Is Evaluative Conditioning Important? Integration into Impression Formation Research Would Answer this Question

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Evaluative conditioning (EC) experiments and impression formation experiments study factors that influence evaluation. Despite large overlap between these two research traditions, they often operate in parallel without attention to findings and theories from the other line of research, risking redundancy. We suggest reintegrating EC research into impression formation as the branch of research that investigates the effect of stimulus co-occurrence distinct from the effects of other relational information. Most learning episodes include stimulus co-occurrence and other relational information (e.g., viewers learn that Batman co-occurs with crime and that he fights crime). Therefore, EC research is important to the extent that the influence of stimulus co-occurrence on evaluation is not overridden by the effects of other relational information. We review initial evidence suggesting that co-occurrence influences evaluation over and above other relational information, and report two experiments that demonstrate empirical directions for studying the effects of co-occurrence versus other relational information.

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Parallel lines of research in psychology are not rare. For example, Ranganath, Spellman, and Joy-Gaba (2010) pointed out that theories explaining arguments believability in the social persuasion literature and in the cognitive category-based induction literature ask similar questions but use different research paradigms. The integration of the findings from these two separate literatures provides a more complete picture of the factors that influence argument believability and inspire new lines of investigation in that area. Overlapping parallel lines of research could emerge from similar question asked by different disciplines. For example, Steel and König (2006) pointed out that the fields of economics, decision making, sociology, and psychology share a common desire to understand human motivation processes, and each field developed its own motivational theories and paradigms. In other cases, similarities among concepts and lines of thought that emerge from different research fields contribute to the understanding of specific phenomena. For example, Carver (2005) argued that work done in developmental psychology has direct relevance for understanding impulse and constraint in personality psychology. Another reason for overlooking overlaps between lines of research is a focus on specific empirical paradigms that were developed to investigate an initial question but later limit the development of research and theory in that field, and obscure commonalities of research questions and findings across different paradigms (Meiser, 2011).

In the present article we argue that evaluative conditioning (EC) research and impression formation research often operate as parallel lines of research, characterized by different paradigms, while they should be closely integrated. EC research studies the effect of co-occurrence between a target object and affective stimuli on the evaluation of the target object. Impression formation research studies how people form impressions of other people and objects. By this definition, EC should be a branch of impression formation research. However, articles about EC seldom integrate findings, theories, and concepts from other branches of impression formation research.

To integrate EC more closely into impression formation research, a main conceptual challenge is to delineate what differentiates between the typical learning procedures used in EC research and those used in impression formation research. Most EC procedures present co-
occurrence between the target object and affective stimuli without specifying any relation other than the co-occurrence. In contrast, most learning paradigms in impression formation research specify the relation between the target object and affective stimuli. This distinction does not only allow studying EC as a well-differentiated branch within impression formation research, it would also help determine the relative importance of EC research. EC research is important to the extent that the effect of stimulus co-occurrence on evaluation is independent of the effect of information about other relations between the target and affective stimuli. Below, we explain our reasoning in more detail, review experiments relevant to the question whether EC is influential even in the presence of information other than stimulus co-occurrence, report novel experiments that addressed this question, and discuss the promises of this research direction.

**Impression Formation**

Impression formation is a rich research tradition that studies how people form impressions of other people. Asch’s (1946) study is often considered the first experimental attempt to investigate impression formation. Asch's identified three important effects: primacy effect (the first items on a trait list hold a large influence on impressions), recency effect (the last items on a trait list hold a large influence on impressions), and centrality effect (central traits guide the interpretation of other information). Asch’s work inspired two main lines of research. The first was known as research pertaining to *Implicit Personality Theory* (Bruner & Tagiuri, 1954; for review see Schneider, 1973). This research studied how perceivers draw inferences about other people from partial information (e.g., Cantor & Mischel, 1977; Rosenberg & Sedlak, 1972; Wishner, 1960). The second line of research that emerged from Asch's research investigated *Processes of Impression Formation*: how perceivers combine different kinds of information to produce an overall impression (e.g., Anderson, 1965; Cusumano & Richey, 1970; Rosenkrantz, & Crockett, 1965).

Over the years, impression formation research studied a wide range of questions such as what factors influence attention during impression formation (e.g., Belmore, 1987; Mayo & Crockett, 1964), how motivation and mood affect impression formation (e.g., De Dreu & Van Kleef, 2004; Forgas & Bower, 1987; Neuberg & Fiske, 1987), what factors bias impression formation (e.g., Skowronski & Carlston, 1989; Ruscher & Hammer, 1966), how category accessibility affects the influence of ambiguous description on evaluation (e.g., Higgins, Rholes,
& Jones, 1977), how organizational processes affect impression formation (e.g., Hamilton, Katz, & Leirer, 1996), assimilation versus contrast processes in impression formation (e.g., Martin, Seta, & Crelia, 1990; Strack et al., 1993), the effects of processing goals (e.g., Chartrand, & Bargh, 1996), the effects of prior knowledge (e.g., Cohen, 1981), effects of fluency (e.g., Sansom-Daly & Forgas, 2010), and more.

Impression formation research is also closely tied to research on persuasion (e.g., Hovland, Janis, & Kelly, 1953; Petty & Cacioppo, 1986), a line of research that has flourished with many empirical investigations and a number of theoretical models. The main difference between impression formation and persuasion research is that instead of evaluation and impressions, persuasion research usually studies changes in opinions: whether people support or oppose certain beliefs, ideologies, and arguments. Still, persuasion research is usually carried out by presenting information about a target object (e.g., a plan to raise tuition) and studying what factors influence people favorability toward that object. Because of this overlap, impression formation and persuasion research are often lumped together as two branches of research on attitude formation and attitude change, usually without clear boundaries between the two. For instance, theories about evaluative response are used in research on impression formation and in persuasion research, on attitudes toward persons and on opinions.

Impression formation and persuasion research subsumes a variety of theories about the formation and expression of evaluative behavior. For instance, the Information Integration theory (Anderson, 1981), the Expectancy-value model of attitudes (Fishbein & Ajzen, 1975), the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986), the Motivation and Opportunity as Determinants of Evaluation (MODE) model (Fazio, 2007), the Associative Propositional Evaluation (APE) model (Gawronski & Bodenhausen, 2006, 2011), the Meta-Cognitive Model (MCM; Petty, Briñol & DeMarree, 2007), the systems of reasoning approach to attitude change (Rydell et al., 2006), and the iterative-reprocessing model of the neural bases of evaluation (Cunningham & Zelazo, 2007).

Early impression formation research and theories have seldom incorporated research on conditioning into their models and research questions. However, more recent theories addressed the effect of co-occurrence on evaluation (e.g., Gawronski & Bodenhausen, 2006; Rydell, et al, 2006). These theories often focused on the differences between automatic and deliberate
evaluation, and, in one way or another, assumed that automatic evaluation is more sensitive than deliberate evaluation to co-occurrence. Automatic evaluation is an evaluative response that has at least one of the following features: it is activated without intention, without control, without awareness or without requiring much cognitive resources (De Houwer, Teige-Mocigemba, & Spruyt, 2009). Deliberate evaluation is an evaluative response not characterized by any of these features. Compatible with that theme, several impression formation studies investigated the effect of co-occurrence on automatic and deliberate evaluation, not always with reference to the term EC, and usually without reference to previous EC research or theoretical models (Boucher & Rydell, 2012; Peters & Gawronski, 2011; Petty, Tormala, Briñol, & Jarvis, 2006; Ratliff & Nosek, 2010; Rydell, McConnell, & Mackie, 2008; Rydell et al., 2006; Siegel, Sigall, & Huber, 2012; Whitfield & Jordan, 2009).

**Evaluative Conditioning**

Evaluative Conditioning (EC; De Houwer, Thomas, & Baeyens, 2001) refers to changes in liking due to stimulus co-occurrence (De Houwer, 2007). In a prototypical EC study, a neutral stimulus (conditioned stimulus; CS) is repeatedly presented with positive or negative stimulus (unconditioned stimulus; US). The common result is a shift in the evaluation of the formerly neutral CS such that it becomes similar to the evaluation of the US. Procedures similar to those studied by modern Evaluative Conditioning research were originally used in research framed as an investigation of the role of affect and classical conditioning in attitude formation (Zanna, Kiesler, & Pilkonis, 1970). In the procedures employed by that early research, conditioned stimuli (usually neutral words or nonsense syllables) co-occurred with positive or negative words (e.g., Blasford & Sampson, 1964; Cohen, 1964; Staats & Staats, 1958) or with aversive stimulus such as an electric shock (e.g., Staats, Staats, & Crawford, 1962; Stagner & Britton, 1949). Early demonstrations of changes in the valence of a natural CS after its co-occurrence with affective US were criticized as artifacts of demand characteristics (e.g., Kiesler, Collins, & Miller, 1969; Orne, 1962; Page, 1969). As a consequence, much research effort was invested in demonstrating that the effect is not confounded by demand characteristics and to determine the role of awareness (Allen & Madden, 1985; Insko & Oakes, 1966; McGinley & Layton, 1973).

The question of awareness also led researches to make a theoretical distinction between *signal learning*—acquisition of propositional-declarative knowledge about stimulus relationships...
in the environment, mediated by controlled cognitive processes, and *evaluative learning*—the process by which an affective reaction evoked by an affective stimulus is transferred to a previously neutral stimulus. Researchers argued that EC represents the latter and not the former (e.g., Baeyens, Elen & Van den Bergh, 1990; Levey & Martin, 1987). Further, EC was separated from classical conditioning with evidence that EC endures conditions that eliminate the effect of classical conditioning—mainly resistance to extinction (Baeyens, Crombez, Van den Bergh, & Eelen, 1988; Baeyens, Eelen, Van den Bergh, & Crombez, 1989) and unawareness of contingency (Baeyens et al., 1990). Although evidence for EC without awareness and for EC’s resistance to extinction is still controversial (e.g., Gawronski, Gast, & De Houwer, 2015; Hofmann et al., 2010; Kattner, 2012; Sweldens, Corneille, & Yzerbyt, 2014), EC research has been established as an independent research tradition (for a review see De Houwer et al., 2001; Walther, Weil, & Langer, 2011), isolated from research on attitude formation and classical conditioning—the lines of research from which EC research evolved.

Over the years, EC research mainly investigated the procedural conditions under which co-occurrence between stimuli results in changes in liking. These conditions include the number of pairings (e.g., Baeyens, Eelen, Crombez, & Van den Bergh, 1992), the order of stimuli presentation (e.g., Hammerl, & Grabitz, 1993), extinction (e.g., Baeyens et al., 1988; Gast & De Houwer, 2013; Gawronski, Gast, & De Houwer, 2015), contingency memory (e.g., Bar-Anan, De Houwer, & Nosek, 2010; Gawronski & Walther, 2012; Hütter et al., 2012), changes in the identity or valence of stimuli (e.g., Baeyens, Eelen, Van den Bergh, & Crombez, 1992; Walther, Gawronski, Blank, & Langer, 2009), and many more.

One turning point in the history of EC research is De Houwer’s (2007) argument that there is variability in the conceptualization of EC among different EC researchers, and his suggestion to define EC as an effect. That shift in conceptualization is important because *conditioning* is a concept that means to people more than it should. People tend to equate conditioning with concepts such as *automatic, unconscious, associative*. De Houwer decoupled all these implicit assumptions from what is known: the effect observed in numerous studies. De Houwer defined EC as ”a change in the valence of a stimulus that results from pairing the stimulus with another stimulus” (De Houwer, 2007, p. 230). We prefer to replace *pairing* with
co-occurrence because there are many methods to pair stimuli other than co-occurrence, yet virtually all EC research before 2007 investigated co-occurrence and no other pairing methods.

After years of a dominant view of EC as the result of associative processes, De Houwer’s definition of EC as an effect allowed him to propose the propositional model of EC (De Houwer, 2007; Mitchell, De Houwer, & Lovibond, 2009). The propositional account states that propositional knowledge about the relation between the stimuli underlies EC. Partly because of De Houwer’s propositional approach, EC research started to extend beyond stimulus co-occurrence and investigated other types of information. For example, EC studies investigated the effect of relational qualifiers that explain the relation between the co-occurring stimuli (Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2012; Walther, Langer, Weil, & Komischke, 2011; Zanon, De Houwer, Gast, & Smith, 2014) and, unsurprisingly, found that people’s evaluation takes the relational information into account. Other studies found that instructions about how to encode the co-occurrence moderated the effect of co-occurrence on evaluation (Balas & Gawronski, 2012; Gawronski, Balas, & Creighton, 2014). EC studies also found that context cues moderated the effect of co-occurrence on evaluation (Bar-Anan & Dahan, 2013; Zanon, De Houwer, & Gast, 2012).

**Why Integrate?**

As our review demonstrates, recently, impression formation research has investigated how co-occurrence affects evaluation. And, lately, EC research started to look at how information other than co-occurrence affects evaluation. Even more than before, each line of research reaches into the territory of the other, risking redundancy and ignorance of past relevant findings and theories. Therefore, we believe that the time is ripe for closer integration between these two research traditions. On one hand, EC research will benefit from taking into account theories and findings from impression formation research. Although EC research deals with evaluative response, general evaluation theories about what influences evaluative response (e.g., Anderson, 1981, Fazio, 2007; Fishbein & Ajzen, 1975; Gawronski & Bodenhausen, 2006) are hardly ever discussed in EC literature. Moreover, impression formation research offers many theoretical, conceptual and empirical insights that could advance EC research. A relatively recent example is the distinction between automatic and deliberate evaluation (Fazio, 2007; Gawronski
& Bodenhausen, 2006; Rydell et al., 2006), which EC research hardly used as a tool for understanding the EC effect (for an exception, see Gawronski, Balas, & Creighton, 2014).

On the other hand, impression formation research has not attempted to integrate EC research much beyond using the basic EC effect (often without explicitly calling it EC). Impression formation theories would benefit from taking into account finding about the conditions under which co-occurrence of stimuli results in changes in liking. Impression formation theories would increase their power and improve their accuracy if they could explain EC findings about blocking (e.g., Lipp, Neumann, & Mason, 2001), extinction (e.g., Gawronski et al., 2015), contingency memory (e.g., Hütter et al., 2012), order of presentation (e.g., Hammerl & Grabitz, 1993) counter-conditioning (e.g., Walther et al., 2009), and more. In summary, because both research lines overlap in their questions, they could benefit from more frequent integration.

**EC is a Branch of Impression Formation Research**

The key for integrating EC and impression formation is not only to define the overlap between these two lines of research (both study factors that influence evaluation), but also the difference between EC research and the typical impression formation research. Most EC research presented co-occurrence of neutral objects with affective stimuli (mostly images). In contrast, the typical impression formation research presents traits or behaviors attributed to the target person, or even more complex information (e.g., the fact that the participant and the target person agree that drugs should be legalized). In other words, the difference between EC and impression formation research is that EC paradigms present co-occurrence between the target object and affective stimuli without specifying any relation other than the co-occurrence. In contrast, in impression formation research the information about the target usually includes explicit relational information other than (or additional to) co-occurrence. Most impression formation research does not only present affective stimuli in spatiotemporal proximity to the target object. Impression formation research usually specifies the relation between the affective stimuli and the target object. For instance, impression formation that presented trait information about a person (e.g., Asch. 1946; Ajzen, 1974; McCarthy & Skowronski, 2011) explicitly indicated that the traits characterize the target person. In short, EC research is a branch of impression formation that specializes in the study of the effect of co-occurrence on evaluation.
Is EC important?

One advantage of integrating EC into impression formation research is that it would help estimating the importance of EC. In our view, EC research is important if stimulus co-occurrence has an effect on evaluation that is not easily eliminated by other relational information. We reason that most evaluative learning episodes include co-occurrence between the targets object and affective stimuli, but also include other relational information. This is true when people observe other people’s behaviors, and when they are told about other people’s traits. It is even true when people watch attractive people in spatiotemporal proximity to a product in commercial ads, a prototypical example used by EC researchers. Most viewers are aware of the complex relational information the product and the attractive people were presented together for marketing purposes. If relational information easily overrides the effect of co-occurrence, then EC has a limited effect on impression formation in everyday life. For instance, the knowledge that attractive people were deliberately presented with a product to convince viewers to like the product might erase any effect of the co-occurrence and render EC irrelevant to this situation.

As a first step in integrating EC into impression formation research we suggest focusing on the factors that moderate the relative effect of co-occurrence on evaluation versus other relational information about the target objects. Such research would help determine how common EC is in evaluative learning episodes. That research direction could also shed light on the factors that moderate EC in general, providing evidence toward better theoretical models of EC. This line of investigation would also add valuable evidence about factors that determine evaluative response, and cognitive processes behind evaluative learning. In the rest of the article, we consider past relevant evidence, and report two novel relevant experiments.

Evidence that EC is Not Eliminated by the Effects of Other Relational Information

So far, no published research has purposely compared the effect of co-occurrence on evaluation versus the effect of other relational information. However, some experiments provide evidence relevant to this question. The first evidence we consider comes from research on source credibility (Gruder et al., 1978; Hovland & Weiss, 1951). In these studies a topic (e.g., a four-day work week) is presented with positive or negative arguments communicated by a source. Participants also receive information about the source credibility (high or low). We construe the arguments as co-occurrence between the subject matter and positive or negative attributes. The
information about the source credibility is another form of information that, via reasoning processes, should discount (or enhance) the co-occurrence effect. The common finding is that if people evaluate the topic immediately after receiving the information, the source credibility affects their evaluation. However, if people evaluate the topic after a delay, the co-occurring argument influences the evaluation regardless of the source credibility. With the concept of EC in mind, one possible reason for this finding might be that co-occurrence influences evaluation despite discounting information, but only if people are not given the chance to cancel the co-occurrence effect immediately after the arguments presentation.

More relevant evidence comes from studies that tested the effect of information about the validity of co-occurrence on evaluation (Boucher & Rydell, 2012; Peters & Gawronski, 2011). Peters and Gawronski (2011) asked participants to form impressions toward four novel men, each presented with verbal descriptions of positive or negative behaviors. Participants were also provided with information whether the behavioral description was characteristic or uncharacteristic of the target person. One man occurred with positive behaviors that characterized him, and one occurred with characteristic negative behaviors. The other two men co-occurred with behaviors that were presented as uncharacteristic of them: one with positive behaviors and one with negative behaviors. As one could expect, Peters and Gawronski’s (2011) studies found that the information whether the co-occurring behaviors are characteristic or uncharacteristic of the men had a strong influence on participants’ deliberate evaluation of the targets. However, co-occurrence still influenced the evaluation independently of the effect of the validity information. In all three studies, Peters and Gawronski found a reliable main effect of co-occurring valence on deliberate evaluation: Participants reported more liking of men who appeared with positive behaviors over men who appeared with negative behaviors (see Experiment 1 in Boucher & Rydell, 2012, for similar procedure and results).

More evidence comes from research that tested the effect of relational information on evaluation (Moran & Bar-Anan, 2013). Participants observed targets characters that started or ended pleasant or unpleasant sounds. Some characters started pleasant music, some started unpleasant noise, some ended the pleasant music, and some ended the unpleasant noise. Thus, participants were exposed to co-occurrence information (the characters co-occurred with either positive or negative sounds) and also relational information (the characters either
started or ended the sounds) that allowed them to infer the characters’ valence (e.g., the character is positive because he ended the unpleasant noise). As could be expected, the characters’ relations with the sounds had the dominant influence on deliberate evaluation. Participants preferred characters that ended the unpleasant noise over characters that ended the pleasant music. However, co-occurrence influenced evaluation independently of the effect of inference. Overall, participants evaluated characters that co-occurred with pleasant music more positively than characters that co-occurred with the noise.

Support that the effect of stimulus co-occurrence is not eliminated by the effect of other relational information comes also from a few EC studies. Participants in Förderer and Unkelbach’s (2012) study observed the co-occurrence of CSs (pictures of men) with positive (e.g., puppies) or negative (e.g., snakes) USs provided simultaneously with a relation qualifier that was either loves or loathes (e.g., X loathes snake). As could be expected, the relational qualifiers had a dominant effect on evaluation: People liked targets that loathed snakes and disliked targets that loathed puppies. However, co-occurrence still influenced evaluation independently of the effect of relational qualifiers. Participants liked targets that co-occurred with positive stimuli more than targets that co-occurred with negative stimuli (S. Förderer, personal communication, June, 6, 2013).

Zanon, De Houwer, and Gast (2012) presented to participants nonwords (CSs) or pairs of nonwords that co-occurred with a positive outcome (a win) or a negative outcome (a loss). The study manipulated a patterning rule; in one condition (the opposition condition), two nonwords that co-occurred with positive US when appearing without other nonwords (CS$_1$-US$_{pos}$; CS$_2$-US$_{pos}$) co-occurred with a negative US when they appeared together (CS$_1$CS$_2$-US$_{neg}$). In the other condition (the similarity condition), the nonwords appeared with the same US, even when they appeared with another nonword (CS$_1$CS$_2$-US$_{pos}$). After learning, participants evaluated each CS, when presented alone on the screen. The critical question was the evaluation of nonwords that appeared only in pairs during the learning phase (e.g., CS$_3$CS$_4$-US$_{pos}$, CS$_5$CS$_6$-US$_{neg}$). These nonwords co-occurred with US of one valence, but in the opposition condition, participants could infer that when the CS is alone, its outcome is opposite of the outcome with which it co-occurred when appearing in pairs. Zanon et al. found support of the assumption that the hypothetical inference attenuated the evaluation (e.g., smaller preference for CS$_3$ over CS$_5$ in the
opposition than in the similarity condition). More relevant to the present question, Zanon et al. found that overall, independently of the effect of the patterning rule, participants reported more positive evaluations of nonwords that co-occurred with positive outcome (CS\textsubscript{3} and CS\textsubscript{4} in our example) than nonwords that co-occurred with negative outcome (CS\textsubscript{5} and CS\textsubscript{6}).

Finally, Gawronski, Walther, and Blank (2005) tested the role of cognitive balance in the formation of interpersonal attitudes. In their study, participants first formed impressions of individuals based on the behavioral descriptions. Then, these individuals co-occurred with new individuals with the information that the known individual either likes or dislikes the new individual. Participants showed positive evaluation of targets liked by positive people and of targets disliked by negative people. Participants showed negative evaluation of targets liked by negative people and of targets disliked by positive people. However, a main effect of co-occurrence still emerged: overall, independently of the effect of the relational qualifier (likes/dislikes), participants evaluated the new targets that co-occurred with positive known individuals more positively than targets that co-occurred with negative known individuals.

In summary, some previous research found evidence suggesting that co-occurrence has an effect on evaluation independent of the effect of other relational information. In these studies, although relational information other than co-occurrence usually had the dominant influence on evaluation, co-occurrence still had an independent effect on evaluation.

Evidence that Relational Information Overrides the Effect of Co-occurrence

In contrast to the evidence reviewed above, some previous research did not find any effect of co-occurrence on evaluation when other explicit relational information was available. In one study (Petty, Tormala, Briñol, & Jarvis, 2006) participants first observed an EC procedure that paired an image of one person with positive stimuli and an image of another person with negative stimuli. Afterwards, participants were exposed to the attitudes held by the two persons: one of them largely agreed with the participants on important issues, and the other disagreed. In one condition, the person who agreed with the participant was the CS\textsubscript{pos} from the pairing procedure, and in the other condition that person was the CS\textsubscript{neg}. Participants self-reported a more positive evaluation of the person who agreed with them than of the person who disagreed with them. The co-occurrence in the pairing procedure did not moderate that preference.
In another relevant study (Siegel, Sigall, & Huber, 2012), participants observed co-occurrence between names of members of one group and positive adjectives, and between names of members of another group and negative adjectives. In one condition, prior to that procedure, participants were told that the adjectives accurately described the groups. In the other condition, participants were told that the adjectives were randomly paired with each group. The evaluation of participants who were told that the adjectives described the persons who co-occurred with them was sensitive to the co-occurrence. Although the pattern of results among participants who were told the adjectives were randomly paired with the social groups reflected an EC effect, the EC effects were small (ds = 0.31, 0.19, in Experiments 1 and 2, respectively), and did not reach conventional statistical reliability (the samples were smaller than 30 in each experiment).

**The Present Experiments**

Our review suggests that the effect of co-occurrence on evaluation *often* persists even if other relational information pushes evaluation to a different direction. However, the main effect of co-occurrence over and above other relational information was an incidental finding in most studies. Little research efforts were invested in investigating the effect of co-occurrence when relational information pushes evaluation to valence opposite of the US. As a consequence, knowledge of what factors moderate this effect is scarce. So far we presented arguments why investigating those moderators is critical for EC research. Next, we present two experiments, each demonstrating a different research direction pertinent to the question. One research direction examines whether assigning specific relational meaning to co-occurrence moderates the effect of co-occurrence. The other research direction investigates what third variables moderate the relative effect of co-occurrence versus other relational information. We consider each experiment a different prototype of a research direction with good potential for advancing knowledge about the role of EC in impression formation.

There are many possible methods to provide relational information in addition to the co-occurrence. Relation words such as *loathes* (Förderer & Unkelbach, 2012) and *ends* (Moran & Bar-Anan, 2013) are a direct verbal method. Another method is to “inject” relational meaning into co-occurrence itself. For instance, Siegel et al. (2012) explicitly informed participants, in advance, whether the CSs co-occurred with adjectives that described them or not. In our conceptualization, they specified the relational meaning of co-occurrence. When participants
were informed that co-occurrence does not imply any relation between the CS and the US, Siegel et al. did not find reliable EC effect, perhaps because of small sample size (the preferences were consistent with EC). In Experiment 1, we continue in the same research direction, with a much larger sample, and with different relational meaning attached to co-occurrence. Instead of specifying that co-occurrence is random, we exposed participants to a context in which stimuli of opposite valence co-occur. We examined whether such a context would inject an opposition meaning to co-occurrence and cause reversed EC when participants observe neutral stimuli co-occur with affective stimuli.

In Experiment 2, we tested focus on valence as a possible moderator of the relative effect of co-occurrence versus relational information on evaluation. We provided participants with verbal relational information with each co-occurrence, explicitly stating the relation between the CS and US. We tested whether participants’ focus during learning on the evaluation of the US versus the evaluation of the CS as inferred from the specific relation would moderate the relative effect of co-occurrence on evaluation.

**Experiment 1**

The goal of Experiment 1 was to test whether the effect of co-occurrence on evaluation can be reversed by exposing participants to an environment in which stimuli of opposite valence tend to co-occur. Participants completed a sequential priming task. They categorized target images as pleasant and unpleasant. Before each image, one of six strings of letters appeared. Two letter strings were unpleasant words, two were pleasant words, and two were nonsense words. The experiment had two conditions. In both conditions, one nonsense words appeared before pleasant images, and the other before unpleasant images. In previous research, such co-occurrence induced the typical EC effect (Schmidt & De Houwer, 2012). In the *similarity* condition, the four affective words always appeared before images of the same valence (e.g., pleasant words always preceded pleasant images). In the *opposition* condition, the four affective words always appeared before images of the opposite valence (e.g., pleasant words always preceded *unpleasant* images). 

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1 We report all data exclusions, manipulations, and measures, and how we determined our sample sizes. To see the materials and data of the whole project (Experiments 1-2) visit https://osf.io/5fnzr/.
We hypothesized that co-occurrence has a relational meaning of similarity that is flexible to temporary changes. Therefore, we assumed that in the opposition condition, EC will reverse. A rival hypothesis is that the common effect of co-occurrence on evaluation has nothing to do with the relational meaning of co-occurrence, and therefore changing the rules about which stimuli tend to co-occur would have no effect on EC.

Method

Participants. In both studies, we planned to collect at least 320 participants for high statistical power (95% chances of detecting an effect of $\eta_p^2 = .02$ for the interaction between EC and the tested moderating factor). Participants in both experiments were volunteers at the Project Implicit research website (Nosek, 2005). Of the 523 participants who started the study, 323 (62%) completed all the measures (because the participants at the website are not obliged or paid for their participation, 50%-70% is currently the range of the typical completion rate). We excluded from the analyses 13 participants (4%) with more than 40% trials faster than 300ms on the sequential priming task, and/or more than 40% errors in the task. The final sample included 310 participants (59% women, $M_{age} = 32.37$, $SD_{age} = 13.42$).

Materials. The CS$_{pos}$ and CS$_{neg}$ were chosen randomly for each participant from a pool of three nonewords: "BAUBED", "EBELSA", and "QUESTL." The affective words were four positive words (Love, Pleasure, Pretty and Wonderful), and four negative words (Hate, Pain, Disgusting and Noxious). Two positive words and two negative words from these lists were chosen randomly for each participant. The targets on the task were four images of happy attractive men and women and four images of unhappy unattractive men and women.

Design. The design was 2 (co-occurrence meaning: same, different; between participants) X 2 (CS type: occurred with positive, co-occurred with negative; within participants).

Learning Procedure. Participants completed an evaluative priming task (Fazio et al., 1995). In each trial, the prime appeared at the center of the screen for 250ms, then replaced by the target. The target appeared until response, or 3000ms. After 3000ms with no response, a red “PLEASE RESPOND FASTER” message appeared on the screen, and the trial ended. In each of three blocks, each letter string appeared in eight trials (total of 24 pairing), always before images of one valence.
The instructions informed participants that words and images would appear on the screen. Participants were instructed to ignore the words and categorize the images as unpleasant (by pressing the left key) or pleasant (by pressing the right key). In the similarity condition, the affective words always preceded images of their own valence (e.g., Love always preceded pleasant people). In the opposition condition, the affective words always preceded images of opposite valence (e.g., Love always preceded unpleasant people).

Evaluation. Afterwards, participants rated the CSs on three different questions, presented in random order: "Based on only visual appearance, how pleasant is this word's appearance?", "Based on what you feel right now, how much do you like this word?", and "If this word had a meaning, how positive do you feel that the meaning would have been?" The response scale ranged from 1 (Not at all) to 9 (Extremely).

Results and Discussion

For each CS, we averaged the rating of the three questions (α = .80). A 2 (co-occurrence meaning: similarity, opposition) x 2 (CS valence: positive, negative) ANOVA on evaluation, revealed a main effect of valence, $F(1, 286) = 16.39, p < .0001, \eta^2_p = .054$, 90% CI [.01, .10], reflecting the EC effect. This result was against our hypothesis because we assumed that EC will be canceled across conditions. There was no effect of co-occurrence meaning condition, $F < 1, \eta^2_p < .01$. The EC effect was moderated by co-occurrence meaning, $F(1, 286) = 7.06, p = .0083, \eta^2_p = .024$, 90% CI [.003, .06]. The interaction reflected a substantial difference in EC between conditions. The average difference between the CS_{pos} evaluation and the CS_{neg} evaluation was $M = 0.76, SD = 1.99, d = 0.38, t(162) = 4.89, p < .0001$, in the similarity condition, and only $M = 0.15, SD = 2.09, d = 0.07, t(146) = 0.88, p = .38$, in the opposition condition.

The results suggest that the meaning of co-occurrence can temporarily change leading to a diminished EC. However, attaching an opposition meaning to co-occurrence did not reverse its effect on EC. The lack of reverse fits the initial conclusion suggested by our review of relevant findings: co-occurrence influence evaluation despite other relational information. In the present case, although opposite stimuli clearly appeared in 96 (66%) out of 144 trials, and similar stimuli never co-occurred, the effect of co-occurrence was not reversed. Therefore, it seems that the common effect of co-occurrence is not easily reversed by reasoning from additional information.
On the other hand, we found that EC was eliminated by attaching an opposition meaning to co-occurrence. These results suggest that there might have been two forces that pushed evaluation to two different ends: co-occurrence had an EC effect that was balanced by the inference from the new relational meaning attached to co-occurrence. In summary, the results of Experiment 1 refute two opposing extreme hypotheses. The effect of co-occurrence is not constant, but it is also not completely constructed from inference about the type of relation co-occurring stimuli tend to have. Further research is needed to reveal more about what happens when people are exposed to an environment in which opposite stimuli co-occur. From our results, it seems that people are either affected by two opposing forces, or that there are individual differences in people’s reaction to such situations. One clear next step is to measure individual differences in people’s explicit knowledge about the co-occurrence rules introduced in each condition (e.g., the opposition rule), and examine whether the knowledge predicts EC.

**Experiment 2**

From the incidental evidence reviewed earlier and from the results of Experiment 1, it seems difficult to completely erase the typical effect of co-occurrence on evaluation. However, it is clear that the relative effect of co-occurrence versus the effects of other relational information is inconsistent. Whereas some experiments found that clear explicit relational information is more dominant than the effect of co-occurrence (e.g., Moran & Bar-Anan, 2013; Förderer, & Unkelbach, 2012), others found that the effect of co-occurrence was equal to the effect of other relational information (e.g., Experiment 1 in the present article; Zanon et al., 2012), and some were not able to detect any effect of co-occurrence above and beyond the effect of other relational information (e.g., Petty et al., 2006). In Experiment 2 we directly test a possible moderator of the co-occurrence effect: whether people focus on evaluating the US or on inferring the evaluative meaning of the specific CS-US relation.

Participants observed men that either gave them or took away from them positive or negative stimuli. The men who took away affective stimuli co-occurred with stimuli of one valence but performed an action that had an outcome of opposite valence. For instance, a man who took from the participants positive objects performed a negative behavior but co-occurred with positive valence. We tested whether co-occurrence has a stronger influence on the evaluation of the target men when participants focus on the evaluation of the stimuli with
which the men co-occurred than when participants focus on the evaluation of the men’s behavior.

Method

Participants. Of the 2,098 participants who started the experiment, 1,092 (52%) participants completed all the measures. We inadvertently obtained many more participants than planned before stopping collection and analyzing the data. 119 participants (11%) who did not pay attention to the manipulation were excluded\(^2\). The final sample included 973 participants (63% women, \(M_{age} = 41.76, SD_{age} = 18.02\)).

Materials. The four targets were pictures of young adult white males (Minear & Park, 2004; pre-tested by Bar-Anan & Amzaleg-David, 2014). We named them Chris, James, Michael and David. The affective stimuli were eight images of cute animals (e.g., a puppy) and eight images of nasty animals (e.g., a cockroach).

Design. The design was 2 (focus: on men’s action, on US valence; between participants) X 2 (US valence: positive, negative; within participants) X 2 (action’s valence: positive, negative; within participants).

Learning procedure. The experiments started with the learning procedure. Before the procedure started, participants were told that they would meet four men and that they should learn what actions each of them performed and form impressions of the men.

Each trial started with a 400ms fixation (different images of forests). Afterwards, a man image and name appeared on the left side of the screen next to an image of cute or nasty animals on the right side of the screen for 400ms. Then, text was displayed between the man and the animals, indicating either gives or takes away. That was the display of the full action and it

\(^2\) We included in the analyses only participants whose performance in the learning task indicated that they paid attention. Among participants who had to evaluate the US, we included only participants whose mean rating of the positive animals was more positive than the mean rating of the negative animals (96% of the participants who completed this condition). Among participants who had to evaluate the men’s actions, we included only participants whose mean rating of the "give positive animals" action was more positive than the mean rating of the "give negative animals" action, and that their mean rating of the "take away negative animals" action was more positive than the mean rating of the "take away positive animals” action (83% of the participants who completed that condition).
remained on the screen for 1600ms, before disappearing. The task had 32 trials (eight trials of each man) presented randomly. Instructions informed participants in advance that each man always performed the same action: one man gave the participants positive animals, one gave negative animals, one took negative animals from the participant, and one took positive animals.

To manipulate focus, after each trial we presented a rating task. In the US focus condition we presented the animal image that appeared on the preceding trial with the instructions “Please rate how positive or negative this animal is.” In the action focus condition we presented again the relation word and the animal image that appeared on the preceding trial with the instructions “Please rate how positive or negative this action is.” In both conditions the rating scale was 1 (very negative), 2 (negative), 3 (positive), and 4 (very positive).

**Evaluation.** After the learning task, participants reported on a 7-point scale how much they liked each man (1=dislike extremely, 7=like extremely)\(^3\).

**Results and Discussion**

The upper part of Table 1 presents the evaluation scores for each target type, for each focus condition. We submitted the evaluation scores to a 2 (focus) x 2 (US valence) x 2 (action’s valence) ANOVA. A main effect of action’s valence, \(F(1, 971) = 269.20, p < .001, \eta^2_p = .23, 90\% \ CI [.18, .25]\), reflected more liking of targets that helped participants (\(M = 4.46, SD = 1.12\)), than targets that harmed participants (\(M = 3.44, SD = 1.10\)). The action effect was moderated by focus condition, \(F(1, 971) = 7.85, p = .005, \eta^2_p = .008, 90\% \ CI [.001, .01]\), reflecting a stronger effect of action’s valence among participants who focused on the valence of the action, \(F(1, 458) = 163.3, p < .001, \eta^2_p = .26, 90\% \ CI [.20, .31]\), than among participants who focused on the US valence, \(F(1, 513) = 128.37, p < .001, \eta^2_p = .20, 90\% \ CI [.15, .24]\).

Replicating the reviewed evidence that co-occurrence influence evaluation independently of the effect of other relational information, the ANOVA found a main effect of US valence, \(F(1, 971) = 37.54, p < .001, \eta^2_p = .03, 90\% \ CI [.02, .05]\), reflecting more liking of targets who co-

\(^3\) For exploratory reasons, all participants completed a Brief IAT (Sriram & Greenwald, 2009) after the deliberate evaluation measure. The results were very similar to those found with deliberate evaluation (see full details in [https://osf.io/9mr35/](https://osf.io/9mr35/)).
occurred with positive animals ($M = 4.08, SD = 0.87$) than of targets who co-occurred with negative animals ($M = 3.82, SD = 0.90$).

Table 1

*Experiment 2: Evaluation as a function of co-occurring valence and role valence in each focus condition*

<table>
<thead>
<tr>
<th>Target role</th>
<th>Co-occurring valence</th>
<th>Positive</th>
<th>Negative</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on men’s action</td>
<td>N = 459</td>
<td>4.57$a$ (1.44)</td>
<td>4.47$a$ (1.47)</td>
<td>3.45$c$ (1.35)</td>
<td>3.18$d$ (1.46)</td>
</tr>
<tr>
<td>Focus on US valence</td>
<td>N = 514</td>
<td>4.60$a$ (1.42)</td>
<td>4.23$b$ (1.44)</td>
<td>3.70$c$ (1.42)</td>
<td>3.40$d$ (1.42)</td>
</tr>
<tr>
<td>Only participants with perfect comprehension</td>
<td>Focus on men’s action</td>
<td>N = 185</td>
<td>5.60$a$ (1.22)</td>
<td>5.11$b$ (1.68)</td>
<td>2.88$c$ (1.48)</td>
</tr>
<tr>
<td>Focus on US valence</td>
<td>N = 187</td>
<td>5.63$a$ (1.20)</td>
<td>4.47$b$ (1.79)</td>
<td>3.42$c$ (1.83)</td>
<td>2.34$d$ (1.24)</td>
</tr>
</tbody>
</table>

*Notes.* Participants with perfect comprehension evaluated each of the two men who helped them more positively than each of the two men who harmed them. On each row, different subscripts indicate a significant difference, tested as contrasts in the ANOVA.

Finally, we found very weak evidence in support of our prediction that focus would moderate the effect of US valence, $F(1, 971) = 3.25, p = .071, \eta^2_p = .003, 90\% \text{ CI [.00, .01]}$. As expected, the interaction reflected stronger co-occurrence effect when participants focused on US valence, $F(1, 513) = 27.21, p < .001, \eta^2_p = .05, 90\% \text{ CI [.02, .08]}$, than when they focused on the action’s valence, $F(1, 458) = 11.83, p = .006, \eta^2_p = .02, 90\% \text{ CI [.006, .05]}$.

The results replicated the reviewed evidence that co-occurrence influences evaluation even when other relational information pushed evaluation away from the US valence. As for our hypothesized moderation, the results were in the predicted pattern but very weak. This could be considered more evidence in support of the sustainability of the co-occurrence effect. Even when participants focused on the valence that should be inferred from the explicit relational information (e.g., taking away positive animals is a negative behavior), the valence of the co-occurring valence influenced the evaluation. On the other hand, it could be that the moderator effect is stronger in reality but our learning procedure was too difficult for some participants who failed learning the role of each man. To investigate that possibility, we repeated the same analysis with participants who rated each of the two men who helped them more positively than the two men who harmed them (40\% of the participants in the focus on men’s action condition, and 36\% of the participants on the focus on US valence condition). These participants showed strong evidence that they understood the roles of each man correctly. That is, these people understood the relational information well and correctly picked up on what each target man has
done during the game. The lower part of Table 1 presents the evaluation scores of this subsample. The results remained similar, but the effects were usually stronger than those found with the whole sample.

Specifically, we found a main effect of the action’s valence, $F(1, 370) = 584.97, p < .001$, $\eta^2_p = .61$, 90% CI [.56, .65], that was moderated by focus condition, $F(1, 370) = 10.97, p = .001$, $\eta^2_p = .02$, 90% CI [.007, .06], reflecting a stronger action valence effect among participants who rated the actions during learning, $F(1, 184) = 358.01, p < .001$, $\eta^2_p = .66$, 90% CI [.59, .70], than among participants who rated the US during learning, $F(1, 186) = 230.53, p < .001$, $\eta^2_p = .55$, 90% CI [.47, .61]. Importantly, although these participants were selected because they showed good understanding of the additional relational information (the men’s actions), they still showed a strong effect of US valence, $F(1, 370) = 142.79, p < .001$, $\eta^2_p = .27$, 90% CI [.21, .33], reflecting more liking of men who co-occurred with positive animals ($M = 4.38, SD = 0.85$) than men who co-occurred with negative animals ($M = 3.51, SD = 0.94$). Importantly, with this subsample the interaction between co-occurring valence and focus was stronger, $F(1, 370) = 11.87, p = .0006$, $\eta^2_p = .03$, 90% CI [.008, .06], again reflecting a stronger co-occurrence effect when participants evaluated the US during learning, $F(1, 186) = 92.68, p < .001$, $\eta^2_p = .33$, 90% CI [.24, .41], than when they evaluated the target’s actions, $F(1, 184) = 50.56, p < .001$, $\eta^2_p = .21$, 90% CI [.13, .29].

The analysis with a subsample that showed excellent comprehension of the whole information provided in the learning procedure suggests that focus on evaluation during learning is probably a reliable moderator of the effect of co-occurrence on evaluation, independently of the effect of other relational information. In all conditions and all samples we found, again, strong evidence that co-occurrence pushes the evaluation toward the US valence regardless of the CS-US specific relation. Experiment 2 suggests that this effect is stronger when, during learning, people focus on the evaluation of the US and that it is weaker when they focus on the evaluative implication of the specific CS-US relation.

**General Discussion**

The main message of the present article is a call for closer integration of evaluative conditioning (EC) research into impression formation research. The two research traditions study how people form impressions of other people and objects. We consider EC research a branch of
impression formation research that specializes in the effect of co-occurrence between a target object and affective stimuli on the evaluation of the target object. Yet, research about EC has seldom borrowed any knowledge from other branches of impression formation research. Although EC research investigates the causal chain from stimulus co-occurrence to evaluative response, present EC theories focus mainly on processes during learning with no clear assumptions about the processes that lead to the evaluative response. It stands to reason that theoretical models and findings pertaining to how evaluative information is stored in memory and how that information is activated and influence behavior are relevant to the question of what memory forms upon exposure to novel information (i.e., the CS-US co-occurrence).

EC research has largely ignored knowledge accumulated in impression formation research. For instance, there is little or no attention in EC research to findings and theories about how evaluative information is integrated (Anderson, 1981), how different goals and motivations influence evaluative learning (Chaiken, Liberman, & Eagly, 1989; Hamilton, Katz, & Leirer, 1980; Neuberg & Fiske, 1987; Petty & Cacioppo, 1986), the formation of ambivalent objects (Priester, Petty, & Park, 2007; DeMarree et al., 2014), and the difference between automatic and deliberate evaluative response (Gawronski & Bodenhausen, 2006). This neglect becomes more costly now that research under the EC tradition has started investigating factors such as motivation and explicit relational information (e.g., Balas & Gawronski, 2012; Förderer & Unkelbach, 2012). With such additions, EC researchers might soon establish a new line of impression formation research, parallel to current impression formation research. Such a development is inefficient and might hinder scientific progress. Instead, we believe that the integration of findings, theories and concepts from impression formation research into EC research and vice versa will make a valuable contribution to scientific progress.

Integrating EC more closely into impression formation requires defining the unique features of the procedures studied so far under that line of research. In our perspective, the main distinction is that EC paradigms present co-occurrence between a target object and affective stimuli without specifying any relation other than the co-occurrence. In contrast, impression formation paradigms specify the relation between the target object and affective stimuli.

The integration of EC into impression formation research does not only entail considering theories and findings from impression formation research. The integration would also stir
empirical investigations into one of the most critical questions about the EC effect: how important is EC relatively to other evaluative learning effects? Typical EC paradigms might seem contrived, exposing participants to situations that rarely occur in everyday life. In reality, people usually do not perceive stimulus co-occurrence without having any information about the reason for the co-occurrence. In other words, co-occurrence is rarely the only relation known between the CS and the US. Therefore, it is crucial to study whether the effect of CS-US co-occurrence on evaluation persists even when people receive information about other relations. For that reason, the integration that we propose is not only of theoretical knowledge. We propose conducting studies that add relational information to co-occurrence, test the effects of different types of relational information, and find what factors moderate the sensitivity of evaluation to co-occurrence versus other relational information.

In this paper we presented two possible research directions to investigate these important questions. In Experiment 1, we tested whether it is possible to change the relational meaning of co-occurrence. We exposed participants to a context in which stimuli of opposite valence co-occur and examined whether such context would reverse EC. Experiment 1 was an example for research about whether a specific method to convey relational information eliminates EC. In Experiment 1, the information was about the meaning of co-occurrence, provided with examples what types of stimuli tend to co-occur in a particular environment. There could be many other types of relations conveyed in many different methods. For instance, our lab started investigating whether Gestalt principles that determine whether people perceive different stimuli as members of the same or different groups serve as relational information that enhances, diminishes, or even completely reverses EC (e.g., would EC occur when the CS and the US appear moving into different directions?).

In Experiment 2, we provided participants verbal relational information with each co-occurrence, explicitly stating the relation between the CS and US. We found that participants’ focus during learning on the evaluation of the US versus the evaluation of the CS as inferred from the specific relation moderates the relative effect of co-occurrence on evaluation. The experiment was an example for investigation of third variables that might moderate the relative effect of co-occurrence versus other relations. There are numerous other candidates for moderators. For instance, perhaps because the effect of co-occurrence is illogical when other
relational information suggests a different evaluation, people who tend to favor feelings over reason would show a stronger EC than people who favor reason over feelings.

In both experiments we found strong evidence that co-occurrence affects evaluation despite other relational information that pushes evaluation to valence opposite of the US. In Experiment 1, attaching an opposition meaning to co-occurrence did not reverse EC. In Experiment 2, the main effect of co-occurring valence was strong despite the effect of relational information. These results suggest that the effect of co-occurrence is a unique effect, independent of the effect of explicit relational information. This evidence is compatible with the incidental findings we reviewed from previous experiments. Thus, critically, initial evidence allows optimism regarding EC: it is an important effect, possibly present in most episodes of evaluative learning in everyday life.

References


Footnotes