in latencies between the trial types in the short SOA condition (Experiments 1 and 2) as compared to the long SOA condition (Experiment 3), B = .02, SE = .01, t = 2.06.

The relation between direct and indirect measures

We investigated the relation between direct and indirect measures of ambivalence applying the same approach as in Experiment 2.[8] Means and standard deviations of all direct measures are reported in Table 7.

Ambivalent primes paradigm. We followed the same procedure to examine relations between latencies in the categorical priming paradigm and direct ambivalence ratings in the ambivalent primes paradigm. Model fit did not differ between the null model and a model including the potential ambivalence measure, PB-test(1) = .27, p = .61, the felt ambivalence measure, PB-test(1) = .06, p = .81, and their interaction, PB-test(1) = .07, p = .80.

Ambivalent targets paradigm. The model including main effects for both the z-standardized Griffin index and felt ambivalence ratings had the best model fit, PB-test(1) = 25.46, p = .001, indicating that both main effects were significant. Latencies increased significantly with increasing values of the Griffin index, B = .02, SE = .00, t = 4.22. Similarly, latencies increased significantly with increasing self-reported felt ambivalence, B = .02, SE

[8] Correlational analyses for the ambivalent targets paradigm yielded highly positive coefficients between the Griffin index and mean latencies, $r(1218) = .19$, $p < .001$, felt ambivalence ratings and mean latencies, $r(1218) = .21$, $p < .001$, and the two direct measures, $r(1230) = .63$, $p < .001$.

= .00, t = 3.69, indicating that higher values of felt ambivalence co-occur with higher latencies. There was no interaction between the two direct measures, PB-test(1) = .91, p = .34.

Table 7

Means (standard deviations) for positivity ratings, negativity ratings, Griffin index as an indicator for potential ambivalence, and felt ambivalence in Experiment 3.

Stimulus type	Positivity rating	Negativity rating	Potential ambivalence	Felt ambivalence
ambivalent	54.66 (33.98)	53.02 (30.99)	18.46 (39.19)	49.30 (32.43)
positive	95.01 (14.41)	11.94 (21.04)	-30.74 (32.09)	12.26 (22.44)
negative	15.47 (24.10)	81.99 (24.74)	-22.07 (34.05)	21.84 (28.57)

Discussion

With a longer SOA of 450ms, the standard evaluative priming effect consistently obtained in Experiments 1 and 2 disappeared in both priming paradigms. This finding further supports the growing body of research demonstrating the absence of reliable priming effects with SOAs larger than 300ms (Hermans et al., 2001; Klauer & Musch, 2003; Klauer et al., 1997).

Along with this finding, no response deceleration was found in ambivalent trials in comparison to congruent, neutral, and incongruent trials in the ambivalent primes paradigm (support for $H4_{primes}$). These findings support the notion that the patterns of activation obtained for ambivalent primes in Experiments 1 and 2 occur automatically and therefore do not generalize to long SOAs. The elimination of this effect was additionally confirmed in a comparison across Experiments 1, 2, and 3, which revealed a significant interaction between trial type and length of SOA.

In the ambivalent targets paradigm, in contrast, we still obtained higher latencies for ambivalent targets as compared to univalent targets with the long SOA (support for $H4_{targets}$). Moreover, direct ambivalence ratings predicted latencies in the ambivalent targets paradigm indicating that latencies increase with both increasing felt ambivalence and increasing potential ambivalence. The most parsimonious explanation across all first three experiments is that this effect is mainly due to the deliberate resolving of the ambivalence when ambivalent stimuli serve as targets. While this pattern of results suggest a strong contribution of deliberate processes for the occurrence of the deceleration effect in the ambivalent targets paradigm, it should be noted that we cannot rule out the possibility that automatic processes further contributed to the effect as measures are hardly ever process-pure (cf. Hütter & Klauer, 2016).

Experiment 4

Theories of ambivalence assume that ambivalence entails a conflict that individuals are spontaneously motivated to resolve (e.g., Priester & Petty, 1996). Resolving this response conflict requires the inhibition of one of the two valences (Logan, 1980), which in turn requires cognitive resources and time (Garner, 1962; Katz, 1981). The question arises, however, whether such an evaluative conflict is unconditionally elicited upon merely encountering ambivalent objects. If it is, a general slowing down in responses should be observed independent of the nature of the target-related task. Alternatively, the slowing down observed in the previous experiments under short SOAs may reflect conflicts arising only at the response expression stage. If this is the case, then no slowing down should be observed anymore when using a target-related task that is immune to such response expression conflicts.

Experiment 4 provides a direct test of whether the slowing down elicited by ambivalent primes at short SOAs is unconditional ($H5b_{primes}$) *versus* due to a task-relevant conflict ($H5a_{primes}$). For that purpose, we applied a valent/neutral categorization task (Werner & Rothermund, 2013) that removes the conflict during response execution while still requiring the processing of valence to complete the task (cf. Spruyt et al., 2007, 2009). The paradigm follows a similar logic as the evaluative priming paradigm with the critical difference that target words are either univalent or neutral and have to be classified along this dimension. Accordingly, target words are either univalent (i.e., positive or negative) or neutral, while primes may be neutral, univalent, or ambivalent. The typical result obtained in this task consists in shorter latencies in compatible trials (i.e., trials in which both prime and target are valent or both prime and target are neutral) as compared to incompatible trials. The latter attests to the fact that valence is processed in this task. In the valent/neutral categorization task, however, both positivity and negativity converge to the same (‘valent’) response. Consequently, the absence of priming effects in this paradigm demonstrates the important role played by response priming in the evaluative priming paradigm.

Method

Participants. We collected data from N = 80 university students, three of which were excluded from data analysis due to error rates of 45% or higher indicating guessing behavior. The remaining 77 participants (64 female) were *M* = 23.27 years on average (*SD* = 4.37).

Design. In Experiment 4, we only conducted a paradigm in which ambivalent stimuli served as primes. The experiment employed a 4 (prime type: ambivalent vs. positive vs. negative vs. neutral) × 3 (target type: positive vs. negative vs. neutral) design. Key assignment (A = ‘positive or negative’ and L = ‘neither positive nor negative’, and vice versa) was counterbalanced across participants.

Materials. We selected two sets of verbal material serving as primes or targets, respectively (Appendix C). We used nouns as primes and adjectives as target words. Primes consisted of the eight ambivalent words used in the previous experiments, four positive and four negative words, and sixteen neutral words from the Berlin Affective Word List (Võ, Jacobs, & Conrad, 2006). We further matched all four prime types for word length and word frequency (Brysbaert et al., 2011). Targets consisted of eight positive, eight negative, and sixteen neutral words from a standardized pool created by Schwibbe, Röder, Schwibbe, Borchardt, and Geiken-Pophanken (1981). Target types were matched for word length and word frequency (Brysbaert et al., 2011).

Each prime and target word was used eight times to ensure equal exposure to all stimuli. The combination and number of different trial types was designed to control for all relevant aspects of the paradigm. Base rates were kept equal for (1) response-compatible (i.e., valent prime and target, or neutral prime and target) and response-incompatible trials (i.e., valent prime and neutral target, or neutral prime and valent target), (2) for evaluatively congruent (i.e., positive prime and target, or negative prime and target) and incongruent trials (i.e., positive prime and negative target, or negative prime and positive target), (3) for univalent and ambivalent primes as well as univalent and neutral primes, and (4) for univalent and neutral targets. The experiment consisted of 256 trials in total, which were divided into two blocks of 128 trials each with equal baserates in both blocks.

Procedure. As in the previous experiments, instructions and tasks were administered by a customized Visual Basic program. Participants were instructed to classify the presented words as either belonging to the category ‘positive or negative’ or to the category ‘neither positive, nor negative’ as fast and accurately as possible. Participants were informed that each target word would be preceded by another word. They were further informed that the presentation time of the first word was so short that they might not be able to identify it and that they may simply ignore it. Participants were instructed to press one of two keys to categorize the targets. All other parameters of the evaluative priming paradigm were identical to Experiments 1 and 2.

Participants started with a practice block consisting of 24 trials. Subsequently, they completed the first block consisting of 128 trials. After finishing the first block, they were informed that a second, identical block would follow. Participants were offered a short break and asked to start the second block as soon as they were ready. Finally, they provided ratings of potential and felt ambivalence for all nouns and adjectives.

Results

We excluded responses faster than 300ms (0.10%) and slower than 3,000ms (0.22%) resulting in 19,649 trials for analysis.

Standard compatibility and evaluative priming effects

The results of the multilevel models and model comparisons that were conducted to investigate the standard compatibility and evaluative priming effects are displayed in the upper half of Table 8.

Response compatibility effect. We excluded wrong classifications (9.01%), that is, trials in which the ‘positive or negative’ key was pressed when the target was neutral and trials in which the ‘neither positive, nor negative’ key was pressed when the target was positive or negative, resulting in 17,879 trials for analysis. Furthermore, latencies were log-transformed to correct for a skewed distribution. We first tested whether this paradigm produced standard compatibility effects, that is, faster responses in trials where prime and target were both valent or both neutral as compared to incompatible trials. For this analysis, we excluded all trials containing ambivalent primes.[9] We compared the null model with a model that included the main effect of compatibility. Parametric bootstrapping revealed a significantly better model fit for the more complex model, indicating the expected compatibility effect.[10]

Evaluative priming effect. To test for an evaluative priming effect, we compared the subset of trials including a match between prime and target valence (i.e., both positive or both negative) with those including a mismatch (i.e., prime positive and target negative, or vice versa). The more complex model including the factor congruency did not fit better than the null model indicating that evaluative priming did not predict latencies in the valent/neutral categorization task.

Effects of ambivalent stimuli

Latencies. To test whether the valence conflict inherent to ambivalent stimuli slows down responses in the absence of a response conflict, we separately compared compatible and incompatible trials with univalent versus ambivalent primes. First, we looked at the subset of compatible trials containing univalent targets. Within these trials, we compared trials with univalent versus ambivalent primes. The more complex model including a factor coded *zero* for ambivalent primes and *one* for univalent primes did not differ from the null model in terms

[9] An analysis of the compatibility effect including trials with ambivalent primes also showed a significantly better model fit for the model including compatibility as a predictor for latencies, PB-test(1) = 8.45, $p < .01$, participants were significantly faster in compatible as compared to incompatible trials, $B = -.01$, $SE = .00$, $t = -2.91$.

[10] The exclusion of ambivalent trials in the analysis of the standard compatibility effect produces unequal numbers of observations across target type conditions. Because target types differed in mean latencies with neutral trials being slower (M = 762ms, SD = 237ms) than positive (M = 720ms, SD = 231ms) and negative (M = 749ms, SD = 244ms) target conditions, the unequal numbers of observations bias the mean. Specifically, as there is a disproportionately high number of neutral trials in the compatible condition, the simple average that does not account for trial type suggests that latencies were not shorter in the compatible as compared to the incompatible condition (cf. Table 8).

Table 8

Results from the multilevel models and model comparisons estimated to validate the paradigm (upper panel) and to test our hypotheses (lower panel) in Experiment 4

	Comparison		*Multilevel models*			*Model comparisons*	
	Condition 1 (M, SD, number of observations)	Condition 2 (M, SD, number of observations)	*B*	*SE*	*t*	PB-test(1)	*p*
Validation	compatible trials (749, 239, 6748)	incompatible trials (747, 237, 6674)	-.01	.00	-2.91	7.67	.01
	congruent trials (732, 246, 1130)	incongruent trials (733, 233, 1116)	-.00	.01	-.28	.08	.76
Comparison of ambivalent and univalent trials	ambivalent prime – valent target (737, 241, 2253)	univalent prime – valent target (733, 240, 2246)	-.00	.01	-.42	.19	.66
	ambivalent prime – neutral target (768, 237, 2204)	univalent prime – neutral target (772, 236, 2202)	.01	.01	.72	.54	.48

Note. All statistics are based on the analysis of log-transformed latencies.

of model fit. Thus, univalent and ambivalent primes did not differ in their effects on latencies in compatible trials. Next, we compared the same two models in the subset of incompatible trials containing neutral targets. Again, the more complex model did not increase model fit significantly, indicating that also on incompatible trials, univalent and ambivalent primes did not affect latencies differently. Figure 8 shows mean latencies and standard errors for all trial types, the results of the corresponding multilevel models and model comparisons are reported in the lower half of Table 8.[11]

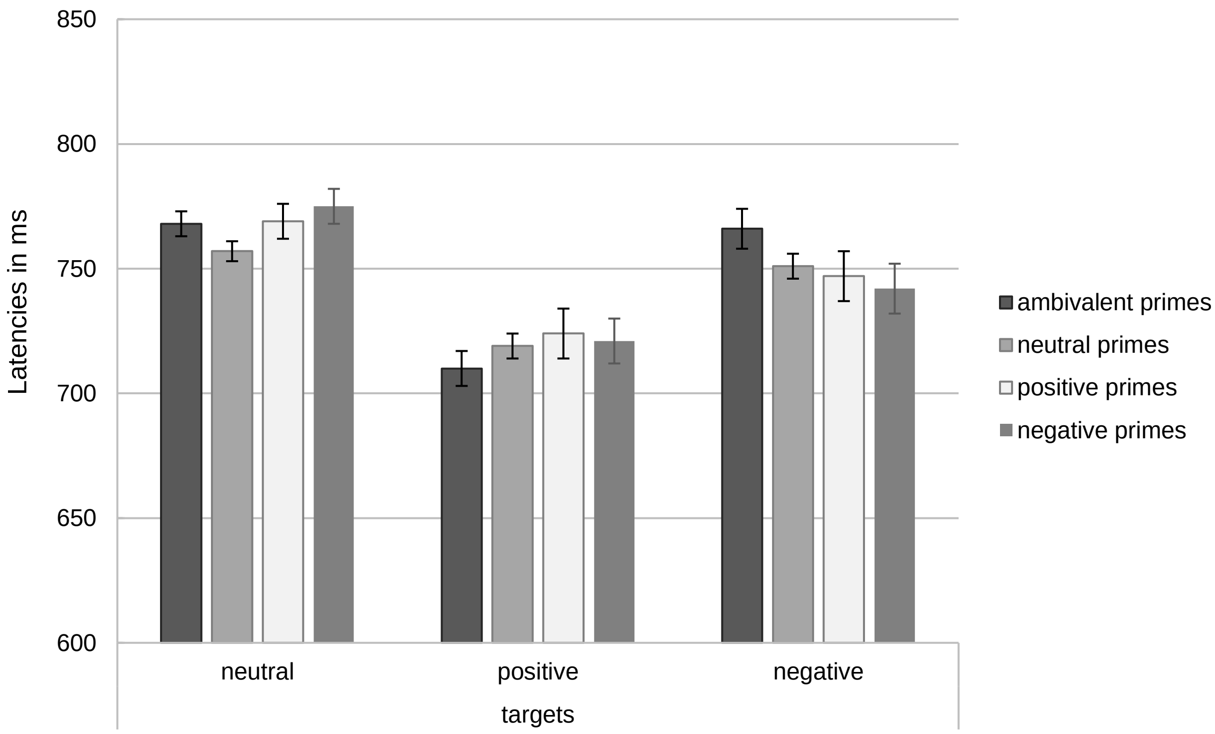

Figure 8. Mean latencies and standard errors in the valent/neutral categorization task (Experiment 4) depending on prime type and target type.

Effect comparison across Experiments 1, 2 and 4

In order to further investigate the absence of decelerated response times for compatible trials including ambivalent primes as compared to univalent (positive or negative) primes in

[11] We conducted analyses of error rates that were analogous to the analyses of latencies. Ambivalent and univalent primes did not differ in their influence on error rates, neither in compatible trials, PB-test(1) = .38, *p* = .53, nor in incompatible trials, PB-test(1) = .00, *p* = .97.

Experiment 4, we completed an additional analysis across Experiments 1, 2, and 4. We conducted stepwise model comparisons of the null model with the models including the trial type (coded *zero* for trials including ambivalent primes and *one* for congruent trials in Experiments 1 and 2, and trials including univalent primes in Experiment 4, respectively), the task type (coded *zero* for the valent/neutral categorization task and *one* for the evaluative priming paradigm), and their interaction. The model with the best model fit included only an interaction of trial and task type, PB-test(1) = 4.38, p = .04. Consistent with predictions, the interaction effect attested to a significantly larger difference between ambivalent and congruent trials in the evaluative priming task (Experiments 1 and 2) as compared to the valent/neutral categorization task (Experiment 4), B = -.02, SE = .01, t = -2.09.

The relation between direct and indirect measures

Table 9 shows mean values and standard deviations of the Griffin index as a measure of potential ambivalence and felt ambivalence ratings for prime and target words, respectively. Because descriptive statistics suggested differences in felt ambivalence ratings for neutral and valent stimuli, we conducted two additional analyses. First, we compared the null model with a more complex model in which felt ambivalence ratings were predicted by the stimulus type (coded *zero* for neutral stimuli and *one* for positive or negative stimuli) independent of the role (i.e., prime or target). The more complex model had a significantly better model fit, PB-test(1) = 11.65, p < .01. Neutral stimuli were reported to be experienced significantly more ambivalent than univalent stimuli, B = -6.06, SE = 1.70, t = -3.56. Second, we compared the null model with a model including a predictor testing neutral stimuli against ambivalent stimuli (coded *zero* for neutral stimuli and *one* for ambivalent stimuli). Again, the more complex model had a better model fit, PB-test(1) = 37.96, p = .001. Ambivalent stimuli had significantly higher felt ambivalence ratings than neutral stimuli, B = 21.18, SE = 2.69, t = 7.86.

In order to investigate whether latencies could be predicted from the direct ambivalence measures, we conducted stepwise model comparisons. Potential and felt ambivalence ratings were z-standardized and centralized before being included in the models. The more complex models did not increase the model fit as compared to the null model for the ambivalence ratings

Table 9

Means (standard deviations) for the Griffin index as an indicator for potential ambivalence, and felt ambivalence separately for prime and target words in Experiment 4.

	Primes		Targets	
Stimulus type	Potential ambivalence	Felt ambivalence	Potential ambivalence	Felt ambivalence
ambivalent	18.63 (37.81)	40.30 (33.85)		
neutral	3.37 (20.24)	16.36 (26.91)	7.00 (23.23)	20.34 (29.64)
positive	-30.77 (31.85)	10.78 (20.39)	-29.41 (33.63)	12.12 (22.02)
negative	-23.42 (32.18)	15.85 (24.81)	-31.78 (24.60)	11.92 (20.91)

of the *prime*, indicating that latencies could not be predicted from self-reported potential ambivalence, PB-test(1) = 1.68, p = .20, felt ambivalence, PB-test(1) = .93, p = .35, or their interaction, PB-test(1) = .01, p = .94. Latencies were however predicted well by the felt ambivalence reported for the target words, PB-test(1) = 31.83, p = .001. Specifically, latencies increased with increasing felt ambivalence ratings of the targets, B = .01, SE = .00, t = 6.01. There was no increase in model fit when including potential ambivalence, PB-test(1) = .16, p = .70. Also no interactions regarding self-reported prime and target ambivalence improved the model fit compared to the null model, neither for the felt ambivalence ratings, PB-test(1) = 1.87. p = .18, nor for potential ambivalence, PB-test(1) = 1.41, p = .27.[12]

Discussion

Experiment 4 relied on a valent/neutral categorization task to investigate whether the deceleration effects of ambivalent stimuli shown in two experiments and two paradigms are due to an evaluative conflict occurring at the exposure stage or at the level of response

[12] Correlational analyses yielded a significant correlation between felt ambivalence ratings for the target words and mean latencies, $r(17877) = .07$, $p < .001$, and significant coefficients between ratings of potential and felt ambivalence for the primes (nouns, including ambivalent materials), $r(17877) = .52$, $p < .001$, and for the targets (adjectives, no ambivalent materials, $r(17877) = .51$, $p < .001$.

execution. Of note, we replicated the expected response compatibility effect (i.e., faster responses when prime and target were both neutral or both valent), therefore attesting to the success of the implementation of the valent/neutral categorization task. Moreover, our findings confirm that attention to valence alone does not produce evaluative priming effects (Werner & Rothermund, 2013; Rothermund & Werner, 2014).

Crucially, this task excluded any response conflict for compatible stimuli, because opposing valent associations in ambivalent stimuli converge in this task to the same response production (“positive or negative”). This time, we found no difference in latencies between univalent and ambivalent primes, suggesting that the conflict at the level of response execution constitutes the main driving factor for the deceleration effect observed in Experiments 1 and 2 (support for $H5a_{primes}$ and rejection of $H5b_{primes}$). The absence of an effect in Experiment 4 was further supported by an analysis conducted across Experiment 1, 2, and 4 indicating a significantly larger difference in latencies between the trial types in Experiments 1 and 2 than in Experiment 4. These results suggest that the unintentional and simultaneous activation of positivity and negativity from ambivalent stimuli does not require extra processing efforts unless a response conflict arises.

It is noteworthy that these results are in line with recent neurophysiological research showing that ambivalence is only linked to perceived negative affect (which is typically taken as indication of cognitive conflict) if its resolution is necessary for the task at hand (Nohlen et al., 2016). This reasoning is further supported by correlational analyses performed on self-report measures of ambivalence and latencies. In Experiments 2 and 3, self-report measures of ambivalence were highly correlated with the latencies in trials containing ambivalent targets, self-reported felt ambivalence of the target words. In contrast, neither felt ambivalence nor potential ambivalence of the prime words predicted latencies in the valent/neutral categorization task of Experiment 4.

However, higher ratings of felt ambivalence of the target words were related to slower responses in this task. This effect may indicate that many words and concepts entail both positive and negative aspects. However, as positivity or negativity were not task-relevant, this finding may foremost speak to a lack of discriminant validity of the felt ambivalence measure reflecting uncertainty of many different kinds, such as uncertainty stemming from a subjective lack of information. This interpretation is supported by participants reporting to feel significantly more torn toward neutral stimuli as compared to univalent stimuli in this experiment.

General Discussion

A core assumption in attitude research posits the simultaneous activation of positive and negative valence in ambivalent attitude objects. The present experiments provide the first adequate test of this assumption by using an evaluative priming paradigm in which ambivalent words served as primes. This paradigm allows for a test of a spontaneous, simultaneous activation of positivity and negativity triggered by ambivalent stimuli. In addition, an evaluative priming paradigm that employed ambivalent materials as targets served as a conceptual and extended replication of an experiment reported by De Liver and colleagues (2007), by examining the effect of univalent primes on the resolving of response conflict in ambivalent targets. Table 1 provides an overview of all hypotheses put to test in Experiments 1 to 4, and indicates whether our data yield evidence in favor or against the hypotheses.

In line with findings reported by De Liver and colleagues (2007), we consistently observed slower responses when trials contained ambivalent targets as compared to evaluatively congruent (univalent) trials. However, except for a marginal effect in Experiment 2, we generally did not find evidence that responses towards ambivalent targets were biased by prime valence, thereby contradicting findings by De Liver and colleagues (2007). This discrepant finding may be due to differences in the materials. Unfortunately, the paper by De Liver and colleagues does not contain information on the criteria according to which ambivalent materials were selected. Another reason may be that the activation of prime valence is too short-lived (as indicated by the results of Experiment 3) to influence the resolution of strong response conflicts elicited by ambivalent targets. Further research is needed to address these explanations that are only speculative at this stage.

While the ambivalent targets paradigm demonstrates that ambivalence is processed when the task requires its resolution, these effects are not informative regarding the simultaneous activation of ambivalent attitudes, which was the main question of interest for this research. In order to address the latter question, we used an ambivalent primes paradigm. Here too, we observed a general slowing of responses following ambivalent primes. Hence, in this paradigm, we also did not find evidence for acceleration effects, this time contradicting the findings by Petty et al. (2006). As explained in the introduction, however, Petty et al. (2006) relied on an evaluative priming paradigm that implemented an unreliable SOA and the lack of a baseline condition prevents a clear interpretation of the data. However, consistent with the co-activation assumption by Petty et al. (2006), our findings support the view that the activation of opposite valences occurs simultaneously and in an unintentional manner. Yet, these findings may be conditional on a focus on valence that was implemented in all our experiments (Spruyt et al., 2007, 2009; Werner & Rothermund, 2013).

Experiment 3 further tested our interpretation that the slowing down occurs in a (conditionally) automatic manner in the ambivalent primes paradigm, but is of more deliberate nature in the ambivalent targets paradigm. For that purpose, Experiment 3 employed a long SOA and compared latencies in trials containing ambivalent stimuli across the two priming paradigms. While the deceleration effect disappeared in the ambivalent primes paradigm, responses were still characterized by a general slowing in the ambivalent targets paradigm.

Experiment 4 removed the response conflict by introducing a valent/neutral categorization task (Werner & Rothermund, 2013). While we obtained a compatibility effect, which provides evidence that valence was processed in this task, no slowing of responses was observed for ambivalent primes. From this pattern, we conclude that the activation of conflicting associations in ambivalent primes does not unconditionally trigger an evaluative conflict. Rather, a conflict arises at the response expression stage in tasks that require a univalent response.

Finally, yet another goal of the present experiments was to investigate the relation between different self-report measures of ambivalence and the latencies in the sequential priming paradigms. We found that self-reported potential and felt ambivalence predict latencies in ambivalent trials in the ambivalent targets paradigm. The absence of a relationship between direct and indirect ambivalence measures in the ambivalent primes paradigm, however, speaks to the paradigm's suitability for assessing associative structures that have clear consequences for judgment, possibly outside the scope of reportability (but see below for a discussion of this issue).

Theoretical and methodological implications for ambivalence research

The empirical interest in ambivalent attitudes is primarily due to their marked status in attitude acquisition and their behavioral consequences, thereby assigning ambivalence a special role in attitude research (for reviews, see Conner & Sparks, 2002; Jonas et al., 2000; Van Harreveld, Nohlen, & Schneider, 2015). Several theoretical models have been developed to investigate the sources of intriguing discrepancies between implicit and explicit attitudes (e.g., Wilson, Lindsey, & Schooler, 2000; Petty & Briñol, 2006, 2009; Rydell & McConnell, 2006). Self-reported ambivalence has been shown to be associated with higher scrutiny in the processing of arguments related to the ambivalent attitude object (e.g., Johnson, Petty, Briñol, & See, 2017; Maio, Bell, & Esses, 1996; Petty et al., 2006) as a means of resolving attitudinal ambivalence (e.g., Bell & Esses, 2002; Priester & Petty, 2001; Van Harreveld, Van der Pligt, & De Liver, 2009). Surprisingly, despite this large interest, the central assumption stating that ambivalence in attitudes consists in the concurrent activation of positive and negative associations has remained largely untested. The present research offers strong evidence in support of this assumption.

Previous work on ambivalence has claimed that ambivalence is an aversive state that individuals are strongly motivated to resolve (e.g., Maio et al., 2000). Building on these claims, we assessed (1) whether this conflict arises automatically and (2) whether participants use the univalent primes to resolve the response conflict instigated by ambivalent targets. Across our experiments, we did not find consistent and convincing evidence for either of these assumptions. First, we have no evidence of conflict in a situation in which the task at hand does not require a univalent categorization (Experiment 4), complementing research that found indication of negative affective consequences only in settings that require the resolution of ambivalence (Nohlen et al., 2016). Nevertheless, these findings do not limit the importance of this attitudinal phenomenon. To the contrary, many situations in which individuals are confronted with their ambivalent attitudes require them to make a choice (e.g., to select or select against a job candidate, to consume or not to consume a certain food item, or to recommend or not to recommend a hotel), rendering ambivalence a consequential phenomenon that deserves theoretical and empirical attention.

Our results also have methodological implications for the study of ambivalence. We found that even the univalent and especially the neutral targets varied considerably with regard to their degree of felt ambivalence. This finding may be explained by the high conceptual proximity of felt ambivalence and uncertainty. It can be assumed that neutral words carry little information and are thus linked to higher degrees of uncertainty. Our research demonstrates that felt ambivalence measures may often assess uncertainty rather than experienced ambivalence. It is thus advisable to utilize both phenomenological and structural measures of ambivalence to do justice to the notion that uncertainty and ambivalence are distinct concepts (e.g., Clarkson, Tormala, & Rucker, 2008; Luttrell, Petty, & Briñol, 2016; Luttrell, Stillman, Hasinski, & Cunningham, 2016; Olsen, 1999; Petrocelli, Tormala, & Rucker, 2007).

We further want to point out that there are a number of paradigms that aim at measuring attitudinal ambivalence indirectly. However, for different reasons briefly discussed in this section, they are less suited to investigate the simultaneity and unintentionality assumptions put to test in the present research. The most commonly applied indirect attitude measure is the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) in which target words are categorized according to their valence. Underlying associations are inferred from differences in response latencies across experimental blocks. Critically, attitude objects share a response key with positive stimuli in one experimental block and with negative stimuli in another block. De Liver and colleagues (2007) found equally strong associations of ambivalent stimuli with positive and negative valence in an IAT. Similar to the ambivalent targets paradigm, however, the task assesses patterns of activation in a given context (i.e., whether ambivalence and positivity share a key or whether ambivalence and negativity share a key). Additionally, the IAT does not include a baseline condition, which precludes the most interesting comparison with neutral attitude objects.

Another widely applied measure that aims at identifying implicit preferences for attitude objects is the Affective Misattribution Paradigm (AMP; Payne, Cheng, Govorun, & Stewart, 2005). While the AMP is structurally similar to the sequential priming paradigm in the sense that attitude objects serve as primes and participants categorize unrelated targets, the underlying theoretical assumptions and dependent variables differ between the two paradigms. In the AMP, targets are exclusively neutral. It is assumed that the prime valence is unintentionally attributed to the target and is thereby reflected in the evaluation of the target. In contrast to the evaluative priming paradigm, the misattribution affect is neither defined in terms of response latencies nor error rates, but in the percentage of trials in which the target object was rated more pleasant than an average target object. With regard to the investigation of ambivalence, a preference rate of fifty percent for an attitude object may signify either a neutral attitude ("I neither prefer nor reject the target") or an ambivalent attitude ("I both prefer and reject the target"). Therefore, this paradigm did not seem suited for addressing our current questions.

Another paradigm we want to shortly discuss in relation to the evaluative priming paradigm is the mouse tracking paradigm developed by Schneider and colleagues (2015). In their paradigm, the authors rely on a correspondence between attitudes and motor movements. Specifically, this paradigm assesses the trajectories of the mouse when evaluating attitude objects as either "positive" or "negative" via mouse click. The paradigm visualizes whether positive or negative inclinations dominate response tendencies at a certain point in time and provides insights into the temporal dynamics of this conflict. It is less clear, however, how a simultaneous activation, that is, a constant pull toward the two responses, could be distinguished from neutral or highly uncertain attitudes. Moreover, as the paradigm requires the deliberate evaluation of ambivalent stimuli, it primarily investigates the time-course of the response conflict rather than the simultaneous and unintentional activation of opposing valences.

What is (Not) Automatic about the Activation of Ambivalence?

The present work affords the discussion of three criteria often utilized to define automaticity (e.g., Bargh, 1994; Moors & De Houwer, 2006): intentionality, efficiency, and awareness. Our discussion is primarily based on the ambivalent primes paradigm, in which participants were not instructed to use the primes, on the comparison of Experiments 1 and 2 with Experiment 3 that implemented short versus long SOAs, and on correlational evidence regarding the correspondence between latencies in the ambivalent primes paradigm and direct measures of potential and felt ambivalence.

The effects observed in the ambivalent primes paradigm can be classified as unintentional in the sense that participants were not asked to use the primes and in the sense that the fast sequence of primes and targets does not allow for intentional and deliberate processing. Experiment 3 further supports this reasoning. Increasing the SOA from 150ms to 450ms removed all effects of the ambivalent primes on the processing of the targets. Consequently, the phenomenon is short-lived and difficult to reconcile with accounts of strategic and effortful uses of the primes (Klauer et al., 1997). At the same time, all of our experiments made sure that participants processed the valence of the words. Hence, the unintentional activation of positivity and negativity may be conditional on the goal to evaluate, which is in line with recent theorizing on automatic evaluative priming effects (Spruyt et al., 2007, 2009).

The awareness criterion is more difficult to evaluate in light of the present experiments. Awareness has to be defined in terms of mental contents. In the context of the present research, several contents of interest for ambivalence research may be discussed: the simultaneous activation of opposing valences and the conflict this activation creates when having to produce a univalent response (either when categorizing targets succeeding ambivalent primes or when categorizing ambivalent targets). Direct measures of ambivalence assess mental contents triggered by ambivalent stimuli that are accessible and reportable. These measures predicted latencies on ambivalent trials in the ambivalent targets paradigm, but not in the ambivalent primes paradigm. The question thus arises whether this absence of correlations in the ambivalent primes paradigm allows for the conclusion that the primes' impact on processing was unaware.

It is possible that the participants did not become aware of the associations automatically activated by the prime or that they did not become aware of the evaluative conflict it induced when responding to the target. However, we want to raise caution towards accepting uncritically that these mental contents were not accessible to subjective experience as there are a number of reasons speaking against this view. First, we selected ambivalent stimuli based on self-report measures. Second, any measure may activate a different subset of information that participants may be fully aware of. Moreover, the overlap in these subsets may differ between pairs of measures. For instance, as only the ambivalent targets paradigm requires participants to make a judgment on the ambivalent stimulus, there is a larger methodological correspondence between direct measures and the ambivalent targets paradigm as compared to the ambivalent primes paradigm that may explain the differences in correlations. Third, even though we found the simultaneous activation of positive and negative valence to be unintentional and short-lived and even though participants' attention was fully engaged in target-related decisions, primes were presented long enough to be consciously processed. Fourth, response times do not allow inferring phenomenological states.

From this discussion, it should be evident that evaluating the awareness criterion requires more research in the future. This research requires defining precisely the mental content one intends to address such as the simultaneous activation of positive and negative valence or the evaluative conflict that delays the categorization of the targets. As a further note of caution, the most informative research in this domain should employ experimental rather than correlational designs (Corneille & Stahl, in press; Shanks, 2017; Sweldens, Tuk, & Hütter, 2017).

Implications for Dual-Process Models of Attitudes

It is worth discussing the present findings in light of dual-process models of attitudes. While different dual-process models vary in substantial ways, they generally distinguish two types of learning processes or learning systems underlying the formation of attitudes (for a critical review, see Corneille & Stahl, in press). These learning pathways are typically referred to as associative and propositional (e.g., Gawronski & Bodenhausen, 2006, 2011) or associative and rule-based (e.g., Rydell & McConnell, 2006; McConnell & Rydell, 2014). In these models, indirect evaluative measures are typically seen as reflecting preferably the operation of more automatic learning and response expression processes. It is not entirely clear, however, how such models allow for the demonstration of structural ambivalence on an indirect evaluative measure. On the one hand, associative principles permit the acquisition of both positive and negative evaluations regarding an attitude object and these associations may vary in strength. On the other hand, however, some of these models (e.g., for instance the MODE model; Fazio, 2007) define attitudes as evaluative summaries stored in memory and ambivalence is likely to be lost as the summarized evaluative representation is formed (for a discussion, see for instance McConnell & Rydell, 2014). More generally, dual-process models of attitudes that endorse principles of spreading activation in evaluative networks, such as the Associative-Propositional Evaluation model (e.g., Gawronski & Bodenhausen, 2006, 2011) may readily suggest an averaging effect of antagonistic valence activation.

Hence, the present findings suggest that dual-process models should be further specified or refined (see also Corneille & Stahl, in press).

Another question relevant to dual-process models is how ambivalence assessed with an indirect evaluative measure such as the ambivalent primes paradigm, relates to subjective feelings or subjective knowledge of ambivalence. Our experiments show that the time taken for deliberately categorizing ambivalent targets is positively related to both potential and felt ambivalence as assessed with direct measures. In contrast, the latter relationships are not obtained when ambivalent stimuli are automatically processed as primes. As just alluded to, many dual-process models of attitudes draw a distinction between implicit and explicit evaluations, which preferably reflect associative versus propositional processes and are typically evidenced by indirect and direct evaluative measures, respectively. In these models, indirect measures are sometimes seen as tackling implicit attitudes that are less amenable to conscious introspection. The latter conceptualization would assume that ambivalence as assessed with indirect measures is not related to direct measures of ambivalence, because the representation it tackles stems from implicit processes. Given the many findings that question this distinction - for instance, by demonstrating that participants can predict their scores on an IAT (Hahn, Judd, Hirsh, & Blair, 2014) or that instructed learning is reflected in indirect measures (De Houwer, 2006a) - and given that ambivalent stimuli were selected based on direct measures in the present research, we are careful to interpret the absence of a correlation in the ambivalent primes paradigm as evidence for distinct learning systems.

More generally, we believe that research on ambivalence and the automaticity of acquisition and retrieval would benefit from an experimental approach to ambivalence. That is, establishing ambivalence via learning paradigms that adhere to principles of the two types of learning processes would be more conclusive regarding the relation between acquisition principles and measures. A difficulty arises from the fact that attitude models generally focus on univalent attitudes or discrepancies between direct and indirect measures (e.g., Rydell & McConnell, 2006; Wilson, Lindsey, & Schooler, 2000) rather than ambivalence within an indirect measure. While some authors have attempted inducing opposite evaluations on direct and indirect measures (e.g., Rydell, McConnell, Mackie, & Strain, 2006; Rydell, McConnell, & Mackie, 2008; but see Corneille & Stahl, in press; Heycke, Gehrmann, Haaf, & Stahl, in press), we do not know of any induction of ambivalence within an indirect measure. In sum, further theorizing is needed on attitudinal ambivalence that informs the experimental inductions of structural ambivalence on indirect measures and relates it to direct measures of potential and felt ambivalence.

Further Implications for Attitude Research

Scott (1968; see also Conner & Armitage, 2008; Krosnick & Petty, 1995) proposed that ambivalence constitutes an indicator of attitude strength with high levels of ambivalence resulting in low attitude strength. Various findings support this reasoning, demonstrating that ambivalent attitudes are weakly linked to intention and behaviors (e.g., Armitage & Conner, 2000; Conner, Sparks, Povey, James, Shepherd, & Armitage, 2002), are expressed more slowly (e.g., Bargh et al., 1992), and less resistant to persuasive messages (e.g., Armitage &

Conner, 2000). On the other hand, ambivalent attitudes have been shown to be related to better discrimination between weak and strong arguments in persuasion paradigms (e.g., Maio et al., 1996), which is a typical characteristic of deliberative processing (Chaiken, 1980; Petty & Cacioppo, 1986) and linked to strong attitudes (Fabrigar, Priester, Petty, & Wegener, 1998; see also Van Harreveld et al., 2015).

The present research weighs in favor of the notion that ambivalent attitudes may indeed possess characteristics that are typically attributed to strong attitudes. In particular, the response patterns obtained in the present experiments suggest that ambivalent attitudes can be highly accessible. For instance, Experiment 1 demonstrated significantly longer latencies in trials including ambivalent primes as compared to trials including neutral primes. Experiment 2 revealed a tendency in the same direction. That we found strong conflicts at the response execution stage is also indicative of strong activation of positivity and negativity. If attitude objects had been associated only weakly with opposite associations, there would be no reason why we should have observed these conflicts.

Implications for Evaluative Priming Research

The present research contributes to the evaluative priming literature in at least two ways. First, we replicated the observation that the valent/neutral categorization task does not reveal evaluative priming effects in our own lab using our own set of stimuli (Werner & Rothermund, 2013; Rothermund & Werner, 2014). Hence, our data support the notion that the activation of valence alone is insufficient for observing priming effects.

Second, we investigated effects of a specific kind of valent stimuli, namely ambivalent stimuli. Ambivalent stimuli have hardly received attention in the priming literature, which has primarily focused on evaluative conflicts created between prime and target rather than either within the prime or within the target. At the same time, however, a number of theories and empirical demonstrations suggest that priming effects are strongest when prime and target are assimilated by establishing inclusive (versus exclusive) processing windows (Klauer, Teige-Mocigemba, & Spruyt, 2009; Alexopoulos, Fiedler, & Freytag, 2012), by their semantic relatability (Ihmels, Freytag, Fiedler, & Alexopoulos, 2016), and that priming effects can often be explained by prime and target being integrated in a single compound cue (Ratcliff & McKoon, 1988). Ambivalent stimuli comprise positivity and negativity in close spatial and temporal contiguity and with highest semantic relatability. By showing comparable latencies for ambivalent stimuli and incongruent trials, our results suggest that the different sources of conflict are functionally equivalent.

The Context of the Present Research

We share a strong interest in theoretical and empirical perspectives on attitude learning and retrieval as well as research paradigms that allow for the investigation of automaticity (Corneille & Stahl, in press; Hütter, Sweldens, Stahl, Unkelbach, & Klauer, 2012; Hütter & Sweldens, in press; Mierop, Hütter, & Corneille, 2017; Mierop, Hütter, Stahl, & Corneille, in press; Stahl, Haaf, & Corneille, 2016). Ambivalence is an intriguing phenomenon whose acquisition we seek to study by using learning paradigms such as evaluative conditioning. However, if one sets out to induce a phenomenon, one needs criteria by which to evaluate whether the induction of the said phenomenon was successful. Evaluative conditioning constitutes a learning paradigm that supposedly adds new associations via the pairing of an attitude object with unconditioned stimuli that carry valence (see Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010, for a review). In the present line of research, we established evaluative priming paradigms as a window to the attitude structure underlying ambivalence. This ground work now allows us to continue with experiments that increase our understanding of the acquisition of attitudinal ambivalence on the one hand, and our understanding of how learning conditions relate to different measures of ambivalence (indirect measures and direct measures such as potential ambivalence and felt ambivalence) on the other hand.

Conclusion

In conclusion, the current findings offer the first empirical support for the widespread theoretical assumption that ambivalence entails a simultaneous and unintentional activation of positive and negative evaluations. Moreover, it identifies the stage at which this co-activation results in an evaluative conflict. We additionally add to the systematic investigation of the relation between direct and indirect measures of attitudinal ambivalence. Finally, the present research contributes to clarifying the role of contextual cues in disambiguating ambivalent target stimuli. In sum, the present work has theoretical and methodological implications for research into ambivalent attitudes in particular and attitudes in general.

Section IV: An Evaluative Conditioning Approach to Inducing Attitudinal Ambivalence on Direct and Indirect Attitude Measures

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While univalent attitudes are characterized by positive *or* negative associations with an attitude object (Fazio, 1995), attitudinal ambivalence is defined as the simultaneous presence of positive *and* negative evaluations of the same attitude object (e.g., Kaplan, 1972; Priester & Petty, 1996; Scott, 1966; Thompson, Zanna, & Griffin, 1995). People are found to feel ambivalent about many attitude objects, such as different aspects of food (e.g., Armitage & Conner, 2000; Conner et al., 2002), morally demanding topics such as abortion (Priester & Petty, 1996; Schneider et al., 2015) or organ donation (e.g., Van Den Berg, Manstead, Van der Pligt, & Wigboldus, 2005), the self (DeMarree, Morrison, Wheeler, & Petty, 2011), genders (e.g., Glick & Fiske, 1996), ethnicities (e.g., Katz & Hass, 1988), politics (Abelson, Kinder, Peters, & Fiske, 1982), and organizational (e.g., Ziegler, Schlett, Casel, & Diehl, 2012) and consumer contexts (e.g., Jonas, Diehl, & Broemer, 1997).

When investigating attitudinal ambivalence, most research relies on the so-called correlational approach. In this approach, an existing attitude is measured and put into perspective with other psychological concepts, intentions, or observable behavior. On the other hand stand so-called induction techniques, which experimentally elicit attitude formation processes and thus result in new attitudes that may be directly linked to experimental manipulations. The prevailing correlational approach, however, comes with at least three shortcomings.

First, a correlational approach is not informative with regard to causal inferences. For instance, it remains unclear whether an increase in the level of concept A *causes* an increase in the level of concept B, whether it is a *consequence* of changes in concept B, or whether those two changes are unrelated after all. Second, correlational study designs allow for little to no control over the conditions under which the concept manifested. Experimental designs, in contrast, enable the specific definition of the type, number, duration, and procedure of the stimulus presentation. Third, experimental designs require strong theorizing and precise assumptions regarding the specific relations between the investigated concepts. While strong theories should constitute the base of every scientific study, correlational designs are more at risk of skipping these fundamental theoretical considerations as compared to experimental designs. Consequently, the experimental approach should be preferred over a purely measurement-based approach because it promotes more precise and theory-based research.

Inducing Attitudinal Ambivalence

When experimentally inducing structural ambivalence, it is required that an attitude object acquires links with both positive and negative associations. This may be realized by presenting conflicting pieces of information such as opposing trait characteristics of fictitious persons (Nohlen, van Harreveld, Rotteveel, Barends, & Larsen, 2016; Priester and Petty, 1996), or two-sided as opposed to one-sided messages about an attitude object (Clarkson, Tormala, & Rucker, 2008; Jonas et al., 1997; Schneider et al., 2013; van Harreveld, Rutjens, Rotteveel, Nordgren, & van der Pligt, 2009). Petty, Tormala, Briñol, and Jarvis (2006) based their design on the theoretical assumption that outdated attitudes (e.g., due to attitude change) are not erased but co-exist with potentially opposing new attitudes in long-term memory. In a set of studies, they applied an evaluative conditioning paradigm to induce a univalent attitude toward a fictitious person and subsequently applied a similarity manipulation to either reinforce or change the initial attitude. Ambivalent attitudes were either created if a target person was (i.) paired negatively in the conditioning phase and later described as being similar to the participant or (ii.) paired positively in the EC phase and later described as being dissimilar to the participant. The authors found that participants who underwent attitude change and thus held an ambivalent attitude toward the attitude object were less confident on an indirect attitude measure and engaged in deeper information processing of attitude-relevant information, which both constitute indicators of ambivalent attitudes.

Of note, these theoretical considerations (presentation of conflicting pieces of information, attitude change) explaining the origins of attitudinal ambivalence lack fundamental assumptions. Among others, it is not entirely clear under which conditions ambivalence does or does not emerge, whether ambivalence is the result of automatic, deliberate or both types of processes, whether it is experienced, and whether and under which conditions it is resolved.

The experimental designs realized in the two studies reported here employ two variants of an evaluative conditioning procedure. Evaluative conditioning (EC) refers to a change in the liking of a neutral stimulus (conditioned stimulus or CS) due to its repeated pairing with a valent stimulus (unconditioned stimulus or US; e.g., De Houwer, Thomas, & Baeyens, 2001). The EC effect is a very robust and extensively investigated phenomenon occurring across a wide range of contexts and modalities (for reviews, see De Houwer et al., 2001; Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010; Walther, Nagengast, & Trasselli, 2005).

We decided to rely on this paradigm for three major reasons. First, we share the theoretical assumption that ambivalence results from an attitude structure that is characterized by links to both positive and negative associations. The evaluative conditioning paradigm is found to produce positive or negative associations with formerly neutral attitudes depending of the US valence. The present studies test whether analogous to the transfer of one type of association, it is also possible to create both positive *and* negative associations in the course of an EC procedure (see also Glaser, Woud, Iskander, Schmalenstroth, & Vo, 2018).

Second, by yielding control over the type, identities, number, duration and location of stimuli, the EC paradigm allows for a nuanced investigation of the exact procedural details that produce attitudinal ambivalence. It can further be guaranteed that all participants share the same learning experience and have access to the same information base.

Third, in contrast to induction techniques applied in persuasion paradigms, which are characterized by explicit communication and obvious intentions, evaluative conditioning is subtler in its instructions and in communicating the study purpose. Participants are classically instructed to simply watch the stimuli of a “perception phase” without an invitation to learn, remember, or form an attitude about them. This characteristic contributes to decreasing demand effects (e.g., Greenwald & Banaji, 1995; Nisbett & Wilson, 1977). Furthermore, as the instructions do not encourage the active formation of an attitude toward the CS, the paradigm allows for an investigation of automaticity-related processes such as awareness or controllability (e.g., Hütter & Sweldens, in press).

Evaluative conditioning paradigms are classically used to investigate univalent attitudes, i.e., attitudes that possess *either* positive *or* negative associations. Consequently, in the classical EC paradigm a single CS is either paired with one or multiple positive USs, or one or multiple negative USs, respectively. The EC effect is indicated in a shift in the likeability ratings in the direction of the US valence. If pairing a CS exclusively with USs from one valence increases associations of that valence in the CS, the question arises if assigning a CS multiple USs with different valences or a US of mixed valence produces a shift in the positive direction *and* in the negative direction. Put differently, is it possible to make a CS more ambivalent in the course of an EC phase by pairing it with one or multiple USs that have a positive and negative valence? Research that can be adducted to answer this question is rather scarce. In the following, I will provide an overview over EC studies that may have produced attitudinal ambivalence in their designs, and the inferences that can be drawn from them regarding ambivalence induction.

EC with mixed valence within USs. Glaser and colleagues (2018) created mixed-valence USs by stitching positive and negative IAPS pictures into one US compound. In two studies, an EC procedure containing univalent, ambivalent, and neutral USs, and polygons as CSs was conducted and measures of positivity, negativity, and experienced ambivalence were collected. The authors found a valence transfer of both positivity and negativity to the CSs that were paired with ambivalent USs (CS_{amb}). Furthermore, CS_{amb} were higher on an experienced ambivalence measure as compared to the other three types of CSs. Although neutral CSs, which were expected to remain neutral throughout the EC procedure, also possessed considerable positive and negative associations, this can be considered the first study that provided evidence that positive and negative associations can both be transferred to the same CS applying an EC procedure.

Glaser and Walther (2013) constructed USs that possess both positive and negative aspects mirrored in the group membership (aggressive vs. kind group) and specific behaviors (drug use vs. no drug use) of fictitious persons. In two experiments, they found that the US persons were mainly evaluated based on their behaviors while the evaluation of the corresponding CS persons was more driven by the US group membership. While this finding is interesting with regard to focus shifts to the different attitudinal facets of the USs, no measure of ambivalence was used in either of the studies. It is further noteworthy that the mixed-valence

USs and their corresponding CSs were evaluated clearly negatively when it could have been expected that evaluations lie closer to the midpoint of the bipolar rating scale. Unfortunately, due to the lack of ambivalence measures, it is not clear whether this negativity tendency reflects discomfort, which is often associated with the encounter of ambivalent stimuli, or whether the material was in fact perceived as purely negative.

EC with mixed valence across USs. Within the research area of evaluative conditioning, studies investigating the effect of the context/contingencies may apply mixed pairings, i.e., pairings that are not one hundred percent positive or one hundred percent negative for a single CS thereby potentially creating ambivalent CSs. In the classical sense, the statistical contingency ΔP describes a relation between two variables as a ratio of the probability that a certain outcome is observed given a variable is present and the probability that a certain outcome is observed given the variable is absent. In EC literature, an important point of debate is whether objective contingencies, or even the subjective perception of contingencies moderate the EC effect (cf. Walther et al., 2005). Classically, contingencies are investigated by including trials in which a CS or a US appears in isolation, thereby manipulating the predictive power of the CS.

Advancing this view, Ihmels and Hütter (2018) shifted the concept of statistical contingency to a more ecological perspective and defined contingency as the ratio of the probability of a US_{pos} occurring given a certain CS, and the probability of a US_{pos} occurring given any other CS. Applying this perspective to an experimental approach increases its ecological validity as in real-life, rarely things co-occur with only positive, or only negative objects. When manipulating the ecological contingency systematically, Ihmels and Hütter found both objective and subjective conditional probability of a CS to predict a US_{pos} to be positively related to the EC effect. While the objective baserate of positivity in the US environment did not predict evaluative shifts in the CS, the perceived baserate did predict the EC effect. Interestingly, the smaller the contingencies, the least evaluative change was observed on a bipolar rating scale. Of note, however, with regard to the induction of attitudinal ambivalence as a function of mixed pairings, the finding obtained by Ihmels and Hütter (2018) is ambiguous for it might either mirror decreased learning, or successful learning of the opposing valences that simply cancel each other out on a bipolar rating scale.

Hütter, Kutzner, and Fiedler (2014) conducted a set of studies in which they demonstrated that stimulus attributes, so-called cues, as opposed to specific stimulus identities may also acquire valence through EC. To test to what extent specific identities are conditioned and to what extent cues are conditioned, CSs consisted of specific cue combinations (e.g., gender: male or female – age: young or old – skin color: light or dark) of which one cue was predictive of valence, i.e., one cue level appeared more often together with one valence as opposed to the other valence (ΔP = .67), while the other cues were paired with positive and negative USs equally often (ΔP = .00). If it is possible to load a CS with both valences when pairing it with positive and negative USs to equal parts, unpredictive cues should be maximum ambivalent, while predictive cues should be less ambivalent. As this set of studies investigated psychological concepts unrelated to attitudinal ambivalence, however, it did not employ ambivalence measures. It is therefore impossible to draw inferences regarding a potential ambivalence induction in the respective CSs.

Bar-Anan and Dahan (2013) investigated how different types of pairings of a context CS (exclusively positive vs. exclusively negative) affect the evaluation of a target CS that is paired positively in fifty percent of the trials and negatively in the other fifty percent of the trials. They found that the CS_{target} is evaluated more positively in a negative context than in a positive context while neither a filler CS, which appeared without a US, nor a new stimulus were affected by the valence of the $CS_{context}$. This pattern suggests the formation of valent associations in the CS_{target}, which are weighted differently or vary in their diagnosticity depending on the context CSs. In contrast, context-independent ratings for both, filler and new CSs suggest the absence of valent associations. However, due to a different research focus no measures of ambivalence were included in the design thereby precluding inferences regarding the formation of attitudinal ambivalence in the target CSs.

Beside a conditioning phase that applies intermixed positive and negative pairings of a single CS, so-called counterconditioning paradigms pair CSs with positive and negative USs in a block-wise procedure to investigate processes of attitude change (e.g., Baeyens, Eelen, van den Bergh, & Crombez, 1989; Stevenson, Boakes, & Wilson, 2000). CSs are initially paired with USs of one valence exclusively and are subsequently paired with USs of the opposite valence in a separate conditioning phase. To date, research on counterconditioning is relatively scarce and findings are mixed. Nevertheless, since it basically constitutes an attitude formation and subsequent change manipulation, it is an interesting paradigm with regard to the generation of ambivalent attitudes. Petty and colleagues (2006) argue in their PAST ("past attitudes still there") model that attitude change does not erase the former attitude but rather extends the attitudinal structure resulting in what they call implicit ambivalence. This special type of ambivalence does not necessarily translate to simultaneous positive and negative attitudes on direct measures but may only be mirrored in opposing attitudes on direct and indirect attitude measures, respectively. Hence, in a standard counterconditioning paradigm, it is hardly possible to detect ambivalence as a result of a counterconditioning procedure.

As can be seen from the short list of studies reviewed above, very few designs have employed mixed-valence pairings. This state is unfortunate because mixed pairings more authentically reflect real-life learning conditions and should thus be investigated with more scrutiny. Besides making highly valuable contributions regarding their specific research questions, these designs are extremely interesting for ambivalence research. Due to the lack of separate valence measures, however, it remains unclear whether EC procedures applying mixed-valence pairings result in decreased to no learning, or in successful learning of the separate associations, which is concealed by the bipolar response format. Critically, the latter case would have important theoretical implications. For instance, such findings would suggest that people may hold separate counters for positive and negative information instead of storing summary evaluations. It would further prompt the idea that participants are not only able to learn positive and negative associations separately, but may further retrieve that information flexibly in form of separate evaluations, or an integrated summary evaluation, depending on the response format. The current research provides the first step to answering these questions by combining EC paradigms as a mean of ambivalence induction, and both direct and indirect attitude measures that are more informative regarding attitude learning and retrieval.

Measuring Attitudinal Ambivalence

Direct measures of attitudinal ambivalence either focus on the associative structure of ambivalent attitude objects consisting in both positive and negative associations (i.e., *structural ambivalence*) or they focus on the phenomenological experience associated with the encounter of ambivalent attitude objects (i.e., *experienced ambivalence*). The latter are usually realized in a meta-cognitive questionnaire that asks participants to indicate the degree to which they have conflicting thoughts/feelings or feel torn with regard to the attitude object (e.g., Priester & Petty, 1996). In contrast to conventional bipolar rating scales, measures of structural ambivalence ask participants to rate their positive and negative associations with the attitude object separately while ignoring all associations of the opposite valence (Kaplan, 1972). The most popular ambivalence index is the so-called Griffin index (Thompson et al., 1995) of the form $(P + N)/2 - | P – N |$ where P constitutes the rating for positivity and N constitutes the rating for negativity. Critically, the index increases with increasing similarity and extremity of the separate ratings.

As mentioned earlier, both structural and experienced ambivalence measures belong to the category of direct attitude measures. As direct measures are based on self-reports, they require participants' introspection, ability, and motivation to truthfully report their thoughts and feelings. Consequently, these kinds of measures may fall prey to response tendencies, strategies, and demand effects (e.g., Greenwald & Banaji, 1995; Nisbett & Wilson, 1977). A mean to overcome these unwanted biases, is the use of so-called indirect attitude measures. Indirect measures refrain from directly asking participants. Instead, they infer attitudes from specific behavioral patterns such as response times or error rates. Among the most popular indirect attitude measures counts the evaluative priming paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986). In this paradigm, participants categorize target stimuli as positive or negative by pressing a corresponding key on the keyboard. Critically, the target stimulus is preceded by a briefly presented prime stimulus that either matches or mismatches the valence of the target. Trials in which prime and target valence match are called congruent trials, whereas trials with opposing prime and target valence are referred to as incongruent trials. In a congruent trial, prime and target activate the same valent associations thereby facilitating the target categorization. In an incongruent trial, on the other hand, the prime activates associations that interfere with the target associations thereby aggravating a response toward the target. In their model, Fazio and colleagues assume that associations with an attitude are stored in an associative network in long-term memory.

Applying an evaluative priming paradigm, Berger, Hütter, and Corneille (2018) found that trials including ambivalent prime words were consistently slower than congruent trials and as slow or slower than neutral and incongruent trials. This pattern constitutes first evidence that in ambivalent trials opposing associations are activated concurrently resulting in a conflict that decelerates the categorization of subsequent unrelated target material. Although self-reported structural and experienced ambivalence ratings for those prime words confirmed a successful stimulus selection, latencies were not predicted by direct ambivalence ratings of the prime material. While findings across the four studies speak to intentional processes as a main driving factor for the deceleration effect found in ambivalent trials, the absence of a systematic relation between latencies and self-reported ambivalence of the prime material hints at the possibility that unintentional processes additionally contribute to the effect. The application of the priming paradigm proved suitable for assessing attitudinal ambivalence indirectly and yielded highly informative results that enriched our understanding of this complex type of attitudes.

To our knowledge, no systematic investigation of an ambivalence induction via evaluative conditioning and its success on both direct and indirect ambivalence measures has been conducted yet. Consequently, the present paper contributes to the field by testing highly controllable and standardized induction and measurement approaches. More precisely, it reports two studies that (i.) apply procedurally different EC paradigms and (ii.) combine both direct ambivalence measures, as well as an evaluative priming procedure to capture attitudes indirectly. Of course, many more procedural variations and potential moderators are thinkable, and many more dependent variables that might be affected by ambivalence in the CSs or USs, such as memory and certainty, might be assessed. The present work certainly only constitutes a first step, however, it paves the way for future research.

Hypotheses

We expect an evaluative conditioning effect, i.e., higher positivity ratings for CS_{pos} as compared to CS_{neut} (H1a), and higher negativity ratings for CS_{neg} as compared to CS_{neut} (H1b). With regard to CS_{amb}, we expect both higher positivity ratings (H2a) and negativity ratings (H2b) for CS_{amb} as compared to CS_{neut}.

In line with Berger and colleagues (2018), in the evaluative priming paradigm, we expect trials including ambivalent primes to have higher latencies than congruent trials, i.e., trials in which prime and target valence match (H3), as well as trials including neutral primes (H4). We further expect latencies in ambivalent trials to be comparable to incongruent trials, i.e., trials in which prime and target valence differ (H5).

Experiment 1

Method

Participants. Sample size was based on the studies reported by Berger et al. (2018) with N = 81 participants of which 58 were female. Participants were M = 22.09 (SD = 2.84) years on average. In exchange for their participation participants received 3 EUR or course credit.

Design. In the learning phase, the type of induced attitudes was manipulated via different CS-US pairings within participants (US valence: 100% positive vs. 100% negative vs. ambivalent, i.e., 50% positive/50% negative vs. 100% neutral. For more details, see procedure). The newly formed CS_{pos}, CS_{neg}, CS_{amb} and CS_{neut} then constituted the different prime types in the subsequent evaluative priming paradigm. Consequently, in the measurement phase we applied a 4 (prime type: positive vs. negative vs. ambivalent vs. neutral) × 2 (target type: positive vs. negative) within-participants design.

Material. In the learning phase, conditioned stimuli were eight seven-letter nonwords used by Zanon et al. (2012). To arrive at the required number of twelve CSs or prime words respectively, four additional nonwords were created by building anagrams of existing nonwords and changing one letter per new nonword to decrease similarity (Appendix D). Unconditioned stimuli were positive, negative, and neutral pictures taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1997). The employed pictures were preselected based on valence and arousal ratings.

In the measurement phase, prime words were the twelve CSs used in the preceding learning phase (CS_{pos}, CS_{neg}, CS_{amb} and CS_{neut}). Target words were eight positive adjectives (*gentle, savvy, faithful, healthy, popular, talented, sincere, peaceful*) and eight negative adjectives (*lazy, stupid, lame, lonely, atrocious, envious, arrogant, unfair*), respectively, originally in German language.

Procedure. The experiment can be divided in three sections. All instructions and tasks were presented via a customized Visual Basic program. Participants were informed that the experiment would involve several tasks, the first of which would require to attentively watch unknown words and pictures. They were further informed that word-picture-combinations would be presented for a few seconds each. They then entered the evaluative conditioning phase, which constituted the first experimental section serving to induce the corresponding attitudes. In this learning phase, each trial consisted of the CS (nonword) presented in the center of the screen, one US located right and one US located left of the CS. Critically, while the left-right location of each US was randomly assigned on each trial, distance to the CS was held constant to promote the impression that both USs have a comparably strong impact on associations with the CS. Each CS-US combination was presented for 3,750ms, followed by an inter-trial interval (ITI) of 500ms. Each CS was assigned a US valence, which determined the specific pairings. Specifically, each CS was assigned six different USs that were exclusively used for that specific CS. Four nonwords were randomly chosen to constitute ambivalent primes in the subsequent evaluative priming phase (CS_{amb}). These CS_{amb} were assigned three unique positive and three unique negative USs each. Four "neutral" nonwords (CS_{neut}) were assigned six unique neutral USs each. Two randomly chosen nonwords were assigned the status of a positive (CS_{pos}) prime and were assigned six unique positive unconditioned stimuli, two nonwords were assigned the status of a negative (CS_{neg}) prime and were assigned six unique negative USs, respectively. Each US was used twice, but never twice within one trial. The conditioning phase consisted of 72 trials in total, segmented in six seamlessly merging "blocks" each containing every CS once. This procedural detail guaranteed an equal distribution of CSs across the conditioning phase.

Following the conditioning phase, participants received instructions for the evaluative priming phase, which constituted the second experimental phase serving to measure the attitudes indirectly. They were instructed to categorize presented words as fast and accurately as possible as being either positive or negative by pressing 'A' or 'L' on a QWERTZ-keyboard. Key assignment as 'positive' or 'negative' was counterbalanced across participants. Participants were further informed that each word would be preceded by another briefly presented word, which could be ignored. Each trial started with a fixation cross for 500ms, followed by the prime for 150ms. After that, the target appeared on the screen until it was categorized via key press. In case of responses slower than 1,500ms, a text field labelled "faster" appeared. The ITI was 1,500ms. After a practice round consisting of eight trials, participants underwent the ambivalent primes paradigm introduced in Berger et al. (2018). Each of the twelve primes, four of which were induced ambivalence in the preceding learning phase, four of which were induced neutrality, and two of which were induced positivity and negativity, respectively, was paired four times with a positive target word and four times with a negative target word. The priming phase consisted of 96 trials in total.

Having completed the ambivalent primes paradigm, participants started with the third experimental section, which consisted of direct measures of attitudinal ambivalence. In this section, each of the nonwords serving as primes was sequentially presented at the center of the screen together with three questions. The first two questions asked participants to rate the degree of positivity (negativity) while ignoring all negative (positive) aspects of the stimulus. The third question asked participants to rate the degree to which they feel torn with regard to the thoughts and feelings the word elicits with them. All items were answered on a slide bar ranging from 0 = "not at all positive"/"not at all negative"/"not at all torn" to 100 = "very positive"/"very negative"/"very torn". After the third section participants answered demographic questions, were given an opportunity for debriefing, and left.

Results

To investigate data on a trial level, we calculated multilevel models. Following the recommendation by Judd, Westfall, and Kenny (2012), the estimated models contained random intercepts for participants and stimuli. Models were calculated using the *lmer*-command from the *lme4*-package (Bates, Maechler, Bolker, & Walker, 2015) in RStudio (R Core Team, 2018). We conducted model comparisons to identify significant effects. Specifically, we compared the null model containing the grand mean with random intercepts for participants and stimuli with a model containing an additional factor specifying the groups that were to be compared. Model comparisons were conducted via parametric bootstrapping. *P*-values (type II) were computed based on 1000 bootstrap replicates each. We also report the regression weights, standard errors, and *t*-statistics for all tested effects. Analyses were realized using the function *mixed* from the *afex* package (Singmann, Bolker, Westfall, & Aust, 2018).

Evaluative conditioning effect

Descriptive statistics of all direct measures, i.e., positivity ratings, negativity ratings, structural ambivalence, and experienced ambivalence can be found in Table 10.

Univalent CSs. We treated the evaluative conditioning effect as a difference in the positivity and negativity ratings for nonwords that were paired with positive USs (CS_{pos}) or negative USs (CS_{neg}) in comparison to the baseline condition, i.e., nonwords that were paired with neutral USs (CS_{neut}) during the attitude induction phase. More specifically, an evaluative conditioning effect would be displayed in higher positivity ratings for CS_{pos} as compared to CS_{neut}, and higher negativity ratings for CS_{neg} as compared to CS_{neut}. Of note, a significant evaluative conditioning effect constitutes a measure for the success of our attitude induction manipulation. To test for this, we conducted two separate model comparisons. In a first step, we compared the null model and a model containing a predictor coded *zero* for neutral CSs and *one* for positive CSs to predict positivity ratings. The more complex model had a significantly better model fit, PB-test(1) = 21.35, p = .001, indicating that positive CSs had significantly higher positivity ratings than neutral CSs, *B* = 12.48, *SE* = 2.89, *t* = 4.32. In a second step, we compared the null model with a model containing a predictor coded *zero* for CS_{neut} and *one* for CS_{neg} in their ability to predict negativity ratings. The more complex model again had a better model fit, PB-test(1) = 22.48, *p* = .001, indicating that CS_{neg} had significantly more negative ratings than CS_{neut}, *B* = 14.19, *SE* = 2.87, *t* = 4.95.

Ambivalent CSs. A successful induction of ambivalent attitudes would be displayed in both higher positivity and negativity ratings for CS_{amb} as compared CS_{neut}. To test for this, we compared the null model with a model containing a predictor coded *zero* for CS_{neut} and *one* for CS_{amb} in their ability to predict positivity ratings. The additional predictor did not improve model fit in comparison to the null model, PB-test(1) = .08, *p* = .80, indicating no differences between neutral and ambivalent CSs in their positivity ratings. The same two models were compared in their ability to predict negativity ratings. The more complex model had a significantly better model fit than the null model, PB-test(1) = 11.61, *p* = .001, indicating that CS_{amb} had significantly higher negativity ratings than CS_{neut}, *B* = 7.28, *SE* = 2.19, *t* = 3.32.

Table 10
Means (standard deviations) for positivity ratings, negativity ratings, Griffin index as an indicator for structural ambivalence, and experienced ambivalence in Experiment 1.

Stimulus type	Positivity rating	Negativity rating	Structural ambivalence	Experienced ambivalence
ambivalent	39.15 (31.01)	41.52 (30.95)	1.82 (28.28)	41.96 (29.49)
neutral	38.31 (32.04)	32.24 (39.84)	0.92 (27.41)	36.65 (28.49)
positive	50.80 (33.61)	32.48 (29.34)	-3.18 (27.95)	37.07 (28.55)
negative	28.21 (27.28)	48.43 (33.39)	-3.40 (26.78)	40.65 (29.44)

Self-reported ambivalence

Structural ambivalence. As a measure of structural ambivalence, for each prime word and each participant we calculated the Griffin index of the form (P + N)/2 - | P - N | (Thompson et al., 1995) where P constitutes the positivity rating and N constitutes the negativity rating. In a first step, we compared the ambivalent primes with the univalent (i.e., positive or negative) primes. We therefore applied parametric bootstrapping to compare the null model predicting the grand mean of the structural ambivalence ratings with a model including a predictor coded *zero* for all univalent primes and *one* for ambivalent primes. The more complex model had a significantly better model fit than the null model, PB-test(1) = 6.92, p = .01, indicating that ambivalent primes had a significantly higher Griffin index than univalent primes, B = 5.05, SE = 1.92, t = 2.64. A direct comparison of ambivalent and neutral primes, which constitute the relevant baseline condition, however, did not improve model fit in comparison to the null model, PB-test(1) = .37, p = .55.

Experienced ambivalence. We tested whether ambivalent prime words and univalent, i.e., positive and negative prime words, differed in their experienced ambivalence by comparing the null model predicting the experienced ambivalence ratings with an extended model including a factor coded *zero* for univalent primes and *one* for ambivalent primes. The more complex model did not differ from the null model in terms of model fit, PB-test(1) = 2.39, p = .11, indicating that univalent primes were experienced as ambivalent as ambivalent primes. In a similar comparison between ambivalent primes and neutral primes, the more complex model explained the data significantly better than the null model, PB-test(1) = 7.17, p = .002, with significantly higher experienced ambivalence ratings for CS_{amb} as compared to CS_{neut}, B = 5.45, SE = 2.02, t = 2.70.

Standard evaluative priming effect

We excluded responses faster than 300ms (2.21%) or slower than 3,000ms (0.02%) for all analyses. For all latency analyses we further excluded incorrect classifications (4.91%), i.e., positive responses to negative targets and vice versa, resulting in 7,229 trials. To correct for a skewed latency distribution, all estimated models used log-transformed latencies. Graphs and descriptive statistics depict latencies in milliseconds for reasons of comprehensibility.

In order to validate the ambivalent primes paradigm, a first analysis targeted the standard evaluative priming effect. We therefore excluded all trials including neutral or ambivalent primes and compared congruent trials, i.e., trials in which both prime and target are positive or both prime and target are negative, with incongruent trials, i.e., trials in which prime and target have opposing valences. The classical finding is shorter latencies in congruent trials as compared to incongruent trials. We compared the null model with a model including a factor congruency, which was coded *zero* in the case of incongruent trials and *one* in the case of congruent trials. The additional predictor congruency did not improve model fit in comparison to the null model, PB-test(1) = 1.46, p = .22, indicating that latencies in congruent trials were not faster as compared to incongruent trials.

Ambivalent primes paradigm

In order to investigate the role of ambivalent primes for subsequent targets, in a first step we compared trials including ambivalent trials with congruent trials, that is trials in which prime and target shared a valence. We compared the null model with a more complex model including a predictor coded *zero* for ambivalent trials and *one* for congruent trials. The more complex model did not explain the data better than the null model, PB-test(1) = .01, p = .92, indicating that ambivalent trials and congruent trials did not differ in their (log-transformed) latencies. Next, we compared the null model with a model including a factor coded *zero* for trials including ambivalent primes and *one* for trials including neutral primes. Again, the more complex model did not improve model fit, PB-test(1) = .00, p = .99. Finally, we tested the null model against a model comparing ambivalent trials (coded *zero*) and incongruent trials (coded *one*). Analogous to the model comparisons conducted earlier, the more complex model did not explain data better than the null model, PB-test(1) = 1.55, p = .21. Figure 9 shows mean latencies and standard errors of all possible prime-target combinations.

The relation between direct and indirect measures

To test whether (log-transformed) latencies could be predicted from structural and/or experienced ambivalence measures, ratings were z-standardized. We conducted step-wise model comparisons between the null model and the models including the Griffin index, the experienced ambivalence rating, and their interaction. Neither the stepwise inclusion of the Griffin index, PB-test(1) = .44, p = .54, nor the experienced ambivalence ratings, PB-test(1) = .01, p = .91, or their interaction, PB-test(1) = .14, p = .71, increased the model fit significantly,

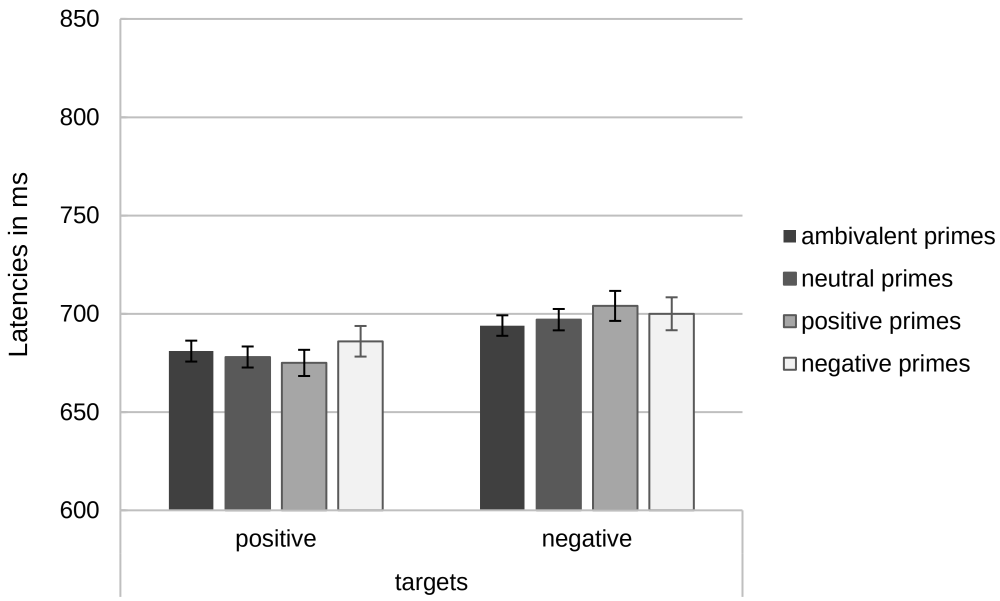

Figure 9. Mean latencies and standard errors depending on prime type and target type in the evaluative priming.

indicating that neither of the direct measures could predict mean latencies for each prime word.

Discussion

We conducted an evaluative conditioning procedure in which nonwords (CSs) were repeatedly paired with two positive (CS_{pos}), two negative (CS_{neg}), two neutral (CS_{neut}), or one positive and one negative picture (CSamb) each. Applying this procedure, we successfully transferred valence of univalent USs to the respective CSs. We found an EC effect on direct ratings of positivity and negativity, i.e., more positive ratings for CS_{pos} as compared to CS_{neut}, and more negative ratings for CS_{neg} as compared to CS_{neut} (support for H1a and H1b). Based on our criterion that ambivalent CSs should possess both, higher positivity and negativity ratings than neutral CSs, we were not able to successfully induce ambivalence. While CS_{amb} had significantly higher negativity ratings than CS_{neut} (support for H2b), they were not rated to be significantly more positive than CS_{neut} (no support for H2a). On direct ratings of attitudinal ambivalence results were mixed. Ambivalent primes had higher ratings on structural ambivalence as compared to univalent primes but not neutral primes, and higher experienced ambivalence ratings as compared to neutral primes but not univalent primes.

The data of the evaluative priming paradigm does neither support H3 (slower responses for ambivalent trials as compared to congruent trials), nor H4 (slower responses for ambivalent trials as compared to neutral trials). As expected, ambivalent and incongruent trials did not differ in their latencies (support for H5). Of note, however, our evaluative priming paradigm did not show the standard congruency effect, i.e., higher latencies in incongruent trials as compared to congruent trials. A reliable interpretation of the response time data is thus not possible. Moreover, no correlation between the priming data as an indirect measure of ambivalence and either of the direct measures was found.

In each trial, Walther and colleagues (2018) presented two USs whose interweaving dissembled a single stimulus consisting of matching or opposing evaluative aspects, respectively. In contrast, in the present experiment, CSs were displayed at the center of the two USs while guaranteeing equal distance between all three stimuli to enable the formation of equally strong associations. Although we found an EC effect for the univalent CSs on direct ratings, the absence of the standard congruency effect suggests that this valence transfer was not strong enough to trigger an unintentional valence activation in the evaluative priming task. Williams and Bargh (2008) found spatial distance primes (in comparison to spatial closeness primes) to decrease the experience of distress evoked by threatening stimuli such as violent media or unhealthy food. Consequently, the spatial distance between positive and negative USs may have prevented a sufficiently strong conflict perception in ambivalent trials thereby producing low levels of ambivalence.

Research on visual perception provides a possible idea on how to arrive at stronger learning effects. Alvarado, Vaughan, Stanford, and Stein (2007), and Stanford, Quessy, and Stein (2005) investigated whether unisensory stimuli, i.e., stimuli stemming from the same modality, trigger fundamentally different perception and integration processes than multisensory stimuli, i.e., stimuli from different modalities. They found evidence that multisensory information integration produces stronger reactions on a neural level than its unisensory counterpart. In the context of learning paradigms, it is conceivable that enhanced neural reactions translate to stronger learning.

In order to facilitate learning effects, Experiment 2 applied a cross-modal procedure. Specifically, in each trial CSs were simultaneously presented with one US picture and one US sound each. By providing clearly different sources of attitude information, we further intend to hamper the integration of opposing pieces of information and consequently, a more difficult ambivalence resolution. Using a cross-modal evaluative conditioning paradigm, we intend to foster conflict perception that is sufficiently strong to carry over to the priming procedure.

Experiment 2

Although the vast majority of EC experiments applies visual unconditioned stimuli, several studies have shown that valence may also be transferred from auditory USs to different kinds of CSs such as Greek letter combinations (Eifert, Craill, Carey, & O'Connor, 1988), consumer products (Gorn, 1982), or alien creatures (Moran & Bar-Anan, 2013). In order to produce stronger learning effects and boost conflict perception in ambivalent trials, Experiment 2 applied a cross-modal EC procedure with both visual and auditory USs in each trial. All hypotheses are analogous to the hypotheses tested in Experiment 1.

Method

Participants. We collected data of *N* = 80 participants of which one person had to be excluded due to his/her participation in Experiment 1. 61 of the remaining *N* = 79 participants were female. The participants were *M* = 23.46 years (*SD* = 2.77 years) on average and received 3 EUR or course credit in exchange for their participation in the experiment.

Design. Analogous to Experiment 1, in the learning phase US valence was manipulated within participants (positive vs. negative vs. ambivalent vs. neutral) resulting in four types of CSs that served as primes in the subsequent measurement phase. The evaluative priming paradigm in the measurement phase applied a 4 (prime type: positive vs. negative vs. ambivalent vs. neutral) x 2 (target type: positive vs. negative) within-participants design.

Material. In the learning phase, conditioned stimuli were identical to those applied in Experiment 1 with one exception. During data collection of Experiment 1, we were notified that the three supposed nonwords “BAYRAM”, “LOKANTA”, and “SARICIK” did possess valence in Turkish language and consequently preclude our intention of using CSs that participants initially do not have any associations with.[13] We thus decided to form anagrams from these words to avoid that Turkish speaking participants already possess valent associations with the CS material. Unconditioned stimuli were pictures and sounds, respectively. Twenty-four positive, negative, and neutral pictures, each, were preselected from the IAPS database (Lang et al., 1997) based on their valence and arousal ratings. For the auditory USs, eight positive, eight negative, and eight neutral sounds were preselected from the International Affective Digitized Sounds database (IADS-2; Bradley & Lang, 2007) based on their valence and arousal ratings.

In the measurement phase again, prime words were the CS_{pos}, CS_{neg}, CS_{amb}, and CS_{neut} from the learning phase, and target words were identical to those used in Experiment 1.

Procedure. The overall procedure was identical to Experiment 1, except for the evaluative conditioning phase, which served to induce univalent, ambivalent, or neutral attitudes, respectively. In this phase, each trial consisted of the CS (nonword) and a US picture, one of which was presented in the left half and one in the right half of the screen. The assignment of CS and US to the left or right half of the screen was random on each trial. Each CS-US combination was presented for 3,750ms and accompanied by a sound of the exact same length. The sound's valence either matched the valence of the visual US (univalent and neutral trials) or it opposed it (ambivalent trials). Each CS was assigned a US valence, which determined the specific pairings. Specifically, CS_{pos} (CS_{neg}) were assigned two positive (negative) pictures and two positive (negative) sounds. Similarly, CS_{neut} were assigned two neutral pictures and two neutral sounds. CS_{amb} were assigned one positive and one unique negative picture as well as one positive and one negative sound, each. Each US was assigned to only one CS and was used three times. The conditioning phase again consisted of 72 trials in total. Both the ambivalent primes paradigm and the direct rating phase were identical to Experiment 1.

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[13] An exclusion of all trials containing these prime words produced the standard congruency effect, PB-test(1) = 3.75, *p* = .04, while not affecting any of the other effects.

Results

Data preparation and analyses were analogous to Experiment 1. Effects were estimated using model comparisons via parametric bootstrapping and multilevel models with random intercepts for participants and stimuli.

Evaluative conditioning effect

Univalent CSs. The standard evaluative conditioning effect is obtained if CS_{pos} have higher positivity ratings than CS_{neut}, and if CS_{neg} have higher negativity ratings than CS_{neut}. To examine this effect, we conducted two model comparisons. First, we compared the null model estimating the grand mean with random intercepts for participants and stimuli with a model including a factor coded *zero* for CS_{neut} and *one* for CS_{pos} in their ability to predict positivity ratings. The more complex model hat a significantly better model fit, PB-test(1) = 29.18, p = .001, indicating that positive CSs had higher positivity ratings compared to neutral CSs, B = 15.23, SE = 2.88, t = 5.30. Next, we compared the null model with a model including a predictor coded *zero* for CS_{neut} and *one* for CS_{neg} in their ability to predict negativity ratings. Again, the more complex model predicted data significantly better than the null model, PB-test(1) = .23.23, p = .001, with higher negativity ratings for negative CSs as compared to neutral CSs, B = 14.19, SE = 2.85, t = 4.98.

Ambivalent CSs. To check whether ambivalence, that is increased positivity *and* negativity ratings, was successfully induced on direct measures, we conducted another two model comparisons. In a first step, we compared the null model estimating positivity ratings with a model including a factor coded *zero* for neutral CSs and *one* for ambivalent CSs. The more complex model did not have a better model fit, PB-test(1) = .01, p = .94. A comparison between the same two models in their ability to predict negativity ratings revealed a significant improvement in model fit after inclusion of the additional factor, PB-test(1) = 12.45, p = .001, indicating that ambivalent CSs had higher negativity ratings than neutral CSs, B = 7.60, SE = 2.25, t = 3.39. Mean values and standard deviation for all direct measures can be found in Table 11.

Table 11

Means (standard deviations) for positivity ratings, negativity ratings, Griffin index as an indicator for structural ambivalence, and experienced ambivalence in Experiment 2.

Stimulus type	Positivity rating	Negativity rating	Structural ambivalence	Experienced ambivalence
ambivalent	39.70 (31.66)	38.27 (30.98)	-0.72 (28.23)	39.59 (28.91)
neutral	39.99 (30.61)	30.62 (28.78)	-1.79 (25.30)	34.49 (28.81)
positive	55.39 (34.46)	26.62 (26.92)	-8.47 (29.21)	34.10 (29.53)
negative	33.99 (30.74)	44.53 (33.57)	-7.73 (26.45)	34.54 (27.28)

Self-reported ambivalence

Structural ambivalence. Analogous to Experiment 1, the Griffin index was calculated for each prime word and each participant. We conducted a model comparison in which we compared the null model predicting the grand mean of the structural ambivalence ratings with a model including a predictor coded *zero* for all univalent primes and *one* for ambivalent primes. The more complex model had a significantly better model fit than the null model, PB-test(1) = 14.11, p < .01, indicating that ambivalent primes had a significantly higher Griffin index than univalent primes, B = 7.39, SE = 1.96, t = 3.78. A direct comparison of ambivalent and neutral primes, however, did not improve model fit in comparison to the null model, PB-test(1) = .32, p = .57.

Experienced ambivalence. To test whether participants perceived more feelings of ambivalence for CS_{amb} as compared to CS_{pos}, CS_{neg}, and CS_{neut}, we compared a null model with a model including a factor predicting the directly experienced ambivalence ratings, which was coded *zero* for all univalent prime words and *one* for ambivalent prime words. The latter model had a significantly better model fit, PB-test(1) = 6.79, p = .02, indicating that ambivalent primes were perceived as being significantly more ambivalent than univalent primes, B = 5.18, SE = 1.98, t = 2.61. We further compared ambivalent CSs with neutral CSs in a similar way, revealing a better model fit for the more complex model as compared to the null model, PB-test(1) = 6.45, p = .01. CS_{amb} had significantly higher experienced ambivalence ratings than CS_{neut}, *B* = 5.10, *SE* = 2.01, *t* = 2.54.

Standard evaluative priming effect

To analyze response time data, we excluded all responses faster than 300ms (0.01%) and slower than 3,000ms (0.05%) resulting in 7,579 observations. Moreover, we excluded all incorrect responses, which is positive responses to negative targets and vice versa, resulting in 7,248 observations left for analysis. In addition, all latencies were log-transformed to correct for a skewed distribution.

The standard evaluative priming effect mirrors in faster responses in congruent trials, i.e., trials in which prime and target valence match, as compared to incongruent trials, i.e., trials in which prime and target possess opposing valences. In this analysis therefore all trials including ambivalent or neutral primes were excluded. We compared the null model with a model including a factor coded *zero* for incongruent trials and *one* for congruent trials. The more complex model had a significantly better model fit, PB-test(1) = 9.01, *p* = .005, indicating the standard evaluative priming effect, *B* = -.03, *SE* = .01, *t* = -3.00.

Ambivalent primes paradigm

To investigate the role of attitudinal ambivalence in an evaluative priming paradigm, we conducted three model comparisons. First, we compared ambivalent trials with congruent trials. A comparison of the null model with a model including a factor coded *zero* for trials including ambivalent primes and *one* for congruent trials revealed no differences in model fit, PB-test(1) = 2.04, *p* = .17, indicating no difference in latencies for ambivalent and congruent trials. The second model comparison tested the null model against a model including a factor coded *zero* for ambivalent trials and *one* for neutral trials. Again, no increase in model fit could be observed, PB-test(1) = .07, *p* = .78, indicating comparable latencies in ambivalent and neutral trials. A last comparison targeted ambivalent trials and incongruent trials. The inclusion of the additional factor increased the model fit significantly in comparison to the null model, PB-test(1) = 4.13, *p* = .04. Latencies were significantly longer in incongruent trials as compared to ambivalent trials, *B* = .02, *SE* = .01, *t* = 2.03. Figure 10 shows mean latencies and standard

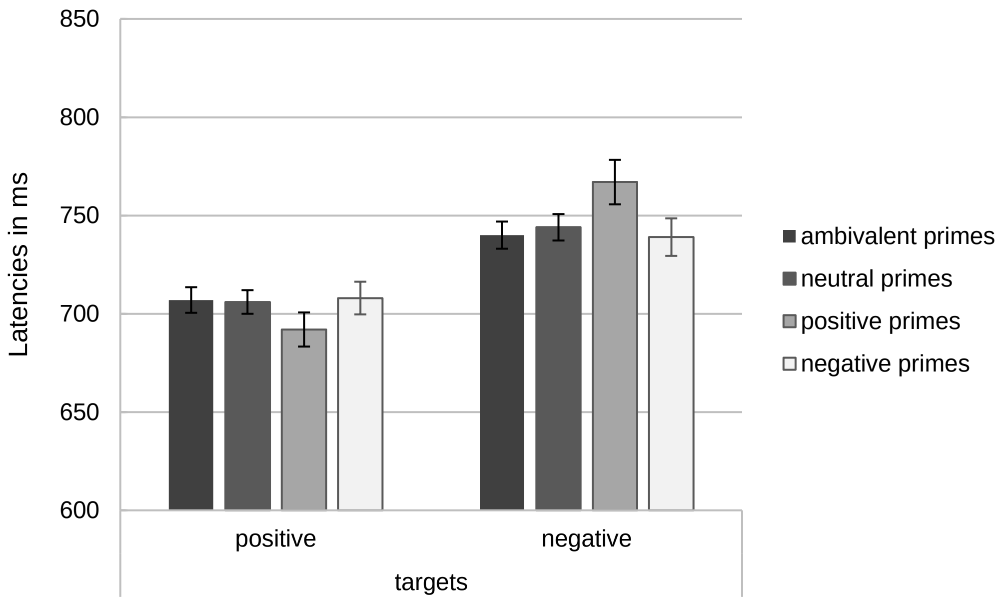

Figure 10. Mean latencies and standard error dependent on prime type and target type in the evaluative priming paradigm.

errors depending on prime type and target type.

The relation between direct and indirect ratings

To investigate the relation between direct and indirect measures of ambivalence, we conducted model comparisons in which the null model was extended stepwise by the *z*-standardized structural ambivalence measure, the *z*-standardized experienced ambivalence measure, and their interaction. Neither an inclusion of the Griffin index, PB-test(1) = .80, p = .38, nor the experienced ambivalence ratings, PB-test(1) = .01, p = .93, or their interaction, PB-test(1) = 1.05, p = .33, improved the model fit significantly. Latencies could not be predicted by any of the direct measures of attitudinal ambivalence.

Discussion

Experiment 2 applied a different conditioning procedure. Specifically, CSs were repeatedly paired with one picture and one sound, which either matched in valence (CS_{pos} and CS_{neg}), had opposing valence (CS_{amb}), or were both neutral (CS_{neut}). Similar to Experiment 1, we found an EC effect for univalent CSs on direct ratings (support for H1a and H1b), while CSs that were paired with both positive and negative USs only had increased negativity (support for H2b) but no significantly increased positivity ratings in comparison to neutral CSs (no support for H2a). If CS_{amb} were simply perceived as CS_{neg} as suggested by the direct ratings, as our priming task was successfully validated, one could expect that separate analyses for trials with positive targets and negative targets, respectively, would yield different results for ambivalent trials. More specifically, if CS_{amb} were perceived as CS_{neg}, ambivalent trials should be comparable to congruent trials in the subset with negative targets, while they should be slower in the subset with positive targets. This is indeed the case: ambivalent-negative prime-target combinations result in latencies comparable to negative-negative prime-target combinations, $B = .00$, $SE = .01$, $t = .01$. In contrast, ambivalent-positive prime-target combinations are significantly slower than positive-positive prime-target combinations, $B = -.02$, $SE = .01$, $t = -2.03$. Contradicting this explanation, however, are the results from the direct measures of attitudinal ambivalence. Here, CS_{amb} had higher structural and experienced ambivalence ratings than univalent CSs. While CS_{amb} did not differ from CS_{neut} in their structural ambivalence, they had significantly higher experienced ambivalence ratings. These findings suggest that people deliberately construct ambivalence if they are asked to directly rate structural and experienced ambivalence, while an automatic activation of the opposing associations does not seem to occur in the priming task.

Interestingly, valence ratings were considerably higher than zero for both CSs_{amb} and for CSs_{neut}. As mentioned by Schneider, Veenstra, van Harreveld, Schwarz, and Koole (2016) supposedly neutral IAPS pictures differ substantially in the level of ambivalence they elicit. The authors had participants rerate the 31 IAPS pictures with the most neutral valence ratings to determine the degree of structural and experienced ambivalence. They found considerable variability in those ratings concluding that neutral IAPS pictures often mask mixed associations. Consequently, we cannot guarantee that the neutral material was in fact non-ambivalent.

This time, responses to congruent trials were significantly faster than responses to incongruent trials suggesting that the priming task worked as expected. While ambivalent trials did not differ from congruent (no support for H3) and neutral trials (no support for H4), unexpectedly they were significantly faster than incongruent trials (no support for H5). Although an ambivalence induction was successful on direct measures, this was not the case for an indirect measure. While we cannot make inferences regarding the degree of automaticity or deliberation of the ambivalence formation processes, the absence of an effect in the priming task suggests that our induced ambivalent attitudes were not strong enough to result in automatic attitude retrieval. Again, latencies were not predicted by any of the direct ambivalence ratings.

General Discussion

Attitudes, that is the sum of associations we hold with regard to a person, object, or event, have explanatory and predictive power for basic perception, affect, cognition, and behavior in humans. Critically, many attitudes do not merely possess positive *or* negative associations, but are characterized by both positive *and* negative aspects. These specific attitudes consisting of opposing evaluations are referred to as ambivalent attitudes. Since ambivalence is a frequent phenomenon (see for instance Berger & Hütter, 2018; Schneider et al., 2016) and possesses unique characteristics such as a weakened attitude-behavior link (e.g., Armitage & Conner, 2000) and deeper information processing (e.g., Maio, Bell, & Esses, 1996), it is essential to further deepen our understanding of this fascinating concept and both, its antecedents and consequences. The most controlled and informative way to do this is by experimentally inducing and then measuring ambivalence. Based on extensive research showing that evaluative conditioning is an established procedure to alter the associative structure of an attitude object, we conducted two experiments in which unknown words were to be loaded with positivity, negativity, neutrality, or ambivalence. Nonwords were repeatedly paired with two pictures (Experiment 1), or one picture and one sound each (Experiment 2). To test for the success of this attitude induction manipulation we (i.) assessed associations with the attitude objects indirectly via evaluative priming and (ii.) directly asked participants to rate the attitude objects' positivity, negativity, and experienced ambivalence.

In both experiments we obtained an EC effect on direct measures, i.e., univalent CSs showed a valence shift in the direction of the US valence. Ambivalent CSs, however, only had increased negativity but not increased positivity ratings in comparison to the neutral baseline CSs. Of note, CS_{neut} consistently possessed positivity and negativity ratings considerably higher than zero. Consequently, instead of suggesting that our EC procedures failed to transfer positive and negative valence to the CS_{amb}, our direct ratings rather point to the possibility that valence was also created in the neutral CSs. As noted by Schneider and colleagues (2016), pictures from the International Affective Pictures System (IAPS; Lang et al., 1997) are rated on a scale applying a bipolar response format ranging from “very negative” to “very positive”. This scale naturally comes with an ambiguous midpoint that may be interpreted as neutral or ambivalent, respectively. Consequently, it does not allow for the unambiguous expression of an ambivalent attitude but risks confounding ambivalent pictures with neutral ones. Consequently, our supposedly neutral US material may have carried valence in the first place.

Regarding the direct ambivalence measures, patterns were inconsistent. While CS_{amb} had higher structural ambivalence ratings than univalent CSs, and higher experienced ambivalence than CS_{neut} in both experiments, they were rated similar to CS_{neut} on the structural ambivalence measure and at least as ambivalent as univalent CSs on experienced ambivalence. A psychological concept that has produced mixed results concerning its potential equivalence to experienced ambivalence is uncertainty (e.g., Clarkson et al., 2008; Jonas et al., 1997). When assessing experienced ambivalence, the specific wording is of high relevance (in this work “To what degree do you feel torn with regard to…?”) to avoid confusion with this related concept. It could have been expected that due to their lack of information and the consequent uncertainty, neutral words would have scored comparably high on experienced ambivalence ratings as ambivalent words. Of note, however, this was consistently not the case thereby proving the item’s suitability to assess experienced ambivalence and not uncertainty.

Priming data did not reveal the expected pattern of results in any of the experiments. While in Experiment 1 the standard congruency effect was not obtained rendering a meaningful interpretation of the results difficult, the paradigm worked as expected for univalent material in Experiment 2. Nevertheless, ambivalent primes consistently did not slow down responses in comparison to congruent or neutral trials. Data from Experiment 2 rather suggests that ambivalent primes acted just like negative primes. This explanation, however, does not match the direct ratings with ambivalent stimuli possessing significantly higher structural and experienced ambivalence ratings than univalent stimuli. Based on this missing correspondence, it seems that supposedly ambivalent primes only activated negativity (as opposed to both valences) undeliberately, whereas in the direct ratings participants seem to deliberately construct ambivalence.

This pattern is further interesting for other areas of attitude research. For instance, the absence of a link between direct and indirect measures challenges theories on self-consistency (e.g., Lecky, 1945). According to this model, a stable self-conception is essential to render social situations more predictable and controllable. For that sake, humans are motivated to be as consistent as possible in different aspects contributing to their self-perception (e.g., cognitions and behavior). As pointed out by Tormala, Clarkson, and Henderson (2011), people are able to draw metacognitive inferences from observing their response behavior and apply those observations on self-reports to achieve higher consistency. They are further able to strategically alter their response patterns (e.g., Degner, 2009) in the direction of their self-reports. If participants possess these abilities and are motivated to be consistent as suggested by self-consistency theory, direct and indirect measures should possess higher correspondence. Of note, however, one should keep in mind that direct and indirect measurement approaches differ considerably in their structural parameters, thereby potentially triggering different attentional foci, processes, and contents. At this point, however, further research is needed to quantify the contribution of different processes to this missing correspondence.

Implications for Attitude Research

Evaluative conditioning is one of the most established paradigms to investigate attitude formation and change. The standard EC effect, i.e., a shift in the liking in the direction of the US valence, is extremely robust and occurs across a variety of attitude objects, domains, and procedural variations (for reviews, see De Houwer et al., 2001; Hofmann et al., 2010). Due to the use of bipolar rating scales to assess the effect, however, most research on evaluative conditioning does not allow for the possibility of ambivalent attitudes. Instead, potentially ambivalent attitudes are concealed as neutral attitudes if positive and negative associations are comparably strong, and as univalent if one evaluation is dominant while the other one is conflicting.

This problem exists both for supposedly neutral US material (Ito, Cacioppo, & Lang, 1998; Schneider et al., 2016) and for supposedly neutral CS material. Berger and Hütter (2018) had participants rate human faces that are commonly used as CSs with separate scales for positivity and negativity. They found that very few of those pictures were in fact rated neutrally. In the same set of studies, Berger and Hütter did not find ambivalent and neutral CSs to differ in the size of the valence transfer after pairings with univalent USs, so in contrast to the authors' expectations relying on an ambivalence amplification hypothesis (Bell & Esses, 2002), ambivalence in the CSs per se does not seem to boost the EC effect. However, the authors found better memory performance for pairings including ambivalent CSs in contrast to neutral CSs indicating deeper information processing. It should further be noted that in the case of ambivalent CSs, the EC procedure does not instigate attitude formation but attitude change processes thereby changing theoretical and practical implications.

In both experiments, pairings with mixed-valence USs resulted in a transfer of both positivity and negativity to initially neutral CSs on direct ratings. On usual bipolar rating scales this would have translated to supposedly smaller valence shifts – as is often reported in EC research with contingencies < 1 and thus supports the idea that those studies induce structural ambivalence by using mixed pairings. A general scarcity of mixed-valence US pairings in EC research, both in the context of contingencies and in the context of attitudinal ambivalence, however, prevents a more comprehensive understanding of the respective consequences. More specifically, more research is required that combines the ecological contingency approach introduced by Ihmels & Hütter (2018) with separate valence scales for positivity and negativity to more adequately track valence changes as a function of varying mixed-valence pairings. The ecological approach possesses increased ecological validity as real-life learning conditions are rarely strictly univalent. Furthermore, it is highly informative with regard to the question whether mixed-valence pairings impair learning processes, or whether the amount of learning remains stable but learned associations are integrated into a summary evaluation as a function of the response format.

The two studies reported here suggest that participants are indeed able to not only store separate valent associations, but to also retrieve evaluations separately. Given these findings, future research should further investigate conditions beyond mere response formats leading to the retrieval of separate or summary evaluations, respectively. Furthermore, future research could compare conditions applying probabilistic pairings with conditions realizing CS or US only pairings. Critically, in both conditions target CSs are equally predictive of a given US, while differing in the informational basis (weaker associations vs. ambivalent associations) they are linked to. It is further recommended that EC research in general uses separate scales for assessing positivity and negativity in order to avoid loss of information.

Classical models of attitude formation assume that attitudes are summary evaluations that result from the integration of different pieces of information. Cacioppo, Gardner, and Berntson (1999) argue that humans tend to integrate various evaluative aspects into bipolar evaluations because those (i.) facilitate action implementations, and (ii.) reduce physiological stress while increasing stability and predictability. Two main integration principles co-exist in the literature: the averaging principle (e.g., Anderson 1971; Kahnemann, Fredrickson, Schreiber, & Redelmeier, 1993) and the summation principle (e.g., Davis, Staddon, Machado, & Palmer, 1993; Fishbein & Ajzen, 1974; Lodge, Steenbergen, & Brau, 1995). While according to the averaging principle, a strongly positive attitude would become weaker after receiving an additional mildly positive piece of information, the attitude would become even more positive according to the summation principle. Interestingly, both approaches assume the integration of single evaluations thereby precluding ambivalence, which is by nature the co-existence of distinct evaluations. As mentioned earlier, more research is needed that investigates circumstances under which separate evaluations are integrated and under which they are kept separate. Eventually, an extension of those models that allows for ambivalent attitudes should be aspired. Of note, binary response scales require such a summary evaluation thereby generally promoting information integration.

Dual-process models of attitudes such as the metacognitive model (MCM; Petty &

Briñol, 2006, 2009) or the MODE model (Fazio, 1995, 1997; Fazio & Olson, 2003) *do* allow for the co-existence of opposing evaluations and thus ambivalence. Essentially, these models distinguish between association-based attitudes that are reported spontaneously and attitudes that are the result of deliberative or propositional processes (cf. Corneille & Stahl, in press). Notably, these models primarily focus on univalent attitudes or on ambivalence between direct and indirect measures. In the two experiments reported here, for supposedly ambivalent material we found a univalent (negative) attitude on the indirect measure and an ambivalent attitude on the direct ratings. As mentioned earlier, the pattern found here suggests that our ambivalent stimuli spontaneously elicited negative associations mirrored in the priming data, and both positive and negative associations on a more deliberate level.

Limitations and Future Directions

In the experiments reported here, we were able to induce valent attitudes on direct measures. In the priming paradigm, however, positive and negative attitudes worked as expected producing a congruency effect, while ambivalent and neutral attitudes did not produce the predicted response time pattern. At least two explanations may be adducted to explain this finding that provide different approaches for future studies. First, the neutral stimulus category proved difficult for the paradigms at hand. As noted by Edwards and Ostrom (1971), supposedly neutral attitudes may result from equally strong positive and negative experiences, exclusively neutral experiences, or the absence of experiences. In the two studies reported here, we tried to create neutral attitudes by presenting unknown words together with neutral pictures and sounds. For reasons elaborated on earlier in the discussion, however, the neutrality of the material is questionable. Thus, in future studies neutral primes might be new nonwords that participants cannot possess any experiences with. By applying new nonwords as neutral material, it is ensured that primes do not carry valence due to pre-existing experiences.

Staying in the realm of evaluative conditioning, an alternative possibility would be to rely on valence reversal instructions (e.g., Hütter & Sweldens, 2014) or cues that reverse the direction of the CS-US relation over the learning phase (e.g., Fiedler & Unkelbach, 2011;

Moran & Bar-Anan, 2013). These techniques have been found to create discrepancies on direct and indirect evaluations, respectively. Consequently, positive and negative valence may be linked to the CS likewise. One should keep in mind, however, that discrepancies on direct and indirect measures constitute a special case of structural ambivalence, which is not necessarily linked to ambivalent feelings. Nevertheless, the combined use of self-reports and evaluative priming procedures may shed more light on the different evaluations and their relations.

Second, standard EC effects, i.e., is CS ratings that are assimilated to the respective US valence, have been repeatedly found to be mirrored in indirect attitude measures such as the evaluative priming paradigm (e.g., De Houwer, Hermans, & Eelen, 1998; Hermans, Baeyens, Lamote, Spruyt, & Eelen, 2005; Hermans, Spruyt, & Eelen, 2003; Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002). Although these effects are significantly smaller than for direct evaluative ratings (cf. Hofmann et al., 2010), they have been found with different procedural variations in the conditioning (e.g., number and type of CSs, number of pairings, type of USs) and priming (e.g., old or new targets, response via key press or voice key) phase. While this state of research clearly suggests that induced univalent associations may be consequential in priming procedures, research is still investigating – and further systematic research is clearly required – boundary conditions under which attitudinal ambivalence is consequential. For instance, Berger and colleagues (2018), and Nohlen and colleagues (2016) found ambivalence to only involve a negative sequel if a resolution of the ambivalence induced conflict was necessary but unfeasible for the task at hand. EC procedures do not causally link CS and US stimuli, they therefore neither render a conflict salient, let alone trigger any resolution motivation. Hence, a lack of relational qualifiers in the EC procedure may render the induction attempt too subtle to build a strong ambivalent attitude.

Future studies may therefore follow different strategies to increase the probability of ambivalence to be reflected in priming paradigms. First, the use of relational qualifiers in an EC paradigm may increase feelings of ambivalence associated with the corresponding CS as it creates a more meaningful CS-US link. This assumption is based on the idea that meaningful

CS-US links render potential attitude conflicts more salient and make it more difficult to resolve that conflict. Both, increased conflict salience (Hass, Katz, Rizzo, Bailey, & Moore, 1992; Newby-Clark, McGregor, & Zanna, 2002) and decreased resolvability of the conflict (Nohlen et al., 2016) are linked to stronger feelings of ambivalence. Alternatively, a stronger motivation to learn the CS-US relation might have the same effect as it also strengthens the CS-US link resulting in increased conflict salience and decreased resolvability. For instance, De Houwer and colleagues (1998) paired nonwords (CSs) with their supposed (valent) translations (USs) and had participants engage in "vocabulary recall tests" to encourage them to build strong relations between the CS-US pairs. It is thinkable that such motivational aspects increase the effect of ambivalence in the CS as it increases the valence transfer from the US to the CS.

Second, future studies may refrain from EC paradigms and rely on more explicit induction techniques. Again, the idea is that ambivalence experience is moderated by salience (Hass et al., 1992; Newby-Clark et al., 2002), resolvability (Nohlen et al., 2016), and potential negative consequences (Cooper & Fazio, 1984; Steele, 1988) associated with ambivalent attitudes. More explicit induction techniques such as the presentation of clearly opposing pieces of information (Jonas et al., 1997; Priester & Petty, 1996; Van Harreveld, Rutjens et al., 2009), or an attitude change manipulation (Petty et al., 2006) may result in increased salience of the attitudinal conflict. Moreover, they allow for cover stories that increase or decrease the ease with which the evaluative conflict may be resolved on the one hand, and may suggest negative consequences or threats for the attitude holder on the other hand. It would certainly be interesting for further research to compare learning and ambivalence perception using identical material (for instance strongly valent character trait words) that is used in a comparably subtle EC procedure on the one hand, and in a more explicit person description scenario on the other hand.

While EC effects are most robust in evaluative priming paradigms at short SOAs indicating undeliberate processes (e.g., De Houwer et al., 1998; Hermans et al., 2003), those processes do not seem to be the only or even main contributor of ambivalence effects. This circumstance makes it even more difficult to capture ambivalence on indirect measures. As argued by Berger and colleagues (2018), the evaluative priming paradigm is the indirect attitude measure that is best suited to investigate attitudinal ambivalence. At the same time, however, this measure is relatively less sensitive to deliberate processes than the IAT (De Houwer, 2006), thereby potentially impeding the effects of attitudinal ambivalence. As only shortly introduced in these preceding paragraphs, many additional studies may and should be conducted to shed light on these partly inconsistent and difficult to integrate findings.

Berger and colleagues further applied an ambivalent targets paradigm, in which ambivalent material served as targets, while primes were univalent or neutral. Although this paradigm cannot test for unintentional effects of ambivalence, it is informative with regard to the use of contextual cues such as prime valence. With ambivalent trials being significantly faster than incongruent trials and just as fast as congruent trials, Experiment 2 suggests response facilitation in ambivalent trials rather than the expected response deceleration. The application of an ambivalent targets paradigm would certainly be interesting to test whether prime valence facilitates the classification of (newly learned) ambivalent targets, or whether participants still deliberately construct ambivalence on direct measures only.

Conclusion

The current research investigated the suitability of an evaluative conditioning paradigm to create attitudinal ambivalence in unknown stimuli. We repeatedly succeeded at creating ambivalence, which is increased positivity and negativity, on direct measures. This pattern, however, was not mirrored in the priming data. Hence, the findings further emphasize the complexity of the concept and suggest an intricate interaction of spontaneous and deliberate processes. Further research is needed to gain a clearer picture with regard to optimal measurement and induction techniques for the investigation of ambivalent attitudes. In conclusion, the current work contributed to the field by testing two different evaluative conditioning procedures to establish attitudinal ambivalence and assessing its success on direct and indirect ambivalence measures, respectively. While it did not yield fully satisfactorily results, it provides valuable implications for attitude research thereby paving the road for future research.

Section V: General Discussion

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An attitude is defined as the evaluation of a certain entity with some degree of favor or disfavor (e.g., Eagly & Chaiken, 1993). The attitudes we hold influence our perception and our interaction with the world and thus possess high relevance for basic research. Given their impact on many domains of the human mind, they are further essential for numerous applied fields such as clinical and health psychology, work and consumer psychology, education, or politics. In social psychology, attitudes have been considered *the* central concept for decades (Allport, 1935).

Despite the prevailing definition stressing associations with either positivity *or* negativity (Fazio, 1995), many attitudes are characterized by the joint presence of (dominant) associations of one valence and (inferior) associations of the opposing valence. If these opposing evaluations are comparably strong, these attitudes are referred to as *ambivalent attitudes*. Ambivalent attitudes possess specific characteristics that differentiate them from univalent, i.e., purely positive or negative, or neutral attitudes. For instance, they are less stable over time (Ainslie, 1992) and possess a weaker link between attitudes and intentions (e.g., Conner, Povey, Sparks, James, & Shepherd, 2003), and actual behavior (Conner et al., 2002, 2003). Hence, people holding ambivalent attitudes are less predictable than those who hold univalent attitudes. Ambivalence is further linked to deeper information processing (Maio, Bell, & Esses, 1996) and a higher vulnerability toward persuasion attempts (e.g., Armitage & Conner, 2000).

Like any other psychological concept, attitudinal ambivalence cannot be observed directly, but must be approximated from self-reports or corresponding behavior. Self-report based measures, so-called direct attitude measures, however, depend on the participant's ability and willingness to report their thoughts and feelings adequately (Greenwald & Banaji, 1995; Nisbett & Wilson, 1977). It may therefore be preferred to refrain from those measures and to rely on so-called indirect attitude measures. This type of measures typically infers underlying associations from behavioral indicators such as for instance the comparison of response times and error rates across different experimental conditions. Essentially, underlying associations either facilitate or aggravate the required response in comparison to the baseline performance. In the last decades, indirect attitude measures have frequently been used to investigate univalent, i.e., purely positive or negative attitudes.

This dissertation takes a closer look at ambivalent attitudes. In the course of three main sections, I (i.) reviewed the current state of the art with regard to conceptual definitions of attitudinal ambivalence, different ways to measure it and experimental approaches to create it, and reported six experiments that (ii.) applied sequential priming paradigms to investigate the fundamental assumption that opposing evaluations can be activated simultaneously and unintentionally, (iii.) systematically investigated the relation between direct and indirect measures of attitudinal ambivalence, and (iv.) realized varying evaluative conditioning procedures to induce ambivalence. The latter section served to investigate whether and how the induction procedures translate to direct and indirect attitude measures. In this General Discussion, I will integrate the insights resulting from these three chapters while interweaving theoretical and methodological implications, and suggestions for future research.

Insights Regarding the Nature of Attitudinal Ambivalence

Definition. As mainly pointed out in Section II of this dissertation, researchers have produced several definitions of attitudinal ambivalence. While these definitions partly use terms that confound concepts that should rather be distinguished from ambivalence (e.g., "approach-avoidance conflict", Emmons, 1996, p. 326; "evaluative dissimilarity", Eagly & Chaiken, 1993, p. 123), the large majority of those definitions either stress the structural aspect of ambivalence, namely the simultaneous presence of positive and negative evaluations (e.g., Conner & Sparks, 2002; Eagly & Chaiken, 1998; Jonas, Broemer, & Diehl, 2000; Jonas & Ziegler, 2007; Kaplan, 1972; Priester & Petty, 1996), or the conflict-like phenomenological experience resulting from attitudinal ambivalence (e.g., Breckler, 1994). While the co-existence of multiple approaches to define the seemingly same concept is not uncommon in psychological research, it is still unfortunate. On the one hand, this condition prevents generalizability and comparability of the results and implications resulting from different studies. Furthermore, to date no research has adequately tested the fundamental assumptions inherent with the definition of attitudinal ambivalence, namely the simultaneous and undeliberate co-occurrence of both, positive and negative associations in an attitude object.

Section III contains a set of four studies that apply an evaluative priming and a valent/neutral categorization task, respectively, to more closely investigate these claims. Over the course of these studies, we obtained evidence that ambivalent stimuli generally slow down latencies in comparison to congruent trials and produce response times that are at least as slow as those in incongruent trials, both if they serve as targets and if they serve as primes. We interpreted this pattern as indication that in contrast to congruent trials, trials involving ambivalent material entail a valence conflict deriving from the simultaneous activation of opposing evaluations. Furthermore, we found the effect to disappear under two distinct conditions that speak to the (conditional) automaticity of the effect: first, when extending the stimulus-onset asynchrony to a dimension that precludes undeliberate processes, all priming effects including the effect of ambivalence disappeared. Second, when applying a valent/neutral categorization task in which ambivalent associations no longer pre-activate conflicting responses but the same response category “valent”, the effect disappears for ambivalent primes. The decelerating effect of ambivalent primes on unrelated subsequent targets, and the vanishing of the effect under the just described conditions attest to the simultaneous and undeliberate activation of positive and negative evaluations in ambivalent attitude objects. Of note, however, this undeliberate activation of opposing evaluations is problematic only if the task at hand produces a conflict at the response expression. The results and implications from Section III thus make a highly relevant theoretical contribution to the field of ambivalence research by providing first evidence for two formerly untested fundamental assumptions regarding attitudinal ambivalence.

As shortly elaborated on earlier, conventional definitions distinguish different types of ambivalence based on their automaticity standards: Explicit ambivalence is equated to self-report based structural and experienced ambivalence, and implicit ambivalence which is a self-reported univalent attitude that as a result of an attitude change or reinterpretational processes possesses ambivalence-like consequences. This classification is problematic because it equates automaticity/deliberation with implicit/explicit measures. Research has shown, however, that automatic processes may affect direct measures (Hütter & Sweldens, 2018) and deliberate processes may be mirrored in indirect measures (De Houwer, 2006; Hahn, Judd, Hirsh, & Blair, 2014). Therefore in Section II, which contains a review that critically reflects the state of the art regarding ambivalence research, we refrain from definitions that are based on supposedly explicit or implicit processes. Instead, we introduce a new classification scheme that is more guided by measurement approaches: structural ambivalence, which may manifest *within* a direct or *within* an indirect measure on the one hand, or *between* a direct and an indirect measure on the other hand (formerly called "implicit ambivalence"). As a second class, we introduce experienced ambivalence on direct or indirect measures. While there is considerable research regarding structural ambivalence on direct measures and between direct/indirect measures, more research is needed on structural and experienced ambivalence on indirect measures.

Automatic retrieval of ambivalent attitudes. With regard to an automatic activation of ambivalence, Section II has further highlighted the importance of precisely determining *which* aspect of automaticity is relevant for the current research question. Bargh (1994) distinguished between awareness, intention, efficiency, and control, thereby disentangling the conscious perception of stimuli, the ability to initiate, end, or alter them, and the relative cognitive ease with which the processing occurs. Even at the specific level of awareness, there are multiple possibilities what participants may or may not be aware of: are they aware of the opposing valences that the stimulus carries? Are they generally aware of the conflict triggered by those evaluations? Or are they aware of the conflict at the level of response execution? Future research should thus focus its attention on more precise theoretical considerations regarding automaticity in specific, and strong theorizing in general. The missing link between direct ambivalence ratings and latencies in the ambivalent primes paradigm suggests that participants were unaware of the conflict elicited by ambivalent attitudes. This interpretation, however, is problematic because (i.) stimulus material was selected based on self-reports and was rated to carry opposing associations, (ii.) prime presentation was clearly supraliminal and thus within the scope of conscious perception, and (iii.) different measures may activate different subsets of information, which participants may selectively be aware of. Slower latencies for ambivalent trials in the ambivalent primes paradigm in Study 1 and 2, but not in Study 3 and 4 further suggest that the unintentional co-activation is only consequential if the task produces a conflict at the response level (cf. Nohlen, van Harreveld, Rotteveel, Barends, & Larsen, 2016). This finding is especially interesting with regard to a supposedly fundamental characteristic of ambivalent attitudes, namely that they are aversive by nature and (automatically) trigger resolution attempts (Maio, Esses, & Bell, 2000). This claim appears difficult to hold given that ambivalence is evaluated positively if it serves a beneficial self-presentation (Pillaud, Cavazza, & Butera, 2013) or decreases outcome uncertainty (Reich & Wheeler, 2016). In Section II, we found that (i.) the effect disappears when the response conflict is eliminated and (ii.) participants do not use prime valence for the classification of ambivalent targets thereby attesting to the absence of resolution attempts.

Attitude strength. Ambivalence is classically assumed to be an indicator of weak attitudes (Krosnick & Petty, 1995; Scott, 1968). More specifically, high degrees of ambivalence are associated with an attenuated attitude-behavior link (Armitage & Conner, 2000; Conner et al., 2003), and less resistance to persuasive messages (Armitage & Conner, 2000). Furthermore, attitudinal ambivalence is classically associated with low levels of attitude accessibility as assessed via response latencies (Bargh, Chaiken, Govender, & Pratto, 1992; Bassili, 1996).

Although this finding was formerly interpreted as indication of low accessibility, results reported in Section III of this dissertation rather imply that both evaluations are highly accessible, thereby potentially producing a conflict that interferes with the response execution. In line with research conducted by De Liver, Van der Pligt, and Wigboldus (2007), we found that ambivalent stimuli generally slowed down responses in an evaluative priming paradigm both if they served as primes and if they served as targets. Consistently across two studies and two paradigms (ambivalent primes and ambivalent targets), ambivalent trials were at least as slow as incongruent trials suggesting that the conflicting evaluations within a stimulus (ambivalent attitude objects) are at least as accessible as conflicting evaluations between two stimuli (incongruent trials). Interestingly, this effect disappeared if the opposing evaluations did not constitute a conflict anymore for the task at hand. Likewise, in an unpublished experiment, Berger and Hütter had participants evaluate univalent, neutral, and ambivalent words that were displayed in front of a univalent, neutral, or no picture by pressing the keys from one ("neutral") to nine (separately "very positive"/"very negative"). Again, ambivalent words were evaluated significantly slower than univalent words. This was the case independently of whether the valence of the univalent word and the background picture matched or mismatched indicating that the conflict resulting from opposing evaluations within a stimulus may be as weighty as a conflict resulting from two separate stimuli.

In addition, Maio and colleagues (1996) found that participants who held ambivalent as compared to univalent attitudes processed new information more deeply. Specifically, participants were better at discriminating between weak and strong arguments in a persuasion paradigm. Since deep information processing is classically linked to deliberative processing (Chaiken, 1980; Petty & Cacioppo, 1986) and strong attitudes (Fabrigar, Priester, Petty, & Wegener, 1998), this finding, too, contradicts the notion that ambivalence is an indicator of weak attitudes (Bassili, 2008).

Ambivalence induced conflict. Based on the finding that positive and negative primes accelerated responses to ambivalent targets but not to neutral targets, De Liver et al. (2007) argued that the opposing evaluations inherent with ambivalent stimuli do not produce inhibition but facilitation, as every ambivalent trial also constitutes a congruent trial. This interpretation appears problematic given that these authors, too, found generally slower responses to ambivalent trials as compared to congruent and incongruent trials. In the experiments reported in Section III of this dissertation, we did not use neutral targets in the positive/negative categorization task and thus cannot provide the analysis corresponding to De Liver et al.'s main analysis. Nevertheless, based on the general slowing of ambivalent trials reported in De Liver et al. (2007), Bargh et al. (1992), Section III of this dissertation, and the results of an unpublished experiment shortly described in the above paragraph on attitude strength, I endorse the notion that attitudinal ambivalence rather produces a valence conflict than facilitation.

In the course of this dissertation, I further investigated whether this ambivalence-evoked conflict (i.) automatically occurs and (ii.) is consequential at the early level of stimulus encounter, or whether the conflict is only consequential if it interferes with the response execution. Maio and colleagues (2000) stated that ambivalence is an aversive state that (automatically) triggers resolution attempts to decrease the discomfort/tension associated with attitudinal ambivalence. In contrast, Nohlen et al. (2016) found that ambivalence is only consequential if the opposing evaluations are relevant for the response execution. In line with the latter study, Section III of this dissertation supports the notion that the unintentional co-activation of opposing evaluations is only *conditionally* consequential, i.e., we did find undeliberate effects at a sufficiently short stimulus-onset asynchrony (SOA) and if the task required a resolution of the conflict, while no such effect was found if both evaluations lead to the same response (Experiment 4) or the SOA was too long to preclude deliberate processes (Experiment 3).

Insights Regarding the Measurement of Attitudinal Ambivalence

The fact that attitudes are not directly observable but can only be inferred from supposedly associated behavior, makes attitude measurement an especially challenging endeavor in social psychology. Attitudinal ambivalence, too, is not exempted from this difficulty. Two major approaches are established to directly measure attitudinal ambivalence: structural measures, which assess positive and negative associations with the attitude object separately, and experienced ambivalence measures, which target the perceived feelings of conflict, tension, and discomfort resulting from ambivalent attitude objects. In Section II, we concluded that both these aspects are critical for attitudinal ambivalence and should thus both be assessed. That is because the co-occurrence of positive and negative associations alone does not necessarily result in conflicting thoughts and feelings. To my knowledge, there is no evidence that structural ambivalence without the experience of ambivalence may be consequential. Further research is needed to address this question systematically. This being said, feelings of conflict do not have to stem from opposing evaluations but may be the result of semantic conflicts (Gebauer, Maio, & Pakizeh, 2013), or low integrativity (Ester & Jones, 2009). The direct ratings of experienced ambivalence reported in Section III and IV further suggest that neutral stimuli, too, often possess high levels of experienced ambivalence potentially stemming from the proximity of the concept with uncertainty.

Indirect attitude measures. While direct attitude measures require the participants' ability and motivation to report their thoughts and feelings correctly (Greenwald & Banaji, 1995; Nisbett & Wilson, 1977), indirect attitude measures refrain from directly asking participants to evaluate attitude objects. Rather, they infer underlying associations from specific response patterns, i.e., latencies and error rates, across different experimental conditions. Classically, it is assumed that direct measures reflect explicit processes such as consciously accessible knowledge and beliefs, and indirect measures tap into implicit and often automatic processes (Strack & Deutsch, 2004). It is, however, a common misconception that indirect attitude measures purely capture implicit processes (De Houwer, 2006; Hahn et al., 2014), and direct attitude measures reflect exclusively deliberate processes (Hütter & Sweldens, in press). Consequently, a direct mapping of explicit/implicit attitudes to direct/indirect attitude measures would be an oversimplification and result in wrong inferences. It is further not clear whether indirect attitude measures actually capture attitudes or whether they simply reflect world knowledge (Arkes & Tetlock, 2004) or structure of language (e.g., Lynott, Kansal, Connell, & O'Brien, 2012). Consider the following example: I may be tolerant and open-minded toward other ethnicities, and have no racist inclinations whatsoever, yet I am aware of the concept of racism, and I frequently read or hear about racist incidents in the news. Consequently, these pieces of information are included in my knowledge structure. Although I may not endorse these attitudes, they are embedded in my associative network and may be revealed via indirect attitude measures.

Discrepancies on direct and indirect measures. In Section II, we introduced *structural ambivalence between direct and indirect measures*. In contrast to ambivalence within measures, which classically means discrepancies on a direct measure or on an indirect measure, ambivalence between direct/indirect measures describes the expression of a univalent attitude on a direct measure, and associations of the opposite valence on an indirect attitude measure. To explain such discrepancies, so-called dual-process models of attitudes can be adducted. Generally, these models assume that indirect measures reflect attitudes that result from automatic learning and response processes, while direct measures mirror attitudes that may deliberately be altered via effortful processes. Due to different circumstances such as attitude change (PAST model, Petty, 2006), a meta-cognitive verification tag (MCM, Petty, 2006; Petty & Briñol, 2006; 2009), or a motivation to alter the evaluation in a more desirable way (APE model, Gawronski & Bodenhausen, 2006; MODE model, Fazio, 2007), self-reported and indirectly measured attitudes may differ. In research on evaluative conditioning, too, ambivalence between direct and indirect measures has been found in studies using relational qualifiers to disentangle associative and propositional processes (Hu, Gawronski, & Balas, 2017a; Moran & Bar-Anan, 2013).

Although these models make highly valuable theoretical contributions, they still lack an explanation for some aspects of ambivalence. First, by showing a general increase in latencies for trials including ambivalent material, Section III provided first evidence for attitudinal ambivalence within an indirect attitude measure. It is not clear, however, how dual-process models allow for opposing evaluations within an indirect measure. This is especially true for those models (such as the MODE model, Fazio, 2007) that consider attitudes to be summary evaluations because summarizing separate evaluations naturally prevents ambivalence. In line with this summary idea are information integration models. While there has not been consensus on whether separate pieces of information are averaged (Anderson 1971; Kahnemann, Fredrickson, Schreiber, & Redelmeier, 1993) or summed up (Davis, Staddon, Machado, & Palmer, 1993; Fishbein & Ajzen, 1974; Lodge, Steenbergen, & Brau, 1995), all models agree that pieces of information do not co-exist but are integrated in one way or the other. If those models were right and attitudes were but the sum or average of separate evaluations, however, ambivalent attitudes would be completely identical to neutral attitudes. With ambivalent attitudes being associated with deeper information processing, perception of negative affect/tension etc., however, this is clearly not the case. It is thus necessary that both, models of information integration and dual-process models are refined to allow for these possibilities.

Second, if it is assumed that indirect attitude measures reflect implicit attitudes that are not accessible, it is not clear if and how ambivalence within an indirect measure or between direct/indirect measures can be experienced (for a comprehensive discussion, see Corneille & Stahl, in press). Rydell, McConnel, Mackie, and Strain (2006) suggest that implicit attitudes may in fact be experienced but its origins stay obscure. Although to my knowledge no empirical evidence regarding the phenomenological experience of ambivalence between measures is available yet (for affective consequences related but not identical to experienced ambivalence, see Rydell, McConnell, & Mackie, 2008), some studies have shown that it indeed is consequential. For instance, Briñol, Petty, and Wheeler (2006), and Petty, Tormala, Briñol, and Jarvis (2006) reported increased scrutiny of attitude-relevant information for ambivalent (between measures) as compared to univalent attitudes. More research is needed to further clarify these open questions.

The relation between direct and indirect measures. Sections II and III of this dissertation point to the scarce literature investigating the relation between direct and indirect attitude measures. Section III of this dissertation contributes to overcoming this state of affairs by providing the first comprehensive set of studies measuring attitudinal ambivalence with classical indirect attitude measures. As more closely elaborated on in the General Discussion of Section III, other well established indirect attitude measures such as the IAT (Greenwald, McGhee, & Schwartz, 1998), the AMP (Payne, Cheng, Govorun, & Stewart, 2005), or mouse tracking (Schneider et al., 2015) are unfortunately not suited to investigate attitudinal ambivalence indirectly. In Section III, we repeatedly found small to moderate positive correlations between r = .07 and r = .21 between structural or experienced ambivalence of the target words and corresponding response times. This is evidence that increased reported ambivalence is associated with increased latencies in sequential priming paradigms. These patterns are in line with findings by Bargh and colleagues (1992) and Schneider and colleagues (2015) who report positive relations between direct ambivalence ratings, and response times and directness of mouse trajectories, respectively. Interestingly, both in Section III and Section IV, we consistently did not find a correlation between ambivalence ratings and response times. This lack of correlations may be due to (i.) a minimal structural overlap between the direct and indirect measures (cf. Hütter & Klauer, 2016), and (ii.) undeliberate, i.e., non-accessible processes that contributed to the deceleration effect found in the ambivalent primes paradigm of Section III.

Sequential priming paradigms. One major contribution of this dissertation is the systematic use of sequential priming paradigms to investigate attitudinal ambivalence via indirect attitude measures. In Section III, we consistently replicated the standard effects in both the evaluative priming paradigm (Fazio, Sanbonmatsu, Powell & Kardess, 1986) at short SOAs, and the valent/neutral categorization task (Werner & Rothermund, 2013; Rothermund & Werner, 2014). Surprisingly, ambivalence research has largely neglected indirect attitude measures so far. I would like to encourage further research in this area for at least three reasons. First, the results from the here-reported priming studies provide a variety of new research ideas whose further pursuit requires the use of indirect measures. To just mention a few examples, the deceleration effect in ambivalent trials suggests that within-stimulus conflicts may be functionally equivalent to between-stimuli conflicts. I do not know of any research that more closely investigated this intriguing possibility. Furthermore, what processes underlie the deceleration effect found for ambivalent primes if not the reportable ambivalence perception? How controllable are ambivalence-induced processes, i.e., do effects vary as a function of instructions? Second, as mentioned earlier, indirect attitude measures have strong advantages over direct attitude measures in that they do not depend on participants' introspection, and their ability and motivation to truthfully report their emotional and cognitive life. Third, the use and insights from indirect measures force researchers to refine and improve established theoretical frameworks such as dual-process models, or information integration models. The use of indirect measures thus further contributes to advancing theoretical considerations and frameworks.

Congruency effects in evaluative priming paradigms, i.e., response acceleration in trials where prime and target valence match, and response deceleration in trials in which prime and target valence mismatch, are classically explained with spreading activation (Fazio et al., 1986). The spreading activation idea is basically an analogy to semantic priming assuming that valent primes automatically activate nodes (and possibly targets) that carry the same valence, and thus accelerate responses to those targets. In standard evaluative priming paradigms, however, those congruency effects are confounded with the compatibility between prime valence and the required response execution (e.g., Klauer, Roßnagel, & Musch, 1997). In Study 4 of Section III, we ran a valent/neutral categorization task (Werner & Rothermund, 2013; Rothermund & Werner, 2014), which removes this confound while still requiring the processing of the stimulus valence. While compatibility effects were obtained, i.e., participants were faster if both prime and target were valent, or both prime and target were neutral as compared to mixed, we did not find valence congruency effects. This pattern supports the idea that congruency effects are the result of response competition.

In both studies reported in Section IV of this dissertation, we found indication of both positive and negative evaluations of formerly neutral stimuli on direct measures. These associations, however, were not (ambivalent primes) or only partly (univalent primes, Study 2) reflected on indirect measures. Although the results from Section III, in which preselected ambivalent material produced deceleration effects in the evaluative priming procedure, suggest that ambivalent attitudes may in fact be sufficiently internalized to be reflected in indirect measures, Study IV suggests that the *formation* of ambivalent attitudes is more complex and/or time-intense than the formation of univalent attitudes. More research is required to better specify the conditions (e.g., more explicit learning paradigms that allow for propositional processes) under which attitudinal ambivalence is reflected on direct/indirect measures.

Insights Regarding the Induction of Attitudinal Ambivalence

As became evident throughout this entire dissertation, the comprehensive investigation of psychological concepts requires an experimental rather than correlational approach. While the latter simply measures two or more constructs to investigate undirected relations between these constructs, an experimental approach systematically induces or manipulates one construct and records consequent changes in another construct. This approach allows for (i.) a higher degree of control over the type, number, and duration of stimulus presentations on the one hand, and (ii.) inferences regarding the causal relationship between the concepts on the other hand.

Ambivalence research largely relies on quasi-experimental or correlational designs. In Section III we used sequential priming paradigms to investigate the effects of preselected ambivalent attitude objects. While these studies too are an example of a quasi-experimental design (the different levels of the independent variable were preselected rather than experimentally manipulated), they constituted an important starting point to investigate whether any effects are to be observed after all. When conducting such studies, it is, however, of major relevance to ensure the following detail: When preselecting material based on structural ambivalence measures, it is important to use the correct aggregation level. Participants vary greatly in their evaluation of attitude objects. Of note, ambivalence is a positive and negative evaluation within a participant (individual level) and should not be confounded with strongly polarizing attitude objects (societal level). This problem can be overcome with an idiosyncratic stimulus selection on the one hand, and a statistical control for differences in the stimulus material (for instance via multilevel modelling with randomly estimated intercepts for stimuli) on the other hand.

Experimental induction of attitudinal ambivalence. So far, most studies involving an ambivalence induction manipulation target structural ambivalence and aim to create both positive and negative associations with an attitude object. Of those studies, most are very explicit in nature and use the presentation of conflicting pieces of information that are meaningfully linked to the attitude object. For instance, Priester and Petty (1996) created ambivalent attitudes by introducing participants to fictitious persons who were described with both, positive and negative character traits. Other authors presented two-sided messages about the respective attitude objects (e.g., Clarkson, Wegener, & Fabrigar, 2008; Jonas, Diehl, & Broemer, 1997). Interestingly, the presentation of conflicting pieces of information was often found to further produce feelings of ambivalence (e.g., Nohlen et al., 2016; Priester & Petty, 1996; Van Harreveld, Rutjens, Rotteveel, Nordgren, & Van der Pligt, 2009). This suggests that an attitude structure containing positive and negative associations may be well suited to evoke feelings of ambivalence. Of note, the mere creation of experienced ambivalence is not sufficient for an unambiguous ambivalence induction because this conflict perception may also result from semantic conflicts (Gebauer et al., 2013), low integrativity (Estes & Jones, 2009), or uncertainty (Berger et al., 2018). Consequently, induction attempts should focus on the attitudinal structure, ideally in combination with high conflict salience (Newby-Clark, McGregor, & Zanna, 2002), and/or a motivation to resolve the conflict due to the task format (Nohlen et al., 2016; Van Harreveld, Rutjens et al., 2009), or because it would otherwise involve negative consequences (Cooper & Fazio, 1984).

Beside impression formation and persuasion paradigms, evaluative conditioning may be adducted to induce structural ambivalence. Petty and colleagues (2006) induced a univalent attitude via a conditioning paradigm and then either reinforced or changed that attitude using a similarity/dissimilarity manipulation of the conditioned fictitious person. In a recent paper, Glaser, Woud, Iskander, Schmalenstroth, and Vo (2018) successfully evoked structural and experienced ambivalence on direct measures in previously neutral material. As repeatedly mentioned throughout this dissertation, however, research including attempts to induce rather than purely measure attitudinal ambivalence is generally scarce. To my knowledge, the studies reported in Section IV of this dissertation, are the first ones to exclusively rely on evaluative conditioning to create both positive and negative associations in attitude objects, while assessing the success of this manipulation with both, classical direct and indirect measures. In line with Glaser et al. (2018), results from this dissertation suggest that evaluative conditioning is well suited to create ambivalence on direct measures. A transfer to indirect measures, however, was not successful. As further elaborated on in the paragraph *Insights Regarding the Measurement of Attitudinal Ambivalence*, further research is needed to determine the conditions under which such transfer to indirect measures may occur. In line with this general research scarcity, and as critically mentioned in Section II of this thesis, to our knowledge no attempt has been undertaken to create ambivalence on indirect measures.

Critically, the success of an experimental induction of ambivalence is certainly impaired by the lack of a unified understanding of the concept. Most theoretical considerations do not focus on the formation of ambivalence within a direct or indirect measure, but of ambivalence between measures. Indeed, relatively many attempts have been undertaken to create discrepancies between direct/indirect measures (e.g., Gawronski & Strack, 2004; Gregg, Seibt, & Banaji, 2006; Heycke, Gehrmann, Haaf, & Stahl, 2018; Hu et al., 2017a, 2017b; Moran & Bar-Anan, 2013; Rydell et al., 2006, Rydell, McConnell, Strain, Claypool, & Hugenberg, 2007; Rydell, McConnell, & Mackie, 2008). Although the extent of research conducted to investigate this concept is generally fortunate, strong claims are made that are to date only hesitantly put to test (e.g., can ambivalence between measures be reported? Is it associated with negative feelings?). Again, I would like to encourage more systematic research regarding the induction of ambivalence within *and* between direct and indirect attitude measures.

Implications for evaluative conditioning. Consistent with this call, in Section IV we turned to the manipulation of the independent variable via evaluative conditioning. Evaluative conditioning is a rather subtle learning paradigm, which in contrast to persuasion paradigms does not ask participants to learn, remember, or form an attitude about the attitude object. The EC effect, i.e., a CS evaluation that is assimilated to the valence of the paired US(s), is a very robust effect that occurs across various contexts, domains, procedural variations, and dependent variables (cf. De Houwer, Thomas, & Baeyens, 2001; Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). The most frequently used dependent variable in evaluative conditioning is a bipolar rating scale ranging from “very negative/unpleasant” to “very positive/pleasant”. This rating scale, however, only allows indicating summary evaluations and not attitudinal ambivalence, which is per definition the co-existence of separate positive and negative evaluations. Hence, separate changes in positive and negative associations are concealed as participants are forced to integrate these changes into a summary evaluative change that can be depicted on a bipolar scale.

Several studies have shown that the use of bipolar rating scales indeed involves a loss of evaluative information both for commonly used US (Ito, Cacioppo, & Lang, 1998; Schneider et al., 2016) and CS material (Berger & Hütter, 2018). This problem is further relevant for EC studies that assign one CS multiple USs of mixed valence, for instance if context or baserate effects, or the effect of contingencies is investigated (e.g., Bar-Anan & Dahan, 2013; Hütter, Kutzner, & Fiedler, 2014; Ihmels & Hütter, 2018). To overcome this problem, Kaplan (1972) suggested the use of two unipolar rating scales to enable participants to indicate their positive and negative associations separately and thus allow for the expression of univalent, ambivalent, and truly neutral attitudes. Except for a very recent paper by Glaser et al. (2018), I do not know of any EC study that records valence shifts separately on positive and negative scales. The possibility of simultaneous shifts on separate scales, however, has entirely new implications. For instance, supposedly inefficient learning procedures resulting in "small" shifts could instead be highly successful but simply affect multiple potentially contrary evaluative aspects. Numerous studies found that ambivalent attitudes have greatly different consequences than univalent or neutral attitudes (cf. Conner & Sparks, 2002; Jonas et al., 2000). The unintended use of ambivalent material in EC studies may thus have led to wrong interpretations of those results. For instance, mixed pairings might produce comparably strong learning in opposing directions instead of weaker or even no learning at all. To avoid such wrong conclusions in one of the most frequently used paradigms to investigate attitude formation and change processes, I recommend the use of unipolar rating scales that allow the expression of more complex attitudes in which positive and negative associations are regarded as independent.

Beside this methodological note, I would like to shortly turn to theoretical accounts of evaluative conditioning. For the last decades, one major subject of debate in EC research is the question whether the EC effect results from associative processes, propositional processes, or a combination of both. Several accounts are distinguished in the first category, such as the referential (Baeyens, Eelen, Crombez, & Van den Bergh, 1992) or the holistic account (Levey & Martin, 1975), which both assume stimulus-stimulus learning based on CS-US co-occurrence, and the implicit misattribution account (Jones, Fazio, & Olson, 2009), which assumes stimulus-response learning resulting from an automatic misattribution of the US response to the CS. Propositional accounts (e.g., De Houwer, 2007, 2009; Mitchell, De Houwer, & Lovibond, 2009) on the other hand share the idea that attitudes are formed based on deliberately created propositions and truth evaluations about CS-US relations. Third, so-called dual-process models share the view that associative and propositional processes co-exist and contribute to the attitude formation process to different extents. Dual-process models differ in their assumptions on where explicit and implicit attitudes are rooted in. For instance, the systems of evaluation model (SEM; Rydell & McConnell, 2006) assumes different types of information to be processed differently thereby producing separate levels of attitudes. The dual-attitudes model (Wilson, Lindsey, & Schooler, 2000) and the metacognitive model (MCM; Petty & Briñol, 2006, 2009; Petty, Briñol, & DeMarree, 2007) in contrast assume that attitude change is the process that causes old and thereby invalid attitudes to become implicit, while the new attitude constitutes the explicit component. In a third category, the associative-propositional evaluation (APE) model (Gawronski & Bodenhausen, 2006) and the motivation and opportunity as determinants (MODE) model (Fazio, 1995, 2007; Fazio & Olson, 2003) assume that the conditions at the attitude expression stage dictate whether a spontaneous/implicit or a deliberate/explicit attitude is reported.

Section IV contains two studies in which previously neutral CSs were rated both positively and negatively after being repeatedly presented with positive and negative stimuli. Although participants reported to in fact perceive the ambivalent material as ambivalent, no deceleration effects were observed in the evaluative priming paradigm. In Section III, while self-reported ambivalence in the prime words did not predict latencies, we still found deceleration effects in trials containing ambivalent primes. These discrepancies between direct and indirect measures further emphasize the complexity of ambivalent attitudes. Of note, however, one should keep in mind that direct and indirect attitude measures (in this thesis self-reports and latencies in an evaluative priming paradigm) may not be equaled with readily accessible explicit attitudes and consciously inaccessible implicit attitudes, respectively. Furthermore, since all insights produced with the current paradigms reflect attitude retrieval processes, it is impossible to draw inferences on ambivalence formation processes. One should thus be careful not to overinterpret our results with regard to different learning models. However, it is fair to say that models such as the APE or the MODE model, which stress the importance of the conditions at the expression stage to explain discrepancies between measures, experience support from our data. Yet, more precise theoretical assumptions and further research are required to extend our understanding of ambivalence formation and retrieval processes on the one hand, and the experimental conditions under which ambivalence may be induced on the other hand.

Conclusion

Despite its frequent occurrence in real life, attitudinal ambivalence, that is the simultaneous positive *and* negative evaluation of the same attitude object, has only received little attention in experimental attitude research. Ambivalence research has produced a large body of valuable insights mainly investigating affective, cognitive, and behavioral consequences of the concept. At the same time, however, its systematic experimental investigation including conceptual claims, measurement, and formation processes, has received comparably little attention.

One contribution of this dissertation is that it provides an extensive overview of the current state of research, thereby paving the road for many directions of future research. Besides reflecting on important achievements in the field, it raises three major concerns: (i.) the lack of a unified understanding of the concept; and associated therewith, the lack of comparability and generalizability of findings in ambivalence research, (ii.) a general scarcity in the use of indirect attitude measures and consequently, little research investigating the relations between different types of measures, and (iii.) a general scarcity of experimental designs aimed at creating attitude ambivalence, allowing for better control and causal inferences.

In two empirical sections, I presented six studies that constitute a first step at closing these three gaps. By using measurement approaches that go beyond self-report based attitude measures, I was able to provide first evidence that positive and negative evaluations are activated simultaneously and automatically, but are only consequential if the task at hand produces a conflict at the response level. At the same time, responses to ambivalent objects are unaffected by contextual cues. Furthermore, the studies provide evidence that the relation between the self-reported degree of ambivalence and response latencies is moderated by the role of the ambivalent objects. By creating self-reported ambivalence in previously neutral material via two different evaluative conditioning procedures, I further followed the call for more induction attempts. The successful induction on direct measures, however, is not reflected on indirect measures, thereby suggesting a complex interaction of automatic and deliberate processes.

Clearly, much more research is needed to complement our understanding of this complex concept. The present thesis constitutes an important step and contributes to the field by creating awareness for a conceptually and methodologically sound basis, and starting to fill in those gaps.

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Appendix A

Stimulus Material Used in Section III, Experiment 1

	Ambivalent targets paradigm		Ambivalent primes paradigm	
	Primes (adjectives)	**Targets (nouns)**	**Primes (nouns)**	**Targets (adjectives)**
ambivalent	-	KARRIERE (career)	Karriere (career)	-
		REGULIERUNG (regulation)	Regulierung (regulation)	
		ARZTBESUCH (doctor's visit)	Arztbesuch (doctor's visit)	
		PROTEST (protest)	Protest (protest)	
		ALKOHOL (alcohol)	Alkohol (alcohol)	
		FEUER (fire)	Feuer (fire)	
		SMARTPHONE (smartphone)	Smartphone (smartphone)	
		STOLZ (pride)	Stolz (pride)	
positive	frei (free)	MUT (courage)	Mut (courage)	FREI (free)
	klug (savvy)	LUST (delight)	Lust (delight)	KLUG (savvy)
	treu (faithful)	GLÜCK (happiness)	Glück (happiness)	TREU (faithful)
	gesund (healthy)	FREUDE (joy)	Freude (joy)	GESUND (healthy)
	beliebt (popular)			BELIEBT (popular)
	ehrlich (honest)			EHRLICH (honest)
	herzlich (sincere)			HERZLICH (sincere)
	friedlich (peaceful)			FRIEDLICH (peaceful)

	Ambivalent targets paradigm		**Ambivalent primes paradigm**	
	Primes (adjectives)	**Targets (nouns)**	**Primes (nouns)**	**Targets (adjectives)**
negative	blöd (foolish)	LEID (sorrow)	Leid (sorrow)	BLÖD (foolish)
	dumm (stupid)	ÄRGER (anger)	Ärger (anger)	DUMM (stupid)
	fies (mean)	FURCHT (dread)	Furcht (dread)	FIES (mean)
	brutal (violent)	TRAUER (mourning)	Trauer (mourning)	BRUTAL (violent)
	grausam (atrocious)			GRAUSAM (atrocious)
	neidisch (envious)			NEIDISCH (envious)
	peinlich (embarrassing)			PEINLICH (embarrassing)
	widerlich (disgusting)			WIDERLICH (disgusting)
neutral	takatg	-	hdreeh	-
	ineifk		izmcsg	
	aahrte		tdkesu	
	ndwrow		unerit	
	rurtum		ilbuel	
	worenl		rdnslb	
	iasweg		ursdcu	
	enoers		nsedni	

Appendix B

Stimulus Material Used in Section III, Experiments 2 and 3

	Ambivalent targets paradigm		**Ambivalent primes paradigm**	
	Primes (adjectives)	**Targets (nouns)**	**Primes (nouns)**	**Targets (adjectives)**
ambivalent	-	KARRIERE (career)	Karriere (career)	-
		REGULIERUNG (regulation)	Regulierung (regulation)	
		ARZTBESUCH (doctor's visit)	Arztbesuch (doctor's visit)	
		PROTEST (protest)	Protest (protest)	
		ALKOHOL (alcohol)	Alkohol (alcohol)	
		FEUER (fire)	Feuer (fire)	
		SMARTPHONE (smartphone)	Smartphone (smartphone)	
		STOLZ (pride)	Stolz (pride)	
positive	sanft (gentle)	HOFFNUNG (hope)	Hoffnung (hope)	SANFT (gentle)
	klug (savvy)	GESUNDHEIT (health)	Gesundheit (health)	KLUG (savvy)
	treu (faithful)	FRIEDEN (peace)	Frieden (peace)	TREU (faithful)
	gesund (healthy)	SCHUTZ (safety)	Schutz (safety)	GESUND (healthy)
	beliebt (popular)			BELIEBT (popular)
	begabt (talented)			BEGABT (talented)
	herzlich (sincere)			HERZLICH (sincere)
	friedlich (peaceful)			FRIEDLICH (peaceful)

	Ambivalent targets paradigm		Ambivalent primes paradigm	
	Primes (adjectives)	**Targets (nouns)**	**Primes (nouns)**	**Targets (adjectives)**
negative	faul (lazy)	GEFÄNGNIS (prison)	Gefängnis (prison)	FAUL (lazy)
	dumm (stupid)	FRIEDHOF (cemetery)	Friedhof (cemetery)	DUMM (stupid)
	lahm (lame)	STREIT (dispute)	Streit (dispute)	LAHM (lame)
	einsam (lonely)	VERSAGER (loser)	Versager (loser)	EINSAM (lonely)
	grausam (atrocious)			GRAUSAM (atrocious)
	neidisch (envious)			NEIDISCH (envious)
	arrogant (arrogant)			ARROGANT (arrogant)
	ungerecht (unfair)			UNGERECHT (unfair)
neutral	edet	-	Nedrhlan	-
	nbsg		Unseniehbht	
	eapela		Lgcaiihrdp	
	audric		Tutcler	
	ottkunf		Rnbaoec	
	veern		Drien	
	caheshae		Ndniranhiu	
	sraedaesb		Ecezg	

Appendix C

Stimulus Material Used in Section III, Experiment 4

	Ambivalent primes paradigm	
	Primes (nouns)	**Targets (adjectives)**
ambivalent	Karriere (career)	-
	Regulierung(regulation)	
	Arztbesuch (doctor’s visit)	
	Protest (protest)	
	Alkohol (alcohol)	
	Feuer (fire)	
	Smartphone (smartphone)	
	Stolz (pride)	
positive	Hoffnung (hope)	SANFT (gentle)
	Gesundheit (health)	KLUG (savvy)
	Frieden (peace)	TREU (faithful)
	Schutz (safety)	GESUND (healthy)
		BELIEBT (popular)
		BEGABT (talented)
		HERZLICH (sincere)
		FRIEDLICH (peaceful)
negative	Gefängnis (prison)	FAUL (lazy)
	Friedhof (cemetery)	DUMM (stupid)
	Streit (dispute)	LAHM (lame)
	Versager (loser)	EINSAM (lonely)
		TÖDLICH (deadly)
		NEIDISCH (envious)
		ARROGANT (arrogant)
		UNGERECHT (unfair)

	Ambivalent primes paradigm	
	Primes (nouns)	**Targets (adjectives)**
neutral	Gegenteil (opposite)	REAL (real)
	Regler (controller)	HOCH (high)
	Sache (thing)	ÖRTLICH (local)
	Situation (situation)	OVAL (oval)
	Aufenthalt (stay)	TYPISCH (typical)
	Alltag (everyday life)	GENERELL (general)
	Tätigkeit (occupation)	TÄGLICH (daily)
	Gelenk (joint)	SPEZIELL (particular)
	Abbild (portrayal)	SICHTBAR (visible)
	Vorkommen (occurrence)	SACHLICH (factual)
	Merkmal (characteristic)	WÖRTLICH (literally)
	Leinwand (screen)	ÄHNLICH (similar)
	Stelle (place)	NORMAL (normal)
	Kappe (lid)	HÄUFIG (frequent)
	Beispiel (example)	THEMATISCH (topical)
	Quader (squared stone)	INDIREKT (indirect)

Appendix D

Stimulus Material Used in Section IV, Experiment 1 (if deviant, Experiment 2)

	Ambivalent primes paradigm	
	Targets (adjectives)	**Primes (nonwords)**
ambivalent	-	
positive	SANFT (gentle)	
	KLUG (savvy)	
	TREU (faithful)	BAYRAM (RAYMAB)
	GESUND (healthy)	DIKONUB
	BELIEBT (popular)	ENANWAL
	BEGABT (talented)	FEVKANI
	HERZLICH (sincere)	GIRKAMO
	FRIEDLICH (peaceful)	KADIRGA
		LOKANTA (KOTANLA)
negative	FAUL (lazy)	NIJARON
	DUMM (stupid)	SARICIK (SAKIRIC)
	LAHM (lame)	TANKALO
	EINSAM (lonely)	UDIBNON
	GRAUSAM (atrociousl)	WOPALEN
	NEIDISCH (envious)	
	ARROGANT (arrogant)	
	UNGERECHT (unfair)	
neutral	-	

Ich erkläre hiermit, dass ich die zur Promotion eingereichte Arbeit mit dem Titel

Attitudinal Ambivalence – A New Look at Structure, Measurement, and Induction Approaches

selbständig verfasst, nur die angegebenen Quellen und Hilfsmittel benutzt und wörtlich oder inhaltlich übernommene Stellen (alternativ: Zitate) als solche gekennzeichnet habe.

Folgende Studien wurden im Rahmen einer Bachelorarbeit in Zusammenarbeit mit den nachfolgenden Studierenden erstellt:

Betroffene Studie	**Beteiligte Studierende**	**Semester**
Kapitel III, Studie 1	Annkathrin Baisch Clara Held	SS 2017
Kapitel IV, Studie 2	Michelle Muellner Christine Vo	SS 2018

Ich erkläre, dass die Richtlinien zur Sicherung guter wissenschaftlicher Praxis der Universität Tübingen (Beschluss des Senats vom 25.5.2000) beachtet wurden.

Ich versichere an Eides statt, dass diese Angaben wahr sind und dass ich nichts verschwiegen habe. Mir ist bekannt, dass die falsche Abgabe einer Versicherung an Eides statt mit Freiheitsstrafe bis zu drei Jahren oder mit Geldstrafe bestraft wird.

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