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Evaluative and Non-Evaluative Conditioning:

Theory and Implications of Conditioning of Valence and Attributes

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Summary

Evaluative conditioning (EC) refers to the change of valence of initially neutral stimuli due to repeated co-occurrence with valenced stimuli. Broadening this phenomenon, non-evaluative conditioning (NEC) refers to the change of attribute associations beyond valence due to repeated co-occurrence of neutral stimuli with stimuli representing an attribute. EC is a robust and well established associative learning phenomenon; however, which process causes these EC effects (i.e., valence changes) is not yet absolutely clear. Support for NEC effects (i.e., attribute changes) was seldom provided and even less is know about the causing processes.

In my dissertation, I wanted to present a deeper insight into mental activities involved and, thus, into processes causing EC effects. Therefore, I will summarize and discuss findings of EC effects and moderating variables, and will also provide own empirical evidence for moderated EC effects. I will discuss these findings in reference to tow processes assumed to cause EC effects, namely an automatic process and a propositional process. Considering all findings, I will conclude that both automatic as well as propositional processes cause EC effects and, thus, only a multiple-process approach is able to explain all current findings within EC research.

In the second part of this work, I will provide first conclusive evidence for conditioning of attributes beyond valence, namely NEC, and will show one method to control specific NEC effects that ensures only specific attribute associations will be changed. Finally, I will discuss theoretical implications for processes causing NEC effects as well as practical implication for the use of NEC procedures within advertisements to create brand images.

Content

1. Introduction

Preferences play a crucial role in our life and significantly influence human behavior. Central to preferences is a psychological tendency for evaluation. That is, people evaluate nearly any experience, objects, or other people to be good or bad and consequently like or dislike the respective object or person (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Gawronski & Bodenhausen, 2006). An intriguing question in social psychology is how preferences are acquired; that is, which mental processes run in human minds during preference formation.

Early research by Pavlov (1927) showed that some preferences are learned as a consequence of stimuli or events co-occurring in the environment. Stimuli or events that repeatedly occur with positive or negative reinforcement lead to a conditioned response of approach or avoidance and thereby also to the liking or disliking of the initially neutral stimulus/event. For example, when a person always receives an electric shock when he hears a certain tone, he will consequently start to dislike and avoid this tone. This is what is known as Pavlovian conditioning (PC). Additionally, studies showed that this conditioned response will diminish if the conditioned stimulus repeatedly occurs without reinforcement or if reinforcement repeatedly occurs without the respective stimulus. That is, PC is susceptible to extinction. Furthermore, if a stimulus A co-occurred with a certain reinforcement, and afterwards stimulus A and X co-occur with the same reinforcement, X will not cause a conditioned response when it is presented alone. That is, PC is also influenced by blocking. Finally, studies showed that when a very salient stimulus A (e.g., loud tone) and a less salient stimulus X (e.g., soft tone) are reinforced together, only A but not X will cause a conditioned response when occurring alone afterwards. That is, PC is susceptible to overshadowing. In recent years however, studies about learning of preferences also revealed results which were in contrast to findings of PC. Levey and Martin (1975) were the first to study conditioning of pure valence by repeatedly pairing neutral stimuli with positive or negative stimuli, that is, *evaluative conditioning* (EC). In the beginning, EC was thought to be a special form of PC; that is, learning of mere likes and dislikes instead of behavioural or autonomic responses. EC turned out to be a robust phenomenon shown in diverse studies with broad applicability to different settings, stimulus types, and modalities (for an overview see De Houwer, Thomas, & Baeyens, 2001; Hofmann, De Houwer, Perugini, Baeyens, and Crombez, 2010). However, studies also showed that EC – contrary to PC – is resistant to extinction, and shows no blocking or overshadowing effects. Thus, the question was raised whether EC is rather a discrete form of learning instead of a special form of PC; and whether different processes underlie EC and PC causing these different findings.

In the current work, I will elaborate on EC in detail: First, I will delineate EC from PC by discussing contrary findings of EC and PC effects. Furthermore, I will provide an overview on the Rescorla-Wagner model (Rescorla & Wagner, 1972) as a model describing preference learning effects. Second, I will discuss several process accounts for EC, and I will categorize them as either accounts that explain EC effects by an automatic process or an effortful propositional reasoning process. Finally, I will provide empirical evidence for the moderation of EC effects and discuss the implications of those results for the underlying EC process.

The second part of this work is contributed to broadening the EC phenomenon to the change of attribute associations beyond mere valence changes. As Baumeister and colleagues (2001, p. 323) stated "'Good' and 'bad' are among the first words and concepts learned by children". There is a great amount of research concerned with studying valence effects on human thinking and behavior (e.g., Baumeister et al., 2001; Rozin & Royzman, 2001; Unkelbach, Fiedler, Bayer, Stegmüller, & Danner, 2008). However, human preferences are not limited to pure valence; they are rather differentiated including specific attributes. For example, Peter is not only likeable; he might be nice, honest, athletic, and healthy. Also abstract concepts like brands are not only positive or negative; they can be associated with being young, active, and natural, for example. By using simple EC procedures (i.e., repeated pairing of two stimuli), I will show how stimuli will be associated with these specific attributes. Hence, I will broaden EC from a mere change in valence to a change in all kinds of attributes. I will refer to this change in associated attributes as *non-evaluative conditioning* (NEC) and will present two studies providing first evidence for conditioning beyond valence. I will discuss theoretical implications for NEC processes and practical implications for the use of NEC procedures within advertisements to form brand images. Finally, an outlook to open questions and further research will be provided.

2. Conditioning of Preferences

The examination of preferences, how they are formed, and what impact they have is central in social psychology. *Preferences* refer to the liking or the disliking of stimuli. Thereby, they affect behavior by causing approach or avoidance tendencies, influencing whom we like or dislike, and which products we buy. A phenomenon describing the acquisition and change of preferences is *evaluative conditioning* (EC). EC is a parsimonious way to change likeability of initially neutral stimuli: The mere spatial and temporal co-occurrence of a neutral stimulus (CS) and a liked or disliked stimulus (US) makes the initially neutral stimulus more or less likeable (Levey & Martin, 1975). In a standard EC procedure, the valence changes due to repeated pairing of neutral CSs with positive/negative USs.

As there are many ways in which the EC phenomenon has been described in literature – as a process, a procedure, or an effect – it is important to clarify the appropriateness of each definition. According to De Houwer (2007), the *EC procedure* refers to the (repeated) pairing of stimuli. The outcome of this pairing is an *EC effect*, the change in valence of a neutral stimulus (CS). Furthermore, it is important to avoid defining EC as a process: First, defining EC as, for example, an automatic process would restrain EC research tremendously. All possible other processes causing the same effects would be overlooked. Second, as processes usually cannot be measured directly it would not be possible to determine whether the assumed process and thereby EC, if defined as a process, really occurred (De Houwer, 2007). Finally, even if there is empirical evidence supporting one specific EC process, this does not automatically mean that no other processes can cause the same effects or were involved in causing the effects. Especially in recent years, research on EC showed how important it is to not limit the EC definition to one process: Lots of different and in part contradicting findings emerged. Several theoretical accounts were brought up with more or less divergent predictions and implications; some of them favor an automatic, others rather a non-automatic process causing EC effects. There is still a hot discussion within the EC field which process approach might be best to capture and explain all findings. To prevent confusion and the problems which follow an EC process definition, I will refer to EC as a phenomenon in which an EC procedure (i.e., stimuli pairing) leads to an EC effect (i.e., valence change); and I will not refer to EC as a process. Likewise, I will refer to PC as a phenomenon in which a PC procedure (i.e., stimuli pairing) leads to a PC effect (i.e., conditioned response).

2.1 Delineation of Pavlovian and Evaluative Conditioning

PC (respectively classical conditioning) refers to the change in behavior due to repeated co-occurrence of a neutral stimulus (CS) and an unconditioned stimulus (US) triggering an unconditioned response (UCR); consequently the CS triggers a conditioned response (CR) (Pavlov, 1927). For operant behavior the idea is that the probability of a specific response which is followed by reinforcement (respectively US) will increase (Brewer, 1974). In Pavlov's original experiment (1927) a dog was given meat (US) which caused salivation of the dog (UCR). After repeatedly presenting meat and a ringing bell (CS), the dog started salivating when it merely heard the bell (CR) but the meat was not present. The central assumption of PC is its dependency on CS-US contingency. *Contingency* refers to the occurrence of stimuli and comprises occasions in which CS and US co-occur as well as occasions where CS or US occur on their own. Thus, when CS and US always co-occur contingency is high; when CS or US often occur alone contingency is low. For PC effects to emerge there must be a high CS-US contingency so that the CS predicts the US, respectively that the US is expected after the CS (see Rescorla & Wagner, 1972; Martin & Levey, 1978). If CS or US often occur alone and consequently contingency is low, PC effects will not emerge.

In the beginning of research on valence changes through conditioning, researchers considered EC to be a special form of PC, like Levey and Martin when they wrote their article "Classical conditioning of human evaluative responses" (1975). More specifically according to Levey and Martin (see also Martin & Levey, 1978), the first response to a stimulus is an evaluative one, and this evaluation causes a behavioral or autonomic response. What is learned is the evaluation (evaluative response) in the first place which is a precondition of the behavioral/autonomic response (CR). Thus, EC and PC effects always emerge together as a consequence of co-occurring stimuli.

During the following decades, Levey and Martin's (1975) assumption of EC as a special case of PC has been challenged both theoretically and empirically. Baeyens, Eelen, Crombez, and Van den Berg (1992a; and also Baeyens, Eelen, Van den Berg, and Crombez, 1992b) assumed different processes and representational structures of PC and EC. Specifically, they defined PC as a form of signal learning which is based on *CS-US contingency* (see also Rescorla and Wagner, 1972). Thus, repeated co-occurrence of CS and US leads to the expectancy that after the CS the US occurs; consequently the CS will cause a behavioral or autonomic CR. However, this is only true for CS and US always co-occurring and not occurring alone, that is, if there is high CS-US contingency. EC on the other hand is not based on CS-US contingency but rather on mere *CS-US contiguity*. *Contiguity* refers to the co-occurrence of stimuli and comprises only occasions in which CS and US co-occur, but not occasions where CS or US occur alone. Thus, for EC effects to emerge CS and US must repeatedly co-occur, that is, contiguity must be high, but it is not relevant whether CS or US also occur alone. Baeyens, Eelen, and Crombez (1995; see also Baeyens & De Houwer, 1995) distinguished between two systems involved in PC and EC, which react to input differently, cause different information processing, and lead to different behavior: An expectancy-system and a referential-system. The *expectancy-system* detects reliable signals for USs; CSs co-occurring with USs are such signals. Consequently, CSs activate the response to the expected USs; however, responses will only be triggered by salient, non-redundant CSs which co-occur in high statistical contingency with the USs (i.e., CSs and USs occur together but do not occur alone). To establish such USs expectancies learning organisms must be aware of CS-US contingencies; that is, they must have conscious knowledge that CS and US always co-occur and the CS, thus, predicts the US. In contrast, when contingency is reduced as CS or US often occur alone a CS will not lead to expecting the US and a CR will not emerge anymore. According to Baeyens and colleagues, the expectancy-system is involved in PC. Studies about PC support their assumption of an expectancy-system and the central role that CS-US contingency plays: First, studies showed that PC is sensible to extinction; that is, if a CS after conditioning repeatedly occurs alone the CR will diminish and finally not emerge anymore. CS occurrence without the US decreases CS-US contingency, consequently, the CS does not cause US expectancy anymore and the CR will not occur anymore. For example, Vervliet, Vansteenwegen, and Hermans (2010) demonstrated that participants showed lower shock expectancy ratings and less change in tonic skin conductance level to a figure (CS) when it was shown repeatedly without a following shock in the extinction phase after conditioning. Second, there are blocking effects for PC (Kamin, 1969): When CS1 repeatedly co-occurred with a US, and later CS1 and CS2 repeatedly co-occur with the same US at the same time, CS2 will not cause a CR when presented alone afterwards. CS1 already predicts the US; thus, CS2 is redundant. For example, Michtell & Lovibond (2002) demonstrated that participants showed lower shock expectancy ratings and less change in tonic skin conductance level when CS2 occurred alone after learning that the shock follows CS1 *and* CS2. Third, studies showed overshadowing effects; that is, CS2 will not cause a CR when it occurs alone after its co-occurrence with CS1 and US if CS1 is a very salient stimulus. Another kind of overshadowing effect would be that single CSs elicit stronger CRs than more CSs conditioned together as it is more salient that this single CS predicts the US. For example, Rübeling (Experiment 2, 1993) showed that participants were slower and less accurate in stopping a moving target on a screen when they heard a tone (CS1) and felt a vibration (CS) (compound trials) than when they only heard the tone or felt the vibration (alone trials).

Contrary to the expectancy-system, the *referential-system* is only sensible for CS-US contiguity; that is, CS-US co-occurrence is important while it is irrelevant whether CS or US also occur alone (i.e., no high CS-US contingency is necessary). Consequently, as CSs do not cause US expectancy no extinction as well as no blocking should occur. According to Baeyens and colleagues (1995) the referential-system is involved in EC. Assumptions and predictions based on this referential-system influencing likes and dislikes are not in line with findings in PC studies. This led to the assumption that EC effects (i.e., valence changes) and PC effects (i.e., learning behavioral or autonomic responses) are caused by different processes and thus EC and PC are different phenomena.

Since then several empirical studies provided support for Baeyens and colleagues' (1992a; 1995) assumption about EC as a distinct form of conditioning. Support for the resistance to extinction was provided for example by Kerkhof, Vasteenwegen, Baeyens, and Hermans (2011) who conditioned cookies (visual CSs) with sweet or bitter cookies participants had to eat (haptic USs). After conditioning, some of the cookie CSs were presented alone in an extinction phase. These cookie CSs were rated as equally pleasant as the cookie CSs not presented in the extinction phase, showing resistance to extinction. Also the meta-analysis by Hofmann and colleagues (2010) supports the assumption that conditioned valence persists when CSs are presented alone, although EC effects were slightly smaller after extinction. Dwyer, Jarratt, and Dick (2007) showed that EC is resistant to extinction, too. Yet, they also showed that there is no difference between likeability ratings of foods (CSs) paired with obese body shapes (negative USs) alone, or foods (CSs) paired with obese body shapes together with another salient food CS. That is, they showed no effect of overshadowing. Finally, Beckers, De Vicq, and Baeyens (2009) showed that EC is insensitive to blocking. One group of children learned that letter strings were associated with a certain candy gain or loss (initial conditioning) and in a second experimental session learned that the same letter strings now presented together with other neutral strings led to the same candy gain or loss (blocking treatment). Another children group only participated in the initial conditioning phase. Afterwards both groups rated the initial letter strings equally on likeability showing that there were no blocking effects.

Thus based on all opposed findings within EC and PC research, EC is assumed to be a *distinct form of conditioning* instead of a special form of PC. EC depends on CS-US contiguity; consequently, EC is resistant to extinction, and it is not influenced by blocking or overshadowing. PC, on the other hand, depends on CS-US contingency; consequently, PC is not resistant to extinction, and it will be influenced by blocking or overshadowing.

In the current chapter, I delineated PC and EC by summarizing how distinct learning settings, like extinction, blocking, and overshadowing, have a different influence on PC and EC effects. In the following chapter, I will provide an overview on a formalized mathematical model describing effects of preference learning: The Rescorla-Wagner model.

2.2 The Rescorla-Wagner Model Describing Conditioning Effects

Rescorla and Wagner (1972) assembled their earlier assumptions about learning caused by co-occurring stimuli into a formalized mathematical model. Like the PC phenomenon, the Rescorla-Wagner model describes conditioning effects; it does this by mathematical calculations which also allow for effect predictions. The *Rescorla-Wagner model* is based on a discrepancy model of conditioning; that is, "conditioning depends on there being a discrepancy between the outcome of a trial[1] and the reinforcement expected on that trial" (Mackintosh, 1983, p. 189) and only when there is an unexpected outcome actions will change and conditioning will emerge. The model's basics are as follows (Rescorla & Wagner, 1972): The effects of reinforcement (i.e., US is present when CS occurs) and non-reinforcement (i.e., US is absent when CS occurs) on a stimulus X's associative strength, that is, the strength of the link between CS X and US representations, depend not only on the existing associative strength of this stimulus X. The effects also depend on the associative strength of stimulus A co-occurring with this stimulus X. When the strength of all compound stimuli (i.e., co-occurring stimuli) is low, reinforcement will have high influence; however, when it is already high, reinforcement will only have minor influence. For non-reinforcement this is quite comparable: If the US is absent when a compound AX occurs this leads to big decreases in learned behavior (CR) when the compound's associative strength in sum was high, and to small decreases when strength in sum was low. This resembles the fundamental difference to Hull's learning model (1943): Hull's model only considers associative strength of the respective stimulus; the Rescorla-Wagner model considers the associative strength of *all* stimuli occurring together. Consequently, high *contiguity* of a neutral stimulus and reinforcement is not enough for learning; only if a stimulus predicts reinforcement better than other stimuli – that is, there is higher statistical *contingency* between CS1 and US than between CS2 and US – conditioning effects will emerge. Thus as for PC, not contiguity but contingency is central in the Rescorla-Wagner model (Mackintosh, 1983), that is, not only trials with co-occurring stimuli are taken into account but also trials with stimuli occurring alone.

On a formalized level, the Rescorla-Wagner model is based on a linear learning model

$$\Delta p_n = \beta(\lambda - p_n)$$

where Δp_n resembles the response probability in a trial, β and λ resemble learning rate and learning asymptote which are both dependent on CS and US in a trial. Thus, de-/ increase of

[1] A trial refers to a single occurrence of stimuli. As conditioning depends on repeated occurrences of stimuli it is a trial-by-trial learning.

learning in a given trial depend on the response already conditioned to the CS and the asymptote which is supported by the US. The Rescorla-Wagner model comprises three major modifications: First, it describes learning curves for association strengths, but not for response probabilities; that is, how links between stimuli are strengthened or weakened through conditioning. Second, learning depends on different external stimuli; for each stimulus i the associative strength is V_i with positive values indicating excitatory conditioning and negative values indicating inhibitory conditioning. Excitatory conditioning refers to building excitatory associative links where there is a positive relationship between CS and US, and the CS elicits a certain CR. Inhibitory conditioning refers to building inhibitory associative links where there is a negative relationship between CS and US, and the CS does not elicit a certain CR (Mackintosh, 1983). And third, when a US follows a compound AX the change of all components' A and X associative strengths are a function of V_{AX}; that is, they depend on the strength of the stimulus compound, not of the single stimuli.

Thus according to Rescorla and Wagner (1972), the model about associative learning is formalized as

$$V_{AX} = V_A + V_X$$

and further, if a US_1 follows a compound AX the associative strengths of the components are

$$\Delta V_A = \alpha_A \beta_1 (\lambda_1 - V_{AX}) \qquad \Delta V_X = \alpha_X \beta_1 (\lambda_1 - V_{AX}) .$$

Therein, α_i resembles the learning rate parameter associated with each component. It represents the stimulus salience and reflects that different stimuli acquire associative strength differing in speed despite the same reinforcement. β_j resembles the learning rate parameter associated with the US; thus, learning depends on the respective US_j. And λ_j resembles the asymptotic level of the associative strength supported by the respective US_j.

To clarify the implications of their model, Rescorla and Wagner (1972) elaborated on two reinforcement scenarios of compound stimuli. A first scenario is that A was pre-conditioned and A has already acquired associative strength (V_A is high). Thus, conditioning of the compound AX has only a small influence on X's associative strength as ΔV_X depends on $\lambda_1 - V_{AX}$ and V_{AX} in turn depends on V_A; thus, ΔV_X is small. However, if V_A is negative as A was conditioned as an inhibitor, $\lambda_1 - V_{AX}$ is large and thus, reinforcement of AX has a larger influence on ΔV_X. A second scenario is that A and AX are reinforced in the same session. That is, in trials reinforcing A V_A grows, thus, also V_{AX} grows, and as a consequence V_X is small (i.e., blocking of learning for X). However, in trials reinforcing the compound AX V_{AX} grows and thereby also V_X grows, at least early in conditioning. Since V_A grows until it reaches the size of λ as A is reinforced in the A alone and AX trials, V_{AX} exceeds the value of λ. As a consequence, further AX reinforcement decreases the associative strength of the components. It is an important feature of the model that further reinforcement of the components not only increases but at a certain point decreases associative strength when V_{AX} exceeded λ.

The Rescorla-Wagner model is able to describe the most intriguing findings within PC in a mathematical way. First, it describes blocking (Kamin, 1969): Stimulus X reinforced in AX trials by a US will acquire no associative strength and elicit no CR (i.e., low V_X) when stimulus A was already reinforced by the same US in prior A-alone trials (i.e., V_A is already high). Second, it describes overshadowing: Stimulus X after being reinforced in AX trials elicits no CR when stimulus A is very salient (i.e., α_A is much higher than α_X). Third, as a central model assumption is CS-US contingency, the model is able to describe extinction of conditioned responses: A conditioned stimulus X after several trials without a co-occurring US (decreasing contingency) does not elicit a CR anymore; X loses associative strength because of non-reinforcement (i.e., V_X will decrease). Finally, the model describes why PC effects are stronger in the beginning of conditioning when the US/outcome is not yet expected (cf., Mackintosh, 1983): When the US is already expected at least one of the compound stimuli has already a high V_i; thus, further co-occurrences/conditioning will have no effect (Rescorla & Wagner, 1972).

In sum, the Rescorla-Wagner model describes PC effects like the PC phenomenon does and moreover, is able to predict impacts of learning settings on PC effects based on mathematical calculations. Consequently, the Rescorla-Wagner model is not able to describe and predict EC effects and impacts of different learning settings, as different learning settings have different impacts on EC and PC effects. As I have shown in the previous chapter, EC effects are resistant to extinction, and there is no influence of overshadowing or blocking; thus, the findings are contrary to predictions of the mathematical Rescorla-Wagner model.

So far, I have discussed only preference learning effects and have disentangled PC and EC phenomena describing different learning effects. Even more interesting, however, is how these effects are caused, that is, which processes underlie preference formation. Also the Rescorla-Wagner model does not provide a process description of conditioning. As I pointed out it is simply a description of PC effects. Originally the Rescorla-Wagner model was classified as a model conceptualizing an automatic process where no cognitive reasoning is involved. However recently, De Houwer (2009) and also Shanks (2007) pointed out that the Rescorla-Wagner model is not incompatible with propositional reasoning processes either.

The model specifies which input leads to which output, but it does not make any assumption how a specific input leads to a specific output, that is, which mental processes are involved. Yet, I assume that at least some conscious knowledge of CS-US co-occurrences and also CS or US alone-occurrence (i.e., awareness of CS-US contingency) is necessary as contingency is the most important prerequisite of PC and thereby of the effects described by the Rescorla-Wagner model (cf., Martin & Levey, 1978; Lovibond & Shanks, 2002). Thus, cognitive reasoning is likely to be involved in PC. For EC it is still an open question whether EC effects are caused by purely automatic processes or non-automatic cognitive reasoning processes. Several process accounts all making more or less different assumptions about prerequisites and consequences of conditioning emerged. Yet, all of these accounts have one assumption in common: EC is a form of associative learning. In the following chapters, I will elaborate on associative learning and describe two processes which might cause associative learning, an automatic and a non-automatic one. Afterwards, I will provide an overview on the current EC process accounts which assume either an automatic or non-automatic process causing EC effects. Finally, I will discuss empirical results which shed light on processes involved.

3. Associative Learning

Associative learning is defined as a learning phenomenon where changes in beliefs or behavior result out of changes in the world's relations (De Houwer, 2009; Mitchell, De Houwer, & Lovibond, 2009). To emphasize again, like for PC and EC, I will refer to associative learning as a phenomenon describing associative learning effects; these effects can originate from miscellaneous processes. Such associative learning effects are, for example, changes in behavior (i.e., PC effect) or changes in stimulus liking (i.e., EC effect) due to repeated co-occurrence of specific stimuli. I do not define associative learning as a process and thereby do not limit it to one single process. As for EC and PC, this effect definition prevents limiting research by ensuring that research is open for different kinds of processes which might cause the effects (see also chapter 2 and De Houwer, 2007).

There are two prevailing processes assumed to cause associative learning effects: an automatic process including no cognitive reasoning (e.g., Thorndike, 1931) and a non-automatic process including propositional reasoning (e.g., Brewer, 1974). Thus, thoughts and behavior can be influenced either through the formation of simple associative links which hold only the information that stimuli/events co-occurred (i.e., automatic process) or through structured inferences and cognitive reasoning (i.e., propositional reasoning process) (Shanks, 2007; McLaren, Green, & Mackintosh, 1994). Both process accounts are based on different assumptions and make different predictions for learning effects and the influence of different learning settings. In the next two chapters, I will provide an overview on the automatic process account and the propositional process account. At this point I would like to point out that other researches often refer to the automatic process as an association formation process or a mere associative process (e.g., De Houwer, Vandrope, & Beckers, 2005; Gawronski & Bodenhausen, 2006; Shanks, 2007, 2010). Thereby, they want to express that learning results out of the formation of an associative link between two stimuli; according to this process account this formation runs completely automatic (i.e., no influence of cognitive load, processing goals, or awareness/conscious knowledge). The problem with using the terms "association formation process" or "associative process" is that it indicates that only this process is based on formation of mental links between stimuli. Yet, a propositional process also includes the formation of mental links between stimuli. The difference, however, is that links formed due to propositional reasoning are not mere associative holding only information *that stimuli are related*. They are rather propositional links which specify *how stimuli are related*; that is, propositional links are specified mental links. For example, an associative link would be X "is associated with" A; a propositional one would be X "is a friend of" A. Therefore, I will use the terms "automatic process" and "propositional process" to prevent this possible confusion and emphasize the most important difference between the two process accounts, namely automaticity.

3.1 Automatic Process

The *automatic process* account assumes that associative links between stimuli's mental representations are built and retain that those stimuli are related, that is, that they co-occur in the environment. Thus, these links develop, for example, during conditioning procedures. This process is stimulus-driven and completely automatic in that it is carried out without any intention, it is unconscious, and efficient (De Houwer et al., 2005); thus, it is not influenced by cognitive processes, processing goals, and learners do not need to be aware of stimuli co-occurrence. Associative links formed due to this automatic process only contain information *that* stimuli are related, not how. These links are sensitive to associative strength (De Houwer, 2009) which is influenced by stimuli contingency: More co-occurrences and (nearly) no alone-occurrences of stimuli (i.e., high contingency) lead to stronger links than fewer co-occurrences and many alone-occurrences (i.e., low contingency). According to this process account, stimuli evaluations are automatic affective reactions resulting out of associative links to related information which were activated as soon as respective stimuli are processed.

Evaluations are independent of truth values; that is, regardless of whether the activated associative links provide valid information about the stimulus, people use those automatically activated associations for evaluation. The activation of associative links is determined by the existing associative structure and the external input stimuli. Thus, depending on the context the same stimuli can activate different associative links and thereby lead to different evaluations (Gawronski & Bodenhausen, 2006).

The conceptualization of associative links between stimulus representations, whose strength is alterable, provides an intuitive analogy to neural networks (see De Houwer, 2009; Mitchell et al., 2009). Once a stimulus occurs activation automatically spreads via associative links and activates other stimulus representations. However, Shanks (2007) argued that process accounts only incorporating unspecified mental links between stimulus representations, like the automatic process account, are severely limited. These associative links do only contain information that stimuli are related; they do not consider how stimuli are related. Consequently, an automatic process including only unspecified mental links would predict no difference in evaluations based on different information like “John teased Marry” or “Marry teased John” (cf., Shanks, 2007, p. 294), although absolutely different meanings are implied. However, a process which assumes the formation of specified mental links, that is, propositional links that include information *how stimuli or events are related* in the environment would predict differences in evaluation depending on different relational information. When specified propositional information is available and considered, the probability for adequate evaluation (e.g., John is disliked as he teased Marry or Marry is disliked as she teased John) will grow. However, it is extremely important to note that this does not automatically imply that adequate evaluations are always caused by a cognitive process incorporating propositional links. There might be situations or learning contexts where an automatic process influences learning and causes adequate evaluations, too. Moreover, finding evidence for a propositional process does not automatically exclude the possibility of automatic processes causing the same effects.

3.2 Propositional Process

According to Brewer (1974, p. 1), “conditioning in human subjects is produced through the operation of higher mental processes”. That is, controlled (i.e., intentional, conscious, and effortful) processing leads to associative learning and thereby to beliefs about the world (De Houwer et al., 2005; Mitchell et al., 2009). A propositional approach comprises that associative learning effects depend on the formation and evaluation of propositions, and non-automatic processes are involved (De Houwer, 2009). Consequently, the process leads to conscious and propositional knowledge about events (Mitchell et al., 2009).

Before I elaborate any further on the process itself, it is important to clarify what is meant by a *proposition*. According to Shanks (2007, p. 294) a proposition has an "internal semantic or propositional structure in the same way as language does." It consists of two stimuli linked through a propositional link which is a qualified mental link, including information about how those stimuli are related (thus, capturing the different meanings of the statements "John teased Marry" or "Marry teased John"). Those propositions imply a truth value; that is, as they include specified relational information they can be true or false (De Houwer, 2009; Mitchell et al., 2009). When, for example, an observer forms the proposition "John likes Marry" after seeing that John repeatedly teased Marry this proposition is false. According to De Houwer, a new proposition (e.g., John is an enemy of Marry) will only be evaluated as true when it is consistent with other existing propositions which are regarded as being true (e.g., John dislikes Marry; John teases Marry). Existing propositions can stem from prior knowledge, experience, deductive reasoning, and also mere instructions (De Houwer, 2009). Associative learning effects depend on the propositions considered to be relevant for respective stimuli/events and the propositions' truth values. When other propositions are considered to be relevant at a certain moment and thus different propositions are taken into account, while evaluating a stimulus, evaluations or behavior can vary over time (Gawronski & Bodenhausen, 2006).

As already stated, a propositional process includes non-automatic processes. Summarized by De Houwer (2009), this means that people need to be input-aware (they recognize that objects co-occur and in what way) and output-aware (they are aware of the proposition about the objects' relation). They do not need to be aware of the process which led to the proposition formation and truth evaluation. That is, associative learning effects only emerge when people have conscious knowledge that stimuli have a certain relation in the world. This knowledge can only form when people recognize and encode that stimuli co-occur and how they are related. Therefore, sufficient cognitive resources need to be available, people need time to initiate and end the reasoning process, and specific goals related to the process exist (De Houwer, 2009). It is however important to note that, although learning is non-automatic, some processes involved in learning can be automatic; that is, automatic processes, like memory retrieval or stimuli perception, can provide input for non-automatic propositional reasoning. Thus, already formed and truth evaluated propositions can be stored in memory and automatically influence evaluation and behavior in the future (Mitchell et al., 2009).

Especially in recent years, a propositional process explanation of associative learning has become popular. Even findings which were considered to be explained by an automatic process were reconsidered and explained by propositional reasoning processes (for further clarifications see De Houwer, 2009; Lovibond & Shanks, 2002; Mitchell et al., 2009). Yet, there are several reasons why one should be cautious in concluding that associative learning effects are caused only by a propositional process: First, findings supporting a propositional account in one learning setting do not imply that automatic processes cannot cause associative learning effects in other learning settings. Second, it can never be excluded that at least some automatic processes run while propositional processes run during learning. Third, also unspecified mental links, that is, associative links that were built in an automatic process can be taken into account when evaluating stimuli within a propositional process; that is, both processes would provide information for evaluation.

In the next chapter, I will discuss theoretical approaches to an EC process and allocate these process approaches to either an automatic or a propositional process approach. Further, I will provide and discuss empirical findings shedding light onto the EC process. Finally, based on the considerations concerning the possibility of excluding one or the other process based on empirical findings, I will discuss implications for an EC process and the possibility of multiple EC processes.

4. Theoretical Approaches to Evaluative Conditioning

Basically there are five theoretical accounts assuming more or less different EC processes (see also Hofmann et al., 2010). On the one hand, there are theoretical accounts which assume an automatic process causing EC effects: The *holistic account* (Martin & Levey, 1978, 1994) assumes that co-occurrences of CS and US result in a holistic representation, encoding CS and US as a stimulus complex which is linked to another stimulus complex of CR and UCR. When a CS is presented after conditioning it works as a weaker form of the US leading to the evaluative response. This approach would predict that a holistic representation will only be formed, thus EC effects only occur when there is some kind of content or feature similarity between CS and US. Further, in this view CS-US contingency is not necessary, only CS-US contiguity is relevant; that is, CS and US need to repeatedly co-occur, but it does not matter whether both also occur alone. Thus, this account predicts that EC is resistant to extinction. Moreover, people do not need conscious knowledge (be aware) of CS-US contiguity as perception and encoding of stimuli is based on automatic processes. Finally, CS valence is influenced by US-revaluation; that is, when US valence will change after conditioning, CS valence changes accordingly as each US presentation automatically activates the associated CS representation and thereby changes the holistic representation. At the first place, predictions of no extinction and sensitivity to US-revaluation seem contradicting: The holistic account predicts that there will be no extinction of EC effects as only contiguity but not contingency is relevant; thus, alone-occurrences of CS/US do not have any influence. This would imply that EC effects do not rely on associative links between CSs and USs which otherwise will diminished during extinction phases. The prediction of US-revaluation influences, however, implies that there is an associative link between CS and US. The account solves this contradiction by assuming not only an associative link between CS and US but rather associative links between CS, US, CR, and UCR forming a holistic representation. Only this holistic representation allows for predicting, on the one hand, resistance to extinction as CSs are linked directly to CR and, on the other hand, US-revaluation influences as CSs are also linked to USs. The *referential account* (Baeyens et al., 1992a) postulates the learning of referential relations; CSs are associated with USs representations and the evaluative response to the US without US expectancy. That is, after the CS the US is not expected, yet, US evaluation is activated. The account predicts that only CS-US contiguity is necessary, not CS-US contingency; yet, people do not need to be aware of the contiguity (i.e., they do not need any conscious knowledge of co-occurrences). As there is no expectancy of the US caused by the CS, extinction and blocking should have no impact on EC effects. Finally, US-revaluation would impact CS valence as CS and US are linked in memory and US presentation in a US-revaluation phase also activates and changes CS representation. The *implicit misattribution account* (Jones, Fazio, & Olson, 2009) posits that US valence is incorrectly attributed to the CS; people assume that the evaluative source lies within the CS. The misattributed valence is activated when the CS occurs alone afterwards, thus, EC should be resistant to extinction. The account predicts that misattribution will only happen if CS and US features overlap and if it is plausible that the activated US valence might have been caused by the CS. And finally, awareness of CS-US contiguity is not necessary, but rather impairs misattribution as the US would be clearly identified as the valence source. These three accounts share the assumption of an automatic EC process where people need not be aware of CS-US contiguity. The accounts' main prerequisite is CS-US contiguity and not contingency. They assume that unspecified mental links (i.e., associative links) are formed between CS and US representations, or between CS and evaluative response to the US.

The *propositional account* (De Houwer, 2009; Mitchell et al., 2009) assumes that the liking or disliking of a CS changes depending on propositional information about CS and US relations (e.g., CS occurs with/is friend with US). Thus, a propositional EC process account assumes a non-automatic, cognitive reasoning process which includes the formation and truth evaluation of propositions. CS-US contiguity is a central prerequisite of the propositional process and people need to be aware of CS-US contiguity to form propositions. In addition, I assume that people also need to be aware of relational information additionally available, as different relations imply different meanings and thereby moderate EC effects (cf., Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2011b). As cognitive reasoning processes are involved, this account further predicts that cognitive load reduces conditioning, and also that conditioning might be influenced by verbal instruction and deductive reasoning. This propositional EC account equals a propositional process causing associative learning effects described earlier.

A fifth account, the *conceptual categorization account* (Davey, 1994; Field & Davey, 1999), assumes that co-occurrences of stimuli make shared features of CS and US salient; as a consequence, the CS is re-categorized either as an exemplar of the “liked” or “disliked” category depending on the US valence. The account assumes that EC effects only arise when CS and US are similar, and that because of this similarity CS-US contiguity is not even necessary. Thus, when USs’ liked and disliked categories are already easily accessible, CSs will be categorized as members of the category they share most features with. The conceptual categorization account predicts that EC effects are resistant to extinction due to the fact that CSs after conditioning are members of the liked/disliked category and, thus, activate valence on their own. US-revaluation might influence CS valence as it leads to a criteria change of the liked/disliked categories; and these changed criteria are applied to CSs which might be re-categorized again. This account cannot clearly be assigned to an automatic or propositional process approach: The CS could be linked to the liked/disliked category representation by an associative link (caused by an automatic process); or a cognitive reasoning process could lead to the re-categorization through a proposition like “CS is an example of the liked/disliked category because CS and US are similar” (resembling a propositional process).

4.1 Empirical Findings Concerning the EC Process.

As stated earlier, the core difference between an automatic process account and a propositional process account is automaticity (see De Houwer, 2009). Automatic process accounts assume associative learning to run automatically; that is, associative learning effects emerge without awareness (of CS-US contiguity, and in- or output of the process) and the underlying process is not influenced by processing goals or limited cognitive resources. Propositional process accounts, however, assume associative learning to run non-automatically; that is, cognitive components like awareness, goals, and resources influence the process and thereby evaluative and behavioral effects. Thus, studies trying to examine processes causing EC effects examined the influence of awareness, processing goals, and limited resources on EC effects. Earlier EC studies provided evidence for an automatic process: EC effects seemed to occur without participants being aware of CS-US contiguity (e.g., Baeyens, Eelen, & Van den Bergh, 1990; Walther, 2002), and even when participants' cognitive resources were low due to distraction tasks EC effects emerged (e.g., Fulcher & Hammerl, 2001).

However, Pleyers, Corneille, Luminet, and Yzerbyt (2007) pointed out some limitations of earlier studies: Some studies used questionable designs where CSs and USs were assigned by the experimenter (i.e., not randomized or counterbalanced) and thus allow no assumption about processes involved (see also Field & Davey, 1999; Lovibond and Shanks, 2002). Other studies implemented better experimental designs (e.g., like randomized CS-US allocation) but used insufficient measures for awareness which did not conform to the information and sensitivity criterion[2] established by Shanks and St. John (1994). Thus, for some studies it is not clear whether measures captured CS-US contiguity awareness or demand awareness; or if the measures implementing open questions or free recalls were sensitive enough to measure awareness for all participants (see Shanks & St. John, 2004). And finally, analyzing methods further added on the sensitivity issue by using participant-based analyses. That is, participants were classified as either aware or unaware when they could or could not identify a certain number of CS-US pairs. Yet, it is highly unlikely that participants were either aware or unaware of all pairs; thus, classifying them biases the results. Therefore, Pleyers and colleagues recommended an item-based analysis deciding for each CS-US pair whether a participant was aware or not and analyzing data on an item-basis afterwards.

[2] Information criterion = information measured by the awareness measure resembles the information which caused performance
Sensitivity criterion = measurement is sensitive enough to capture awareness

In recent years, studies using appropriate experimental designs and item-based analyses of awareness data provided growing evidence that EC is indeed affected by awareness of CS-US contiguity, processing goals, and resources; hence, supporting a propositional EC process. Overall, the meta-analysis by Hofmann and colleagues (2010) showed that CS-US contiguity awareness is the most influential moderator of EC effects. Thus, not only Pleyers and colleagues (2007) provided evidence that awareness is essential for EC effects, but also Stahl and Unkelbach (2009) and Stahl, Unkelbach, and Corneille (2009) showed that people need to be able to remember at least the valence of the paired US (i.e., be valence aware), to name only some examples. Additionally, Wardle, Mitchell, and Lovibond (2007) showed that awareness is also necessary for EC of other stimulus modalities, like flavors. Also, for the influence of the other two components of non-automatic processes (i.e., processing goals and cognitive resources) empirical support was provided: Gast and Rothermund (2011) showed that changes in valence, that is, EC effects only emerged if participants had a valence focus. If participants focused their attention to other stimulus dimensions no EC effects emerged. Further, Corneille, Yzerbyt, Pleyers, and Mussweiler (2009) showed that EC effects were stronger when participants had the goal to search for similarities in CSs and USs. And Dedonder, Corneille, Yzerbyt, and Kuppens (2010) showed that EC effects were weaker or did not even occur when participants' cognitive resources were low because of a demanding secondary task during conditioning, thus preventing contiguity awareness (see also Pleyers, Corneille, Yzerbyt, and Luminet, 2009). Also, Field and Moore (2005) found EC effects only for people fully attending to the conditioning task; people whose attention was bound by a distractor task showed no conditioning effects. These findings led to the conclusion that effortful non-automatic processes are indeed necessary for EC effects to occur and thus propositional reasoning is most likely. Consequently so far, the propositional account (De Houwer, 2009; Mitchell et al., 2009) and also the conceptual categorization account (Davey, 1994; Field & Davey, 1999) would account for the results if we assume a propositional reasoning process involved in the re-categorization of CSs.

Recently, a study by Fiedler and Unkelbach (2011) provided results which can only be explained by a propositional reasoning process: Reversed EC effects depending on relational information for CSs and USs. They used a standard EC procedure and repeatedly paired pictures of neutral men (CSs) and liked/disliked men (USs). During conditioning, they also provided information about the CS-US relation by telling participants the men were either friends or enemies. Results showed that initially neutral CSs were liked more/less when they were friends with liked/disliked USs (i.e., standard EC effects). However, when CSs were enemies of liked USs, they were liked less; and when CSs were enemies of disliked USs, they were liked more (i.e., reversed EC effects). Yet, Fiedler and Unkelbach found these effects only when participants engaged in active encoding, like rating how likely it was that the two men were friends (respectively enemies) during conditioning. When participants only passively received information about the CS-US relation no reversed EC effects emerged (Exp. 4). Fiedler and Unkelbach concluded that not only pure bottom-up processes (processing US valence), but also effortful top-down processes (active generation and encoding of CS-US relations) are involved in causing EC effects. Furthermore, they assumed that repeated pairing of two stimuli commonly result in standard EC effects (CS paired with positive US is liked) when no additional relational information is provided. As there is a default assimilation schema, people form assimilative/positive relations between CS and US (e.g., predicts, co-occur, are friends). Only when divergent information is provided through relational information (e.g., prevents, are enemies) this additional information is taken into account and reconsidered leading to reversed EC effects.

Hence again, support was provided for a propositional EC process as it considers cognitive reasoning influencing EC effects and only propositional links capture information about *how CS and US are related*. Automatic process accounts (i.e., referential, holistic, misattribution accounts) cannot explain the reversed effects as in their vision the reasoning process would not take place; thus the information about CS-US relation (how they are related) would not be processed.

The conceptual categorization account (Davey, 1994; Field & Davey, 1999) might explain Fielder and Unkelbach's results only if we assume the following: This account would only predict reversed EC effects, when CSs linked to USs with negative relations like "is enemy of" were categorized as members of the opposite category of the paired USs. However, negative relations are not unambiguously informative. Thus, it is not completely conclusive that an enemy of a disliked US is automatically categorized as an exemplar of the liked category; the enemy could be an exemplar of another disliked subcategory. Thus, I assume that findings of reversed EC effects can only be explained by a propositional EC account. Moreover, feature similarity of CSs and USs would be necessary for the categorization process (Davey, 1994; Field & Davey, 1999), which was given in Fielder and Unkelbach's research using human CSs and USs. However, feature similarity was not given in the study by Förderer and Unkelbach (2011b) reported next, providing evidence for standard and reversed EC effects caused by a propositional process.

4.2 EC Effects Depend on CS-US Relations (Förderer & Unkelbach, 2011b)

In a recently published study, we showed how relational qualifier, which are words providing information about CS-US relations, moderate EC effects; that is, how specified relational information moderated whether standard or reversed EC effects emerged (Förderer & Unkelbach, 2011b). Therefore, human CSs were repeatedly paired with valenced animal or landscape USs manipulated between-participants including either positive or negative relations (i.e., CS loves/loathes US). Comparable to Fiedler and Unkelbach (2011), standard EC effects emerged when CSs loved USs: A man (CS) loving a liked kitten (US+) was liked more after repeated pairings; a man loving a disliked pit-bull (US-) was liked less. Conversely, when CSs loathed USs reversed EC effects emerged: A man loathing a liked kitten (US+) was disliked and a man loathing a disliked pit-bull (US-) was liked. Interesting about these findings was that standard *and reversed* EC effects emerged when participants passively received relational information, which was contrary to Fiedler and Unkelbach's findings where reversed EC effects only emerged when participants actively engaged in the encoding process. However, there is a problem regarding the design used by Fiedler and Unkelbach: They manipulated relational information (friend or enemy) between-participants which made the information less salient and, thus, information might not have been processed and encoded when participants only passively received it. In contrast, we manipulated relational information (loves or loathes) within-subjects making it highly salient and informative (see Förderer & Unkelbach, 2011b). This supports my prior assumption that people need not only be aware of CS-US contiguity but also need to be aware of relational information, respectively how CS and US are related for accurate evaluation. If people are not aware of the relational information, respectively if they do not have any knowledge about how stimuli are related, only standard EC effects emerge. Thus in Experiment 4 in Fiedler and Unkelbach's study, the standard EC effects, which emerged for CS-US pairs presented with "is friend with" but also with "is enemy of", could have been caused by an automatic processes which took only CS-US contiguity but did not take knowledge about the type of CS-US relation into account. As the relational information was not salient because of the between-participant manipulation, no propositional processes were triggered, which otherwise might have caused reversed EC effects for CSs being enemies of USs.

Our study provides support for a propositional EC account and shows the moderating role of relational information. Only a propositional process (De Houwer, 2009; Mitchell et al., 2009) can cause reversed EC effects as it includes cognitive reasoning taking CS-US relations into account. Considering how CS and US are related influences the direction of EC effects.

Automatic process accounts might only be able to explain these results if we consider excitatory (when CS loves US) and inhibitory (when CS loathes US) associative links between CS and US representations. However, we assumed this to be rather unlikely: To predict reversed EC effects on the basis of an automatic process, one needs to assume that inhibitory links between CSs and positive USs lead to the activation of negative valence; and that inhibitory links between CSs and negative USs lead to the activation of positive valence (Förderer & Unkelbach, 2011b). However, this is not consequential as one might rather assume neutral/no valence to be activated by an inhibitory link to a valenced representation (see chapter 2.2). Moreover, even if inhibitory links activate opposite valence of the US it is unlikely to assume that inhibitory links to negative USs activate equally strong positive valence as excitatory links to positive US (see Unkelbach et al., 2008 on valence asymmetries); however, this is the case in our absolutely symmetrical data pattern (Förderer & Unkelbach, 2011b).

Also, the conceptual categorization account (Davey, 1994; Field & Davey, 1999) cannot account for our results, as the basic assumption of feature similarity in CSs and USs is not given as human CSs and animal/landscape USs are used. It would be rather unlikely that pairing human CSs with animal/landscape USs highlights common features of the stimuli and consequently leads participants to re-categorize human CSs as exemplars of a liked or disliked animal/landscape US category. Moreover analogous to the argument I made in the discussion of Fielder and Unkelbach's study, negative relations are less informative than positive relations. Thus, a CS loathing something the participant dislikes (negative US) is not automatically categorized as liked. The CS might also loathe other things the participant likes and is consequently disliked by the participant.

Independent of existing EC accounts, one might argue that Heider's Balance Theory (1946) provides an alternative explanation for our results. According to Balance Theory, a triad is balanced when there are either three positive or one positive and two negative relations between the triad's components. People strive for balanced triads as unbalanced ones lead to motivational strain. Concerning our study, a triad would include the participant, the CS, and the US. When a participant dislikes a CS because this CS loathes a US the participant likes (US+), this represents not only a reversed EC effect but also a balanced triad (i.e., one positive and two negative relations). Thus, all standard and reversed EC effects in our study are based on balanced triads and Balance Theory explains the findings. However, we rather see Balance Theory as a particular type of a propositional model, instead of an alternative explanation: It assumes that information about the relation of the triad's components mediate the change of stimulus valence. That is, the theory explains how different propositions (e.g., participant dislikes negative US and CS likes negative US) lead to a new proposition about the CS likeability (e.g., participant disliked CS). Thus, we are certain that our results resemble standard and reversed EC effects which are caused due to a propositional reasoning process and, consequently, can only be explained by a propositional EC process.

4.3 Conclusions on the EC Process Debate

Can the debate about the EC process be closed? Is the propositional process put forward by De Houwer (2009) and Mitchell and colleagues (2009) the one and only process causing standard and reversed EC effects? Based on the findings on moderating factors of EC so far one might say yes. Especially the findings on the necessity of contiguity awareness for EC effects built the fundamental groundwork for the assumption of a propositional process. When sensitive and informative awareness measures and analyses were used (cf., Pleyers et al., 2007) results showed that EC effects can only emerge when people were aware of CS-US contiguity (e.g., Stahl & Unkelbach, 2009; Stahl et al., 2009; Wardle at al., 2007). Moreover, the negative influence of reduced cognitive resources (Field & Moore, 2005; Dedonder et al., 2010) and the moderation through processing goals (Corneille et al., 2009) can only be explained by a propositional process relying on cognitive resources and information input. An automatic process, however, would be resistant to those influences; it would still cause EC effects even when cognitive resources were low or people had no contiguity awareness. Finally, reversed EC effects due to negative CS-US relations (Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2011b) can only be caused by a propositional reasoning process influenced by bottom-up (perceiving US valence and relational information) and top-down processes (considering and encoding relational information).

However, the notion of a singular propositional process causing EC effects was recently challenged by a study of Hütter, Sweldens, Stahl, Unkelbach, and Klauer (in press) implementing a new awareness measure and providing evidence for EC that occurs without awareness. They subscribed to Pleyers and colleagues' (2007) argumentation on prior findings of EC effects without awareness arguing that these findings cannot be taken as clear evidence due to methodological issues. However, they also criticized awareness measures used in studies that showed that participants need to be aware of US valence for EC effects to emerge (e.g., Stahl et al., 2009). According to Hütter and colleagues these awareness measures were influenced by inferences based on conditioned valence; that is, when participants cannot correctly identify US valence, they might rely on the conditioned CS valence and consequently infer US valence. Thus, correct USs valence will be identified for successfully conditioned CSs leading to the assumption that EC effects only emerge when participants are aware of US valence. To disentangle pure valence awareness and the influence of CS valence and provide conclusive evidence for the influence of awareness, Hütter and colleagues used a process dissociation approach. They implemented a new awareness measure which enabled them to calculate separate parameters for pure awareness, inferences based on CS valence, and guessing. Results showed that indeed EC effects without awareness of US valence emerged. Thereby, Hütter and colleagues challenged the most important empirical indication for a propositional process, that is, the absolute necessity of awareness. EC that occurs outside of awareness rather speaks for an automatic process which does not depend on cognitive processing of CS-US contiguity.

Adding to the controversy about the necessity of awareness Field and Moore (2005) provided evidence that it is not awareness but rather attention to CS-US contiguity which is necessary for EC effects to emerge. Only when participants fully attended to the conditioning procedure, EC effects emerged independent of whether participants were aware of CS-US contiguity or not. Further, they showed that not only EC effects were influenced by attention to the conditioning procedure, but also that awareness was influenced (i.e., when there was no attention, awareness was low). Hence, results showed that third factors can influence awareness as well as EC effects. Thus, awareness is not a prerequisite of conditioning but rather a side effect of attention which in turn is a prerequisite of EC. The lack of attention could also explain why EC effects are impaired by low cognitive resources, respectively focusing ones attention to distracting tasks, or by distracting processing goals. If people do not attend to the stimuli and the evaluative tasks it is likely that no EC effects emerge.

Therefore, the answer to the original question whether only a propositional process causes EC effects is open again. If one considers the recent findings of Hütter and colleagues about unaware EC supporting an automatic process on the one hand, in combination with findings about the influence of cognitive load, processing goals, and relational qualifier supporting a propositional process on the other, a dual-process model seems most likely to explain all findings (see also Hütter et al., in press). Already Lovibond and Shanks (2002; also De Houwer et al., 2005; Gawronski & Bodenhausen, 2006) considered the possibility of a dual-process model which includes automatic as well as propositional processes. A dual-process model assumes that an automatic process which does not rely on awareness, as well as effortful propositional reasoning which relies on awareness can both cause EC effects.

Based on the controversial findings, I assume that automatic as well as propositional processes cause EC effects. Even findings of EC effects which can only be explained by one process (e.g., reversed EC effects due to negative CS-US relation) do not automatically exclude that the other process causes EC effects under different conditions. And as one can never utterly control that only one process runs at a time, experimental manipulations (e.g., cognitive load) can only increase or decrease the likelihood of the activation of one process or the other. Yet, I would avoid speaking of a "dual-process model" as this leads to some theoretical problems: First, using the term "dual-process" implies one already knows that exactly two processes cause EC effects. This limits research as other possible processes also causing EC effects might be excluded by default. Second, speaking of a model would imply one knows which process works under which conditions. So far, there are only some hints about moderating factors (e.g., awareness, cognitive resources, relational information) yet no final conclusion could be made. Finally, it would also imply that only one process can work at a time excluding the other process in return. I rather speak of a multiple-process account of which we know the following so far: First, automatic as well as propositional processes cause EC effects. If people have enough cognitive resources, a goal of processing and evaluating the provided information of CS-US contiguity, and a focus of their attention on CS-US contiguity, it is very likely that they engage in propositional reasoning processes. Yet, there are circumstances where EC effects emerge even when cognitive resources are low or people are not aware of CS-US contiguity. Second, when information about CS-US relations is salient people engage in a propositional process and reversed EC effects emerge. If this relational information is not salient it is rather likely that mere automatic processes cause only standard EC effects independent of the CS-US relation. Further research has to show which other learning settings determine which process runs and which external factors, like attention, determine whether EC effects emerge or not.

5. Beyond Valence: Non-Evaluative Conditioning

So far, research using EC procedures only considered valence changes in neutral stimuli. However, preferences are far more complex than just positive or negative, liked or disliked. We rather hold specific images of people, objects, or brands in our minds; they are associated with specific attributes beyond mere valence. Thus for example, a brand might be associated with athletic, smart, and sexy. So the question is: How do people, objects, or brands acquire these attributes? Is it just overall positive valence associated with an athletic person (US) that is conditioned to a neutral other person (CS) (resembling an EC effect)? And does this lead to a high evaluation of the initially neutral person on all positive attributes? The question is if the person (CS) is associated with attributes like athletic, sexy, and smart as they are all positive. Or are only specific attributes conditioned beyond valence?

Process accounts about EC do not make any assertion about the change in associated attributes in addition to changes in valence through EC procedures. Yet, they also do not limit the phenomenon to result in valence changes only. Thus, I assumed that simple EC procedures can also lead to changes in associated attributes when CSs co-occur with USs which are associated with prominent attributes. That is, mere spatial and temporal contiguity of a neutral CS and a US representing a specific attribute is sufficient to associate the CS with this attribute. This is what I call *non-evaluative conditioning* (NEC). Prior research also uses terms like associative transfer of non-evaluative stimulus properties (Meersmans, De Houwer, Baeyens, Randell, & Eelen, 2005), associative learning of non-evaluative co-variations (Olson, Kendrick, & Fazio, 2009), and semantic conditioning (Galli & Gorn, 2011) to refer to the same phenomenon. Of course all attributes are associated with some kind of valence; especially attributes associated with brands conveyed in ads are commonly associated with a strong positive valence. Yet, by using the term *non-evaluative* conditioning I refer to the fact that attributes are associated with CSs over and above valence. Thus, it is not only a diffuse positive feeling associated with a CS resulting in high ratings on all positive attributes, but in fact an association of a specific attribute.

So far, evidence of NEC is mixed: Successful conditioning of attributes was shown by Kim, Allen, and Kardes (1996). They made a tissue brand (CS) seem to have softer tissues by repeatedly showing it together with kittens (soft USs); and a pizza delivery (CS) seemed to deliver faster after pairing it with racing cars (fast USs). Galli and Gorn (2011) conditioned fake brands (CSs) by subliminally pairing them with the words “black” or “white” (USs). Results of a lexical-decision task showed that the brands were associated with the non-evaluative attributes “black/white”. However, Meersmans and colleagues (2005) found conditioning effects of “gender” to baby or Kanji (Chinese characters) CSs only in four out of eight experiments. In Experiment 2 and 6, babies (CSs) repeatedly shown with clearly male faces (USs) were rather thought to be a boy than a girl (and vice versa for CSs shown with female USs). Yet in Experiment 6, this was only true for pairings participants were aware of. In Experiment 7 and 8, gender was conditioned to Kanji only when participants were aware of the pairings; and only in Experiment 7 the effects were found on an indirect priming measure. Olson and colleagues (2009) failed to condition the attributes “size” and “speed”; they only found an effect on size when it was primed before conditioning in Experiment 2. They argued that non-evaluative attributes need to be highlighted prior to conditioning as they are less salient than valence. Yet, I think it was rather a design problem as they used lots of filler stimuli in the conditioning phase and a dual task situation. Thus, reduced cognitive-resources, low attention to CS-US pairs, and low awareness might have caused the lack of effects (cf., Pleyers et al., 2009; Field & Moore, 2005).

Besides the sparse and inconsistent findings concerning changing attribute associations through conditioning, the reported effects could have resulted out of an inference process based on valence: None of the reported studies did consider whether the differences in attribute ratings were really caused by a change in associated attributes or by a mere change in valence. For example, female faces are liked more than male faces (e.g., Rhodes, 2006). Thus, when baby CSs were presented with a female US the positive valence of the female face might have been associated with the baby. Afterwards when participants were asked whether the baby is a boy or a girl, they infer the gender based on their positive feeling about the baby and rate it to be a girl (and vice versa for babies paired with male faces). Thus, there was no unambiguous prove for changes in associated attributes, respectively non-evaluative conditioning beyond valence.

5.1 Beyond EC! Evidence for Transfer of Non-Evaluative Attributes (Förderer & Unkelbach, 2011a)

To provide first evidence for NEC beyond valence we conditioned the attribute “athleticism” to different kinds of neutral CSs and controlled for valence statistically (Förderer & Unkelbach, 2011a). In Experiment 1-3, portraits of men (CSs) repeatedly co-occurred with athletic or non-athletic men (USs); consequently, participants rated men co-occurring with athletic men more athletic than men co-occurring with non-athletic others. By conditioning athleticism to neutral shapes and non-words, Experiment 4 showed that NEC is not limited to human CSs but is a general associative learning phenomenon. Although CSs did not differ in likeability ratings (except for Experiment 4), we controlled for valence influences statistically in all four experiments by predicting athleticism ratings based on likeability ratings. We redid the original analyses using the regression residuals which were now adjusted for valence. These analyses showed that the NEC effects were still present and, thus, were indeed caused by athleticism associated with the CSs and not by inferences based on valence which was probably associated with the CSs.

NEC effects were also found on indirect measures: Experiment 1, 2, and 4 used a semantic misattribution procedure (SMP, cf., Imhoff, Schmidt, Bernhardt, Dierksmeier, &

Banse, 2010; which is a modified version of the AMP by Payne, Cheng, Govorun, & Stewart, 2005) where participants indicated that Kanji following athletic CSs represent a word with an athletic meaning more often than Kanji following non-athletic CSs. Thus, CSs' athleticism was misattributed to neutral Kanji which indicates that CSs were indeed associated with athletic/non-athletic. Experiment 3 replicated the effects on a semantic priming measure (cf., McNamara, 2005) where participants responded faster to congruent trials (e.g., athletic CS-prime followed by athletic target) than to incongruent trials. By finding NEC effects not only on direct but also on indirect measures, we are certain that effects were not influenced by demand awareness of participants during measurement. It is unlikely that participants saw a CS for some milliseconds in a SMP, remembered whether it was paired with an athletic or non-athletic USs, inferred which response the experimenter expects, and rated the Kanji accordingly (or responded faster in congruent trials than in incongruent ones in the semantic priming).

The careful reader might have realized that, in the current work, I refer to NEC effects as *changes in attribute associations* for CSs, while we referred to NEC effects as *attribute transfer* in the reported article (Förderer & Unkelbach, 2011a). However, the term "attribute transfer" could be misleading as attributes per se cannot be changed by conditioning. Only the perceiver's impression of a person or object can be influenced by NEC as these impressions are based on attributes perceivers associate with people or objects. Therefore, I used terms like "changing attribute associations" through NEC procedures in the current work and in the following study (Förderer & Unkelbach, under review).

In this first study, only one attribute was conditioned and USs were selected based on a pre-test to be clearly represent the attribute "athleticism". As a follow-up, we conducted another study conditioning several attributes at a time and using celebrities associated with several attributes. Moreover, we will show that specific NEC can be managed. That is, we will show that by emphasizing specific USs' attributes CSs will be associated with only these attributes even is USs represent multiple attributes.

5.2 Non-evaluative conditioning of specific attributes with multi-attribute US (Förderer & Unkelbach, under review)

In the prior study, we provided first empirical support for NEC beyond valence (Förderer & Unkelbach, 2011a); yet, we conditioned only one attribute by using clearly athletic and clearly non-athletic USs. Moreover, we only measured changes in athleticism and likeability. To show that NEC is a general phenomenon able to change specific attribute associations we ran a second series of experiments conditioning distinct attributes in one conditioning phase (Förderer & Unkelbach, under review). We intended to show that only specific attributes of USs will be associated with paired CSs; and that the CSs will not be associated with other also positive attributes. Moreover, we intended to show that even if USs represent multiple attributes (i.e., multi-attribute USs), it is possible to control which of these attributes will be associated with paired CSs.

In Experiment 1 and 2, we conditioned five neutral logos (CSs) by repeatedly pairing them with celebrities (USs) each representing one of five attributes: *humorous, sexy, educated, athletic*, or *soft*. After conditioning, logo CSs were rated higher on the attribute associated with the celebrity US they were paired with than the other CSs were, that is, *basic* NEC effects emerged. For example, the humorous conditioned logo was rated higher on humorous than the other logos were. Moreover, logo CSs were rated higher on the attribute associated with the US they were paired with, than on all other attributes, that is what we call *specific* NEC effects. For example, the humorous conditioned logo was rated higher on humorous than on all other attributes. Thereby, results showed that it is possible to condition specific attributes within one session. Although all attributes were positive in valence, participants rated CSs high only on the attribute associated with the paired USs, instead of rating them high on all positive attributes based on a general positive feeling about the CSs. It is intriguing that participants clearly recognized the attribute a celebrity US represented from a head and shoulder picture of the celebrity; therefor it was not even necessary providing them with several exemplars representing one attribute. That is, results showed no important difference in NEC effects when CSs were paired with either one celebrity US or three celebrity USs representing the same attribute. Experiment 2 showed that conditioned attributes persist over time as there was no difference in NEC effects measured immediately after conditioning or one/two days later. A short conditioning phase was sufficient to form persistent associations/preferences.

In Experiment 1 and 2, celebrity USs were chosen based on pre-test data to represent only one attribute. Yet, when one thinks of entities like celebrities representing attributes it is rather unlikely that they are associated with only one specific attribute. Someone like George Clooney might be associated with being charming, sexy, and smart. Thus, we conducted Experiment 3 testing how different attributes associated with a celebrity US can be conditioned; that is, how NEC can be controlled. Therefore, we used a priming procedure (cf., Higgins, Rholes, & Jones, 1977) to accentuate different celebrity attributes prior to conditioning. For each celebrity US either an easily accessible dominant (e.g., for Jolie sexy) or a less accessible, but also known non-dominant attribute (e.g., for Jolie familial) was primed. Results showed that when the dominant attribute was primed, logo CSs were rated high on the dominant, but not on the other attributes. When the non-dominant attribute was primed logos were rated high on the non-dominant, but also on the not primed dominant attribute. It is important to note that in the dominant-priming condition the dominant attribute was rated much higher than in the non-dominant-priming condition; thus, attribute priming had an effect in both conditions. Consequently, by using simple priming procedures prior to conditioning it is possible to manage NEC and to control which attributes will be associated with CSs even if it were less accessible non-dominant ones. However, one has to keep in mind that dominant attributes readily associated with USs will always be associated with paired CSs.

An interesting difference of this study and prior NEC studies is that in prior studies USs were clearly opposed on the to-be-conditioned attribute. Meersmans and colleagues (2005), for example, used male and female USs; we used clearly athletic or non-athletic USs (Förderer & Unkelbach, 2011a). This has accentuated the attributes gender and athleticism which should be conditioned, as these were the primarily distinguishing variables between USs presented in the conditioning phase. In Experiment 1 and 2 of the current study, USs were not opposed on the attributes in question; they were rather strongly associated with one of several attributes (according to the pre-test). Thus, it is very intriguing that participants made such differentiated CSs ratings which showed that indeed the specific attribute of a US was associated with the paired CS. We assumed that the conditioning context, that is, the stimuli present during conditioning determine which attributes will primarily distinguish between USs. Consequently, this primarily distinguishing attributes will be conditioned as participants' focus is drawn to these attributes. This argumentation is in line with assumptions of Gast and Rothermund (2011). For EC, they showed that EC effects only emerged if participants had a valence focus, that is, when they focused their attention on different USs' valence. When participants focused their attention on other stimulus attributes, no EC effects emerged. Thus, when there are clearly athletic and clearly non-athletic USs, athleticism is the distinguishing attribute and people will focus their attention to this attribute. Consequently, athleticism will be conditioned. This also implies that when a CS co-occurs with a multi-attribute US, different attributes of the US will be associated with the CS depending on other USs also present during the conditioning phase. For example, the attribute athletic was primarily distinguishing Vladimir Klitschko from Obama and Clooney in Experiment 1 and 2; consequently, a CS paired with Klitschko was associated with athletic. Yet, when Klitschko might appear in a conditioning phase with Tyson and Valuev as USs, the attribute distinguishing him from these two USs is rather educated instead of athletic and, consequently, a CS paired with Klitschko will be associated with educated (Förderer & Unkelbach, under review). In sum, this means that USs representing a great number of attributes can be used to change attribute associations with CSs. However, there are two parameters that determine which attribute will be conditioned: First, it is the attribute primarily distinguishing one US from other USs which will be accentuated and, as a consequence, will be conditioned to the CS. Second, priming USs attributes prior to conditioning accentuates these attributes and determines which attributes will be conditioned.

5.3 The NEC Process

Several studies showed that NEC, that is, changing attribute associations beyond valence is possible. That is, through repeated co-occurrence of a neutral stimulus with a stimulus associated with an attribute (i.e., NEC procedure) this attribute is associated with the neutral stimulus (i.e., NEC effect). Yet, no certain conclusion can be made about the underlying NEC process; that is, whether automatic or propositional processes cause NEC effects. However, there are some hints leading to preliminary assumptions. I will discuss findings of NEC effects with regard to EC process approaches as I assume that similar processes underlie EC and NEC phenomena. First, results showed that all kinds of stimuli can be used as CSs and USs; no content or feature similarity is necessary for NEC effects to occur (e.g., Förderer & Unkelbach, 2011a, under review; Kim et al., 1996; Exp 7/8 in Meersmans et al., 2005). Moreover, a yet unpublished study (Exp. 1 in Förderer & Unkelbach, in preparation-a) explicitly explored if category fit of CSs and USs is necessary for NEC which would be postulated by the conceptual categorization account (Davey, 1994; Field & Davey, 1999). Results showed that the attribute healthy was associated with human and cereal bar CSs using both human and food USs associated with being either healthy or unhealthy. That is, category fit and stimuli similarity was not necessary. However, I assume that it is critical for NEC that *the attribute can plausibly be associated with the CS*. A prior study by Todrank, Byrnes, Wrzesniewski, and Rozin, (1995) conditioning valence to human picture CSs with odor USs showed that EC effects only emerged when odors were plausibly human (e.g., smell of soap or sweat). When odors were used which could not plausibly be associated with humans (e.g., benzyl acetate), no EC effects emerged. Thus, I assume that all kinds of attributes can be conditioned to completely unspecific stimuli like non-words or shapes; however, when CSs are humans or foods, for example, attributes need to fit the CS category.

Thus, it was plausible to associate a cereal bar CS with "healthy" and NEC effects emerged, but I would assume no NEC effect when a cereal bar CS co-occurs with a steel bar US to condition "metallic". This assumption is in line with assumptions of the implicit misattribution account (Jones et al., 2009) which for EC assumes that it must be plausible that the CS could be the source of the activated valence. For NEC this would mean that it must be plausible that the CS could be associated with the attribute. This assumption is also in line with a propositional account and the assumption of truth evaluation; only if the proposition ("this cereal bar is healthy") is plausible and is evaluated as true, NEC effects will emerge.

Second and also relating to the conceptual categorization account (Davey, 1994; Field & Davey, 1999), Experiment 2 and 3 of our study conditioning the attribute healthy (Förderer & Unkelbach, in preparation-a) analyzed whether CS-US co-occurrence is necessary for NEC to occur. Or whether attributes associated with a US category will be associated with the CS when CS and US have shared features but do not co-occur. Therefore in Experiment 2, we paired baby CSs with healthy/unhealthy food USs and presented unpaired stimuli which were pictures of either men or women in between (Exp. 3 used male/female USs and unpaired healthy/unhealthy food stimuli). Both Experiments showed that baby CSs were associated with the attributes of the paired USs, but not with the attribute of the unpaired filler stimuli (e.g., baby CS occurring in contiguity with healthy cereal bar US was associated with being healthy, but not with being a girl when unpaired stimuli were female faces). That is, independent of CS-US category fit, US attributes will only be associated with CSs if there is CS-US contiguity. Thus, a first assumption is that a conceptual categorization (Davey, 1994; Davey & Field, 1999) as well as a holistic account (Martin and Levey, 1978, 1994) can be ruled out as the underlying NEC process as both assume feature similarity as a prerequisite for (N)EC. Instead, it is mere contiguity of stimuli which is necessary for changing attribute associations.

Third, nearly all results indicate that people immediately inferred the attribute in question from simple US pictures. Studies of Kim and colleagues (1996), Meersmans and colleagues (2005), and Förderer and Unkelbach (2011a; under review, Exp. 1/2) showed conditioning of attributes without accentuating attributes prior to conditioning. Whether this inference is based on automatic or propositional processes cannot be said. I can only assume that noticing a specific attribute is more complex and needs more cognitive resources and controlled processing than noticing mere valence (cf., Olson et al., 2009). Consequently, I would assume a non-automatic process involved indicating a propositional process involved in causing NEC effects (cf., De Houwer, 2009; Mitchell et al., 2009). However, further research is needed paralleling the approach within EC research; that is, studying the influence of the three distinguishing parameters between automatic and non-automatic processes. Thus, further research should check whether NEC effects will be reduced by limited cognitive resources, what influence different processing goals have, and whether awareness of CS-US contiguity is necessary. The study of Meersmans and colleagues (2005, Exp. 6-8) already showed that NEC effects only emerged when participants were aware of CS-US contiguity, and also our study (Förderer & Unkelbach, 2011a) provides evidence for NEC only when participants were contiguity aware. However, considering Hütter and colleagues' (in press) findings and their critique on the used awareness measures, the question about awareness for NEC effects needs to be reconsidered. Additionally similar to EC, it could be attention as a third factor influencing NEC effects and awareness. A first step would be to replicate prior NEC findings and using a process dissociation approach like Hütter and colleagues did. Further, methods used by Field and Moore (2005) to disentangle attention and awareness influences could be integrated. Further research should also study which influence relational qualifier (i.e., words specifying CS-US relations) have and whether these can moderate NEC effects like they moderate EC effects leading to either standard or reversed effects. So far, comparing Experiment 1 and 2 of our study (Förderer & Unkelbach, 2011a) showed that standard NEC effects (i.e., CS paired with athletic US is rated athletic) were not qualified by providing a relation qualifier (is friends with). That is, NEC effects were not stronger when the positive CS-US relation was emphasized by providing additional information indicating a positive CS-US relation. Further research should implement qualifier creating negative CS-US relations (e.g., CS is enemy of US) and see whether NEC effects will be reversed (i.e., CS paired with athletic US is rated less athletic). Comparable to EC, reversed NEC effects could only be caused by a propositional reasoning process.

Finally based on our NEC study using multi-attribute USs (Exp. 3, Förderer & Unkelbach, under review), I assume that it is a focus on attributes distinguishing between USs that determines which attributes will be conditioned. It seems as if for USs representing a great number of attributes, the attributes that primarily distinguish this US from other USs will be accentuated and consequently associated with the paired CS. Thus, I assume that processing goals, in this case focusing on distinguishing attributes, influence NEC effects. Based on Experiment 3 of the same study, we also know that priming specific attributes prior conditioning can influence which attributes will be conditioned. The procedure used to prime celebrity attributes closely resembled procedures used in research on spontaneous trait inferences (STI). STI research shows that based on pictures and behavioral descriptions of others, people infer traits and ascribe them to the described other. In our study, celebrity pictures were shown together with information about the celebrity, and participants had to infer the respective attribute (cf., Crawford, Skowronski, Stiff, & Leonards, 2008; see also chapter 5.4). As we know from STI research, trait inference is influenced by effortful mental processes (e.g., Carlston & Skowronski, 2005). Thus, these cognitive processes might have been active during priming celebrity attributes and led to associating celebrities with these attributes. Due to conditioning, these primed attributes were associated with neutral logos co-occurring with the celebrities. Thus, it seems that some effortful cognitive processes were involved in producing the observed NEC effects. So far, the influence of a propositional process seems very likely, but if it turns out that awareness of CS-US contiguity is not always necessary, an automatic process might also be at work. And similar to EC, it might be possible that multiple processes, respectively at least an automatic and a propositional process cause NEC effects. Thus, it remains to further research to analyze process variables and moderating factors of NEC and come to a conclusion about the NEC process.

5.4 Distinguishing NEC from Spontaneous Trait Inference/Transference

So far, I assumed that the observed NEC effects resulted out of simple conditioning procedures; that is, the repeated pairing of stimuli. However, when observing the effects one might be reminded of effects caused by spontaneous trait inferences (STI; Winter & Uleman, 1984; Uleman, 1987) or spontaneous trait transference (STT; Skowronski, Carlston, Mae, & Crawford, 1998). STI and STT research is part of impression formation research (Asch, 1946) and is concerned with trait inference based on information about behavior of a person. Like Asch (1946, p. 258) said: “We look at a person and immediately a certain impression of his character forms itself in us. A glance, a few spoken words are sufficient to tell us a story about a highly complex matter.” Thus, when people receive the information “Bart kicked a puppy” they spontaneously infer that Bart is cruel (i.e., STI). Moreover, when a third person tells that “Bart kicked a puppy” people not only infer that Bart is cruel, but also associate the trait “cruel” with the third person/the communicator (i.e., STT; see Carlston & Skowronski, 2005). And going even further, Brown and Bassili (2002) showed that STT also occurred for bystanders and inanimate objects which were consequently associated with the implied trait. Thus, on an *effect level* NEC and STI/STT are identical; that is, all effects refer to associating a target/CS with a trait, respectively attribute which consequently influences target/CS assessment.

On a procedural level NEC, STI, and STT also seem similar. NEC procedures comprise the repeated co-occurrence of a neutral stimulus (CS) with a stimulus representing a specific attribute (US) (e.g., Förderer & Unkelbach, 2011a). Within STI/STT studies participants typically see a picture of a person and a sentence describing behavior of an actor which strongly implies a specific trait. Participants are either told that the person provides a self-description (STI effects expected), or that the person is a communicator and describes another person's behavior (STI effects expected for the actor and STT effects expected for the communicator) (e.g., Carlston & Skowronski, 2005). One can assume that the person describing behavior, independent whether he describes his own or someone else's behavior, represents a CS within a NEC paradigm. A difference on the procedural level surely lies within the source of the trait/attribute. Within STI/STT, a trait source is limited to a description or observation of an actor's behavior, based on this description/observation a trait is activated (Skowronski et al., 1998). NEC, however, offers the possibility to use all kinds of stimuli representing an attribute as no explicit behavior description is necessary. USs can be pictures of people engaging in activities (like the athletes and non-athletes in Förderer & Unkelbach, 2011a) which still might be comparable to the behavior descriptions used in STI/STT studies. But USs can also be celebrities commonly associated with an attribute (Förderer & Unkelbach, under review), foods associated with being either healthy or unhealthy (Förderer & Unkelbach, in preparation-a), racing cars associated with being fast (Kim et al., 1996), and also words naming attributes (like black and white in Galli & Gorn, 2011). Moreover, the NEC phenomenon is not limited to traits implied by behavior but also more generic attributes like gender represented by male or female USs can be transferred (Meersmans et al., 2005). Consequently, I assume that on a *procedural level* STI/STT are special cases of NEC using behavior descriptions as USs to activate and transfer traits to actors/communicators (CSs).

On a process level, however, disentangling NEC, STI, and STT is difficult. There exists general agreement that different processes cause STI and STT effects: Whereas STI is assumed to be based on an elaborated attributional process, a mere associative process underlies STT (Carlston & Skowronski, 2005; Crawford, Skowronski, Stiff, & Scherer, 2007). The attributional process of STI involves deeper processing and more elaborated mental activities, which involve attributional knowledge and rules (Carlston & Skowronski, 2005, p. 1). As a consequence people infer traits form the behavior description during encoding, attribute it to the actor, and store this knowledge in episodic memory (Uleman, 1987) in the form of indicative associative links, indicating that one construct is a property of the other (Carlston & Skowronski, 2005). Despite the inclusion of elaborated mental activities, the process works rather automatic: According to Uleman, people only need to be aware of the presentation of target person and behavioral description, but not of stimulus effects, inference processes, and consequences. And they also do not need any intention to infer traits from described or observed behavior; that is, trait inferences are made spontaneously. These assumptions are quite well in line with a propositional EC account; and findings which led to the assumption of an elaborated attributional process underlying STI are comparable to findings within EC: For example, cognitive load caused by distractor tasks had a negative influence on STI and minimized the effect to the size of STT effects (Carlston & Skowronski, 2005); processing goals demanding for processing the behavior information in another way than inferring traits also minimizes and could even completely eliminate STI (Uleman, 1987; Carlston & Skowronski, 2005; Crawford et al., 2007). STT instead is caused by an automatic association process which is part of a three-step process (Skowronski et al., 1998): (1) During behavior presentation the respective trait is activated; (2) the activated trait is associated with the communicator; (3) and when an impression of the communicator is formed the prior associated trait is automatically activated and influences impression formation. That is, this STT process account does not consider that the trait was actively inferred from a description of someone else. This association process is rather shallow and causes unspecified mental links, respectively associative links between communicator representation and trait, which result out of mere co-occurrence of the activated constructs. Thus, an important difference to STI is that within STT no trait judgment is made while processing the behavior information; the communicator is only associated with the trait. This does not inevitably imply that the communicator holds this trait. The associated trait will be considered as one of probably more information when an impression is formed afterwards (Carlston & Skowronski, 2005). The assumption that STT is caused by a different process than STI is based on the fact that under standard conditions STI effects were always larger than STT effects, which indicates deeper processing and stronger trait associations for STI. It is further based on the fact that moderators have different influences on STI and STT effects. In contrast to STI, STT is not influenced by limited cognitive resources or processing goals (Carlston & Skowronski, 2005; Crawford et al., 2007). STT is extremely robust and even remained stable when participants, for example, were told that communicator pictures and behavioral descriptions were randomly assigned to each other (Skowronski et al., 1998). Thus, the assumption of an automatic association process underlying STT and the reported findings, resemble assumptions and findings within EC proposing an automatic process. STT effects only diminished when participants had to recall whether the behavioral information they received concerned the communicator or a different actor before they completed dependent measures (forced recall condition in Carlston & Skowronski, 2005). Two other studies further showed that STT effects can also be eliminated by showing an actor picture in addition to the communicator picture and behavioral description (Crawford, Skowronski, & Stiff, 2007; Crawford, et al., 2008). Thus, the forced recall and the additional actor picture might have helped participants in the STT condition to correctly identify that the information provided in fact described another person, thus, eliminating STT effects. They might have enforced more elaborated processing of the description which helped recognizing that the description provides information about the actor's traits but not about the communicator's traits (see Crawford et al., 2008).

Concerning NEC, there is not much knowledge about the processes underlying it by now. I can only assume that NEC processes are comparable to the processes causing EC effects (cf., chapter 5.3). Thus on a *process level*, I can draw no final conclusion on the relationship between NEC, STI, and STT until further research analyzed NEC process variables; I can only make two different assumptions: One would be, if it turns out that NEC effects are caused by an automatic process it would resemble the association process underlying STT. That is, due to CS-US co-occurrence the respective attribute is associated with the CS and consequently influences CS attribute assessment. Then (comparable to the similarity on the procedural level) STT would constitute a special form of NEC only occurring when behavioral information is provided in contiguity with a target. In this case, STI would not be a special case of NEC as it is based on elaborated mental activities, that is, on a non-automatic attributional process. Alternatively, if it turns out that NEC effects are caused by propositional processes, this cognitive reasoning process would closely resemble the attributional process involved in STI. Consequently (comparable to the similarity on the procedural level), STI could be assumed to be a special case of NEC, which in this case is limited to person perception and impression formation. Based on the findings that STT is not impaired by limited resources or processing goals, it is not immediately possible to assume that STT effects are caused by a propositional NEC process. Propositional reasoning is influenced by limited resources, processing goals, and awareness (see chapter 3.2). Stating that STT is a special case of NEC caused by propositional reasoning would only be possible if we further assume that traits are more easily activated by behavior descriptions (used in STT paradigms) than by US pictures (often used in NEC paradigms). Behavioral descriptions might provide trait information more easily as people are used to infer traits from behavior (cf., Heider, 1977, p. 46f). However, it might not be immediately clear what should be inferred from celebrity pictures for example. Consequently, less cognitive resources would be needed to infer traits from behavioral information than from pictures and a propositional NEC process might still cause STT under cognitive load. Finally, if it turns out that NEC effects are caused through automatic and propositional processes, like I assumed it for EC effects (cf., multiple-process account in chapter 4.3), both STI and STT phenomena can be seen as special cases of the NEC phenomenon. That is, STI effects and STT effects would resemble special NEC effects which are limited to trait inference of human stimuli, and caused by a propositional (STI effects) or an automatic process (STT effects).

However, I have to admit that until further research will provide information about the NEC process, I cannot draw any final conclusion on the difference of NEC on the one hand, and STI and STT on the other on a process level. I can only say that no matter which process causes NEC effects, NEC is surely a more general and more parsimonious phenomenon than STI and STT. STI and STT are both limited to inferences drawn from behavioral observations or descriptions. NEC, however, occurs with diverse stimuli through mere spatial and temporal contiguity of neutral stimuli and stimuli representing attributes. Thus, NEC is a conceptual generalization of STI/STT referring to changing attribute associations through conditioning procedures.

5.5 NEC in the Context of Brand Image Formation

Brand image is defined as a "set of associations linked to the brand that consumers hold in memory" (Keller, 1993, p. 2). According to Keller, brand associations stem from consumers' direct experiences with products or brands, information communicated about brands, and inferred associations. Associations might be inferred from other entities like users, company employees, or especially celebrities endorsing a brand (Aaker, 1997). In his *model of meaning transfer*, McCracken (1989) postulates that celebrity attributes are transferred to a brand when the celebrity endorses that brand and thereby create the brand's image. Thus, according to McCracken, it is not only celebrities' credibility or attractiveness contributing to the acceptability of information provided within ads; but rather, attributes associated with the endorsing celebrities transfer directly to brands. However, McCracken only describes the phenomenon, but does not provide any empirical evidence or any psychological process underlying the meaning transfer. I will argue that the meaning transfer from celebrity to brand is an instance of NEC.

To my knowledge, only Batra and Homer (2004) experimentally examined the postulated meaning transfer from celebrities to endorsed brand (McCracken, 1989). They showed that celebrity endorsers reinforced consumers' brand image believes (here: fun and sophistication); however, this reinforcement was only successful within a social consumption context. That is, the brand was only thought to be more fun/sophisticated after endorsement when participants thought the brand's product will be consumed in public, but not when participants thought it will be consumed in private. Thus, only when there was a high social visibility brand image believes mattered and celebrity endorsement had some effects. Although, their study provided first evidence for McCracken's model, there are two issues: First, the study did not examine *initial* brand image formation; in fact, known brands with an already existing brand image were used. Thus, the two celebrities associated with the image believes of the target brands simply accentuated those brand image believes. There is no evidence that further, new attributes were transferred from celebrity to brand. It remains an open question how brands initially acquire associations constituting the brand image. Second, conclusions are based on rather sparse effects which were not found consistently for all celebrities, products, and attributes used in the experiments. Batra and Homer, thus, provided empirical evidence rather for meaning accentuation then for initial meaning transfer; and they made no assumption about underlying psychological processes.

Based on the findings of our two studies on NEC (Förderer & Unkelbach, 2011a, under review), I assume that meaning transfer due to celebrity endorsement postulated by McCracken (1989) is an instance of NEC. That is, through repeated co-occurrence of neutral brand (CS) and celebrity (US) representing an attribute the attribute is associated with the brand (NEC effect); consequently the attribute becomes part of the brand's image. Thus, mere spatial and temporal contiguity of brand and celebrity is sufficient to form brand images; this makes NEC procedures more parsimonious than actual celebrity endorsement, as no active engagement or product usage by the celebrity is necessary.

Our studies have theoretical as well as practical implications: On the theoretical side, NEC provides us with information about the psychological process underlying the postulated meaning transfer from an entity representing attributes to a neutral brand or product. Thus, the more we know about processes involved in NEC and boundary conditions, the more precise we can predict which requirements need to be met for successful celebrity endorsement and thus for brand image formation. Based on Experiment 3 of our study pairing logo CSs with celebrity USs (Förderer & Unkelbach, under review), we know that priming moderates NEC effects: By priming celebrity attributes prior to conditioning also less salient attributes will be associated with brands. This leads to a first practical implication for using NEC procedures in advertisement: Marketers can make use of less accessible celebrity attributes and make them prominent by providing participants with respective information about the celebrity or providing a respective ad context priming the attribute in question. However, they have to keep in mind that well-known dominant attributes will also be conditioned.

Using celebrity endorsers carries the risk of conditioning of negative attributes, as well. Some of the most famous celebrities and athletes appear in the news with negative publicity. Charlie Sheen, for example, is not only associated with humorous anymore, but also with being drug addicted, immoral, and criminal after being repeatedly caught with drugs and prostitutes. Or Tiger Woods earlier associated with handsome, successful, and athletic is now also associated with unfaithful after betraying his wife repeatedly. Marketers must be aware of the risk that these negative attributes might also be associated with their brand when they are dominant and readily accessible, or when they become prominent through negative publicity. And even more crucial, even when brand and celebrity are not shown together anymore, negative information about the celebrity might influence the brand associations (see US-revaluation effects in Sweldens, Van Osselaer, & Janiszewski, 2010). To prevent such negative effects, Sweldens and colleagues recommended using more than one celebrity endorsing the brand based on their findings that CSs paired with multiple USs are less prone to US-revaluation effects. Thereby, marketers would further accentuate the intended attribute and minimize the risk that negative associations with a single celebrity might be associated with the endorsed brand.

Although I feel certain to assume that changing attribute associations with brands using entities associated with specific attributes relies on simple NEC procedures, a limitation of our studies (Förderer & Unkelbach, 2011a, under review) is surely that the results are based on lab experiments using a computer program. The program repeatedly paired logo CSs with celebrity USs on a grey computer screen; the procedures are far from resembling a natural advertising context. Thus, it remains to further research to operationalize NEC procedures in a fashion which resemble natural ads more closely (e.g., operationalization used by Batra & Homer, 2004). Using more realistic advertisement contexts in future studies might also shed light on the role awareness and attention play for NEC effects. Questions we will try to answer in future studies (Förderer & Unkelbach, in preparation-b) will be: In an internet-context, will NEC effects occur when brand-celebrity pairings are only shown on a banner on the top of a screen, while participants have to engage in a task referring to the page content? Have participants to be aware of brand-celebrity pairings? Moreover, will NEC effects created in that way influence behaviour when participants know they were influenced by the ad, and know the brand attribute was originally associated with the co-occurring entity (i.e., when they are aware of CS-US contiguity)? Further, it would be interesting to see whether conditioned brand image has an influence on brand choice moderated through self-image congruity (cf. Sirgy, Johar, Samli, & Claiborne, 1991). That is, will brands whose conditioned image is congruent with the consumers self image be liked more and consequently bought more often? Respectively will consumers who experience high self-image congruity pay higher prices?

In addition to the artificial setting, our study using celebrity USs (Förderer & Unkelbach, under review) only used neutral logos as CSs which were associated with no prior attributes. Research analysing the effect of NEC procedures using celebrity endorsers, or other entities representing specific attributes on known brands with an already existing brand image is still pending. Yet, based on findings within the EC paradigm using not-neutral CSs showing less strong conditioning effects (see Hofmann et al., 2010), I assume that NEC effects for known brands would be less strong.

Finally, according to the match-up hypothesis (Kahle & Homer, 1985), it is important for successful celebrity endorsement that the celebrity's image matches the endorsed product's image, and therefore seems to hold relevant information about the brand or product. When the idea of the match-up hypothesis first came up, this match was limited to attractiveness; thus, using an attractive celebrity endorser would only be successful for attractiveness-related products, like cosmetics. Over the years, the concept has become broader and a match could be based on nearly all relevant attributes (e.g. athletes endorsing running shoes). Thus, research has shown that when there is a match between the celebrity endorser's image and the product category/image purchase intentions were higher (Batra & Homer, 2004; Lee & Thorson, 2008), celebrities' attractiveness and credibility had a greater influence on product evaluation (Kim & Na, 2007), celebrities' expertise influenced brand attitudes (Till & Busier, 2000), and believability of the spokesperson was higher and product attitude was more favourable (Kamins & Gupta, 1994). Our study (Förderer & Unkelbach, under review) conditioned new logos with no prior image believes which needed to be matched by the celebrity. Thus, effects for all celebrity USs were equally strong. However, I assume that when NEC procedures are used to form an image of a real brand a match-up between celebrity and *product* category becomes important. Within NEC, it is not only the celebrity's credibility and attractiveness which should have a more positive effect on brand evaluation or purchase intentions, but rather the celebrity attributes itself should be associated with the brand. Thus, it is particularly important that celebrity's attributes seem to contain relevant information about the brand/product, which is only the case when the celebrity matches the product category. This argument is similar to the plausibility argument in chapter 5.3. For NEC effects in general, I assumed that it must be plausible to associate the CS with the attribute which should be conditioned. For NEC effects using celebrity USs and brand/product CSs, I assume that it must be plausible that the celebrities hold relevant information about the brand/product. Consequently, further research should check for the influence of match-up between celebrity's image and product image when using NEC procedures to condition attributes to brands.

6. Final Discussion

Within the last decades a large amount of research focused on studying the acquisition of preferences through EC. EC turned out to be a stable and parsimonious phenomenon which causes valence changes in initially neutral stimuli due to mere spatial and temporal contiguity with other liked or disliked stimuli. One of the central questions within EC research was, and still is, which mental process underlies this form of associative learning and causes EC effects. Furthermore, preferences are not limited to "positive" and "negative", but are complex and based on diverse attributes associated with the attitude object. Thus, another question is whether this kind of learning based on stimuli contiguity is limited to changing valence or whether other more specific attribute associations can be changed as well. Moreover, if changing attribute associations is possible, will it subordinate to the same processes as EC does? Thus in the current work, I strived to come to a conclusion about the processes involved in EC and provided evidence for the conditioning of attributes beyond valence.

6.1 Conclusions on EC

In the beginning, the debate concentrated on differentiating EC from PC, and whether EC is a special form of PC or an independent instance of associative learning. After more and more studies implied that EC is definitely a unique form of associative learning, the discussion went on and different groups of researchers came up with five theoretical process accounts for EC and provided a great number of results supporting one account or the other. In the current work, I gave a short overview on EC process accounts, and based on their assumptions and predictions allocated them to either an automatic or a propositional process. Further, I provided empirical support for moderated EC effects caused by relational qualifier linking CSs and USs (Förderer & Unkelbach, 2011b). Depending on the qualifier (loves or loathes) standard or reversed EC effects emerged. This finding replicated findings of Fiedler and Unkelbach (2011) and moreover, showed that reversed EC effects emerged even when participants did not engage in active encoding procedures but passively received information about CS-US relations. Following, I discussed why these findings can only be explained by a propositional reasoning process, and why automatic process accounts or Balance Theory (Heider, 1946) provide no alternative explanations. Although reversed EC effects can only be caused by a propositional reasoning process, this allows for no final conclusion on the EC process in general. As I have discussed, there might be learning settings where automatic processes can cause EC effects, too. For example, Hütter and colleagues' (in press) study provided evidence that EC effects did indeed emerge when participants were not aware of CS-US contiguity. Thus, like some researches considered already (e.g., Lovibond & Shanks, 2002; De Houwer et al., 2005; Gawronski & Bodenhausen, 2006), I assume a multiple-process account in that EC effects could be caused through automatic and propositional processes. Whether one or the other process runs, or probably both at a time, depends on context factors like available cognitive resources, attention to CS-US contiguity, and salient relational information. Yet, further research is needed to analyze context factors and to be able to make conclusive predictions under which circumstances which process works. Especially interesting is the delineation of the role that contiguity awareness and attention play (cf., Field & Moore, 2005), and what role awareness of relational information plays. So far, I can only assume that relational information needs to be prominent to moderate EC effects (see Förderer & Unkelbach, 2011b). Further studies should experimentally manipulate awareness of relational information, respectively attention which is allocated to this information. Only this empirical test would allow for a conclusion on the necessity of salient relational information.

6.2 Conclusions on NEC

An essential part of the current work was to show that other attributes than mere valence will be associated with stimuli through simple conditioning procedures, thus, providing an incidence of associative learning. Two studies showed that attributes can be conditioned to neutral stimuli after repeated co-occurrence with stimuli representing these attributes (*NEC procedure*). Consequently, the initially neutral stimuli are associated with the respective attribute, which is what I called the *NEC effect*. The studies showed that this phenomenon of a change in associated attributes is not limited to human stimuli, but is a general learning phenomenon applicable to all kinds of stimuli. We found NEC effects for athletic human USs paired with human CSs, but also when CSs were non-words, shapes, or logos (Förderer & Unkelbach, 2011a). NEC effects also emerged when logo CSs co-occurred with celebrity USs representing multiple attributes (Förderer & Unkelbach, under review). Most intriguing about the second reported NEC study is that it showed that different attributes can be conditioned within one session and people, even after a short conditioning phase of less than five minutes, made precise attribute ratings conforming to NEC effects. Participants immediately recognized the attribute in question from a US picture and only this attribute was associated with the CS afterwards. Moreover, by priming a specific US attribute before conditioning, we could control which attribute was conditioned in the end. This feature had important practical implications for the use of NEC procedures to form brand images within advertisements.

Hence, it is certain that changing attribute associations beyond and independent of valence is possible, and that it is a widely applicable robust phenomenon. As has been discussed, NEC is also more than mere STI or STT, as it does not require behavioral information or direct trait descriptions. Rather, NEC occurs with all kinds of USs somehow associated with an attribute. Thus, NEC is a more general and parsimonious phenomenon, a conceptual generalization of trait inference and transfer beyond mere human stimuli. As has been discussed, no conclusion can be drawn on the NEC process. The goal of the current study was to provide first empirical evidence for conditioning of attributes beyond valence which was successfully reached. Future research should now focus on processes involved in causing NEC effects. Similar to EC process research, factors showing great promise for the analysis of the NEC process surely are manipulation of cognitive resources, processing goals, attention, and awareness. This would shed light on the involvement of automatic and propositional NEC processes.

A further question is whether CSs representations are mentally linked to the attribute representation, or whether CSs representations are mentally linked to USs representations in human mind. Depending on these links, for example, changes of US attribute associations will have different effects on CSs. Like it was done for EC, further research should deal with this issue by implementing US-revaluation settings. If it turns out that US-revaluation, in this case a change of attributes associated with the US, leads to a change of attributes associated with the CS this implies a direct link between CS and US representations. If US-revaluation has no influence on CS associations this implies that only the initial attributes associated with the US are linked to the CS representation. If I assume that deeper elaboration and more effortful cognitive processes are needed to recognize specific attributes beyond mere valence and thus, further assume that rather propositional than automatic processes are involved in NEC, I would assume a direct link of the CS to the attribute (instead of a link to the US representation). Similar to the processes involved in STI, deeper elaboration would lead to storing a specified CS-attribute link in episodic memory. US-revaluation, hence, should have no influence on attributes associated with the CS. Yet as this is simply an assumption, there might be instances where, due to automatic processes, CS-US representations are linked in memory. Consequently, US-revaluation should have an influence.

6.3 General Conclusion

The current work elaborated on EC and NEC as phenomena describing preference learning. After empirical evidence has been provided, and theoretical and practical implications have been discussed, I conclude that EC as well as NEC are general associative learning phenomena: Through spatial and temporal contiguity of neutral stimuli and stimuli associated with valence or a specific attribute, the valence/attribute is associated with the neutral stimuli, that is, (N)EC effects emerge. Considering all findings of EC and NEC effects, I assume that automatic as well as propositional processes cause (N)EC effects. For the future it will be interesting to detect whether and how these conditioned preferences influence behavior.

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Erklärung

Erklärung gemäß § 8 Abs. 1 Buchst. b) der Promotionsordnung der Universität Heidelberg für die Fakultät für Verhaltens- und Empirische Kulturwissenschaften

Ich erkläre, dass ich die vorgelegte Dissertation selbstständig angefertigt, nur die angegebenen Hilfsmittel benutzt und die Zitate gekennzeichnet habe.

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Ich erkläre, dass ich die vorgelegte Dissertation in dieser oder einer anderen Form nicht anderweitig als Prüfungsarbeit verwendet oder einer anderen Fakultät als Dissertation vorgelegt habe.

Heidelberg, 01.12.2011

Dipl. Psych. Sabine Förderer

Appendix

Hating the cute kitten or loving the aggressive pit-bull: EC effects depend on CS–US relations (Förderer & Unkelbach, 2011). The article in its final and definite form was first published in Cognition & Emotion and is available at: http://www.tandfonline.com/doi/abs/10.1080/02699931.2011.588687

Beyond Evaluative Conditioning! Evidence for Transfer of Non-Evaluative Attributes (Förderer & Unkelbach, 2011). The article in its final and definite form was first published in SPPS and is available at: http://spp.sagepub.com/content/2/5/479

Non-evaluative conditioning of specific attributes with multi-attribute US (Förderer & Unkelbach, under review)

Note:
For all three studies, the first author, Sabine Förderer, independently developed the basic research idea and design, and independently conducted experiments and data analyses. Manuscripts were written and revised in close collaboration with the second author, Christian Unkelbach.

Hating the cute kitten or loving the aggressive pit-bull: EC effects depend on CS-US relations

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Abstract

Evaluative conditioning (EC) refers to valence changes of initially neutral stimuli (CSs) through repeated pairings with positive or negative stimuli (USs). The current study is about the moderating role of qualifiers that specify the CS-US relation during these pairings. We show successful EC with pictures of men (CSs) and of liked/disliked animals or landscapes (USs). More importantly, the same pairings resulted in standard and reversed EC effects depending on semantic qualifier of the CS-US relation. CSs loving positive (negative) USs became more positive (negative), while CSs loathing positive (negative) USs became more negative (positive). These data favor a propositional EC account (De Houwer, 2009) over a purely associative account, as they show that it is not only relevant *that* CS and US are related, but *how* they are related.

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Key words: *evaluative conditioning, associative learning, propositional reasoning, attitude acquisition*

Hating the cute kitten or loving the aggressive pit-bull: EC effects depend on CS-US relations

Evaluative conditioning (EC) is the phenomenon that initially neutral stimuli change their valence through repeated pairings with positive or negative stimuli (Levey & Martin, 1975). For example, people like initially neutral persons (CSs) who appeared together with cute kittens (US+) more than neutral persons who appeared together with aggressive pit-bulls (US-). In many conceptualizations of EC, this change in liking is supposedly due to the automatic formation of an association between CS and US representations (see Gawronski & Bodenhausen, 2006). Here, we investigate the possibility that changes in liking are not mediated by the formation of associations, but by the formation of propositions, as suggested in propositional learning accounts (De Houwer, 2009; Mitchell, De Houwer, & Lovibond, 2009; Shanks, 2010). We do this by testing whether the effect of CS-US pairings on liking is moderated by semantic qualifiers that provide information about the nature of the CS-US relation. In other words, does it matter whether the neutral person loves or loathes the kitten (or the pit-bull)?

Procedurally, EC is based on the co-occurrence of two or more objects in the environment. As said, the underlying process was traditionally assumed to be associative, stimulus-driven, and largely independent from intentions, consciousness, or cognitive resources (e.g., Olson & Fazio, 2001; Gawronski & Bodenhausen, 2006). Similar to animal learning studies, such associative approaches assume that pairing CS and US forms a link between the representations of the stimuli, and activation of the CS representation co-activates the US representation and the respective evaluative response. With this assumption, EC elegantly explains many psychological phenomena, from persuasion to attitude acquisition and ingroup favoritism (see Walther, Nagengast, & Trasselli, 2005, for an overview).

However, the assumption that human learning is a purely associative process has been challenged on theoretical as well as on empirical grounds (Mitchell, De Houwer, & Lovibond, 2009; Shanks, 2010). In particular, Mitchell and colleagues presented a propositional account of human learning. The main difference between an associative and a propositional approach is the way knowledge is represented in memory. While associations imply a simple link between stimuli, propositions allow specifying the way in which stimuli are related (Mitchell et al., 2009, p. 184). As propositions have an internal semantic structure the same way language does (Shanks, 2007, p. 294), they can include semantic qualifiers that specify *how* stimuli are related. Such relational qualifiers can be for example, “predicts” “prevents”, “loves”, or “loathes”. Thereby, propositions composed of two stimuli linked by a relational qualifier provide more information than a mere association does.

For EC, this propositional approach implies that changes in valence should be moderated by semantic qualifiers specifying the CS-US relation. For example, if a qualifier establishes a positive CS-US relation (e.g., CS likes US), standard EC effects would occur. If a qualifier establishes a negative CS-US relation (e.g., CS dislikes US), reversed EC effects would be expected. For example, if people learn that a target person (CS) loathes a kitten they like (US+), they should dislike the target person. Such a moderating effect of relational qualifiers would be incompatible with an associative approach as CS and US representations are assumed to be merely linked and no information about *how* they are linked is stored in memory. Thus, activation of the CS always co-activates the US and its evaluative connotation; the possibility of a reversed evaluative response does not fit well with an associative approach to learning. A propositional approach, on the other hand, can explain such moderating effects, because the proposition contains the information about *how* CS and US are related. If this relation is “prevents” instead of “predicts”, or “dislikes” instead of “likes”, reversed evaluative responses should emerge.

Above that, we subscribe to a propositional approach for two further reasons. First, functional necessity: As noted by De Houwer (2009), in the multitude of possible associations in the world, it is unclear when and which associations are learned. Without the interplay of top-down and bottom-up processes, any organism relying on the pure bottom-up automatic association of co-occurring stimuli in the environment is surely lost. Second, empirical evidence: A propositional account is better able to incorporate the influence of awareness (Stahl, Unkelbach, & Corneille, 2009; Wardle, Mitchell, & Lovibond, 2007), processing goals (Corneille, Yzerbyt, Pleyers, & Mussweiler, 2009), and cognitive resources (Pleyers, Corneille, Yzerbyt & Luminet, 2009). While there are notable demonstrations of learning and evaluative learning without awareness (Ruys & Stapel, 2009), goals, and resources, there is a growing literature testifying the importance of higher cognitive functions in conditioning.

There is already one study related to the question of whether relational qualifiers moderate EC effects, namely the study of Fiedler and Unkelbach (2010). In four experiments they found standard and reversed EC effects depending on the encoding of the CS-US relation. When CSs were perceived as friends with USs+ or USs-, standard effects emerged (i.e., liked and disliked CSs, respectively); however, when CSs were enemies of USs+ or

USs-, reversed effects emerged (i.e., disliked and liked CSs, respectively). Yet, these effects only emerged when participants actively construed this relation by rating the CS-US relationship as highly likely (Exp. 1 and 2), or when they had to generate reasons why CS and US are friends or enemies (Exp. 3). When participants passively observed CS-US relationships, only standard EC effects emerged (Exp. 4). The authors concluded that EC effects depend on the interplay of bottom-up (US valence) and top-down processes (active relation construal and encoding schemes).

In the current study, we extend the research of Fiedler and Unkelbach (2010) and examine whether the moderating effect of relational qualifiers also occurs when CS-US relations are passively observed. We believe their failure to find reversals without active encoding processes is a design problem. They manipulated their qualifiers (i.e., is friend vs. enemy of) as a between-participants factor: As the qualifier was constant across all trials, it is of low salience and not particularly informative for a given trial. Thus, the qualifier might not have entered the proposition when participants passively observed the CS-US pairings. In addition, the conclusion that active encoding is necessary was based on a null effect (i.e., non-significant reversal in Experiment 4). And finally, all their experiments used human CSs and USs, raising the question whether their encoding scheme effect (i.e., friend vs. enemy) is specific to learning about humans.

Accordingly, the present experiment uses a standard EC procedure (e.g., Walther, 2002), but with relational qualifiers for the CS-US pairings varying within-participants. This should make the qualifiers more salient, leading to differential CS-US propositions and thereby moderated EC effects, even when they are only passively observed. We predict that the relational qualifier “loves” results in standard EC effects (e.g., CSs loving US+ are more positive than CSs loving US-), whereas the qualifier “loathes” results in reversed EC effects (e.g., CSs loathing US+ are more negative than CSs loathing US-). In addition, we use animals and landscapes as USs; if these stimuli lead to equally strong moderated EC effects as involving only human CSs, it would testify the generality of the effect beyond human CS-US pairings.

Method

Participants, design, and materials. Sixty-six University of Mannheim students (40 women, 26 men) participated for 5€ payment and a chocolate bar. They were randomly assigned to one of the US type conditions (animals vs. landscapes). The relational qualifier (“loves” vs. “loathes”) and US valence (positive vs. neutral vs. negative) varied orthogonally within-participants. Twelve black-and-white portraits of neutral men served as CSs; colored pictures of 60 animals (e.g., cat, dog, snake), and 60 landscapes (e.g., forest, mountains, desert) served as USs. A Visual Basic program controlled instructions, stimulus presentation, and recorded the dependent variables.

Procedure. The experiment took place in a laboratory at the University of Mannheim. Participants were recruited from a student cafeteria at the university grounds. Participants first saw all 60 pictures of animals or landscapes to ensure an overview of the pictures' evaluative tone and range before the ratings (see De Houwer, Baeyens, Vansteenwegen, & Eelen, 2000). The program randomized the presentation anew for each participant. After the first presentation, the program presented the pictures again and participants rated them on a scale from -100 "triggers very negative feelings" to +100 "triggers very positive feelings". Based on the individual ratings the computer program selected the four most positive (US+), the four most negative (US-), and four neutral pictures (US0, most closely to zero) for each participant.

For the conditioning phase, the program randomly assigned the selected USs to the twelve CSs. Two positive, two neutral, and two negative USs were randomly selected to be shown with the relational qualifier "loves"; the remaining six USs would be shown with the qualifier "loathes". Instructions told participants that the experiment investigates how people react to different pictures. Therefore, they would see a series of picture pairings, each consisting of a picture of a man and of an animal (or a landscape, depending on experimental condition). Their first task would be to watch this presentation. When they clicked a button, the presentation started. CSs were presented 1s alone, then the qualifier "loves"/"loathes" appeared for another 0.5s, and then the respective US appeared for another 2.5s with the CS and the qualifier still on the screen. CSs were presented in the upper half of the screen and USs in the lower half. After a pause of 1.5s the next pairing was shown. The program presented each pair six times at random, resulting in 72 trials. After the conditioning phase, participants were instructed to rated the CSs' likeability on an 8-point scale, with higher values indicating higher likeability. The program presented the CSs in a random order in the middle of the screen with the rating scale below; by clicking a button participants could confirm their rating and continue with the next CS rating. Upon completing the ratings, the experimenter paid, thanked, and debriefed participants.

Results

Across both US types, animals and landscapes, participants' pretest ratings of US+, US0, and US- showed the expected linear decrease in liking from US+ (M = 90.01, SD = 16.44) to US0 (M = 1.18, SD = 5.25) to US- (M = -88.22, SD = 16.77).

To investigate the predicted EC effects, we calculated participants mean likeability ratings for each two CSs paired with positive, neutral and negative USs, separately for those presented with the relational qualifiers "loves" and "loathes". Figure 1 presents these means by US valence, US type (animal vs. landscape), and relational qualifier. As the Figure clearly shows, for both animal and landscape USs, we found a standard EC effect for "loves", which is completely reversed for the "loathes" condition.

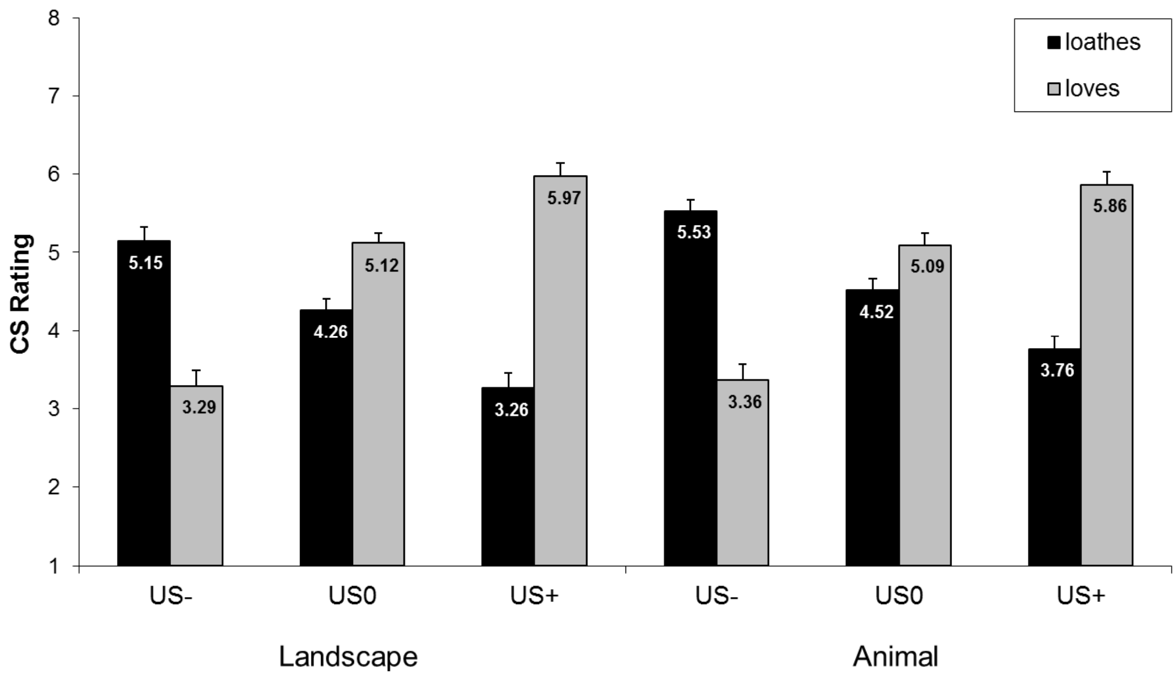

Figure 1. *Mean likeability ratings of CSs paired with US+, US0, and US- separated by US type (animal vs. landscape) and relational qualifier (loves vs. loathes). Higher values indicate higher likeability and error bars represent standard errors of the means.*

We analyzed these means using a 2 (US type: animals vs. landscape) x 2 (relational qualifier: loves vs. loathes) x 3 (US valence: positive vs. neutral vs. negative) ANOVA with repeated-measures on the last two factors. This analysis showed the expected significant interaction between relational qualifier and US valence, $F(2, 63) = 48.53$, $p < .001$. To clarify this interaction we calculated two further ANOVAs; one considering only CSs loving USs and one considering only CSs loathing USs. For CSs *loving* USs, CSs paired with USs+ were liked most ($M = 5.92$, $SD = 1.39$), CSs paired with USs0 were mildly positive ($M = 5.10$, $SD = 1.13$), and CSs paired with USs- were disliked ($M = 3.33$, $SD = 1.66$), resulting in a significant linear contrast, $F(1, 64) = 77.81$, $p < .001$, $d = 2.17$. When CSs *loathed* USs, the effect was completely reversed: CSs paired with USs+ were disliked ($M = 3.51$, $SD = 1.50$), CSs paired with USs0 were neutral ($M = 4.39$, $SD = 1.15$), and CSs paired with USs- were liked most ($M = 5.34$, $SD = 1.29$), also resulting in a significant linear contrast, $F(1, 64) = 58.44$, $p < .001$, $d = 1.88$[1]. Obviously, the interaction of these two linear contrasts was also highly significant, $F(1, 64) = 93.41$, $p < .001$, $d = 2.38$.

Additionally, the overall ANOVA showed a main effect for qualifier valence: CSs loving USs were liked more ($M = 4.78$, $SD = 1.77$) than CSs loathing USs ($M = 4.41$, $SD = 1.52$), $F(1, 64) = 8.28$, $p = .005$, $d = 0.67$. This effect is most visible for CSs paired with USs0 in Figure 1: CSs loving something neutral were liked more ($M = 5.10$, $SD = 1.13$) than CSs loathing something neutral ($M = 4.39$, $SD = 1.15$), $F(1, 64) = 14.84$, $p < .001$, $d = 0.92$. There was no main or interaction effect for US type (animal vs. landscape), all $Fs < 1$, ns.

Discussion

Our experiment showed likeability changes of initially neutral men (CSs) through repeated pairing with liked or disliked animals or landscapes (USs). More importantly, semantic relational qualifiers moderated changes in CS' likeability: A qualifier stating a positive relation between CS and US (CS loves US) led to standard EC effects; a qualifier stating a negative relation (CS loathes US) led to reversed EC effects. Thus, CSs loving positive USs were liked *more* than CSs loving neutral or negative USs, and CSs loathing positive USs were liked *less* than CSs loathing neutral or negative USs. As expected, US type (animal vs. landscape) did not matter, testifying the generality of the effect.

These data contradict associative EC accounts, because the moderating relational information is not included in the assumed CS-US link. Rather, the data support a propositional account. The propositional account assumes that EC is mediated by the formation of propositions (De Houwer, 2009). Propositions have an internal semantic structure (Shanks, 2007) and can therefore include semantic qualifiers of the CS-US relation, that is, information about *how* CS and US are related. These semantic qualifiers clearly moderated the EC effects in the present experiment.

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[1] All single comparisons between CS+ and CS0 and between CS0 and CS- were also significant, compared within loved and loathed USs.

A possible explanation for the current results in terms of associative processes is that the qualifier “loves” led to an excitatory associative link between CS and US representations, while the qualifier “loathes” led to an inhibitory link. As we have an almost perfectly symmetrical data pattern for the “loves” and “loathes” conditions, this explanation must assume that a link inhibiting associations with positive information in memory leads to negative evaluative responses and inhibiting associations with negative information leads to positive evaluative responses. This assumption leads to new and interesting predictions for further research. However, given the huge literature on valence asymmetries (e.g., Unkelbach, Fiedler, Bayer, Stegmüller, & Danner, 2008), it seems unlikely that an inhibiting link to negative information should lead to the same evaluative response as an excitatory link to positive information (and vice versa, see Figure 1). Thus, the moderating effect of the relational qualifiers does indeed not fit well with an associative approach to learning.

A non-predicted but interesting finding was that the relational qualifiers themselves served as valence sources: CSs loving USs were liked more than CSs loathing USs. This effect, however, was particularly due to the pairing involving neutral stimuli. If we repeat the reported analysis without the neutral CSs, the main effect of relational qualifiers completely vanishes. A very similar effect was observed by Fiedler and Unkelbach (2010); it seems when no other valence source is available, the valence of the relational qualifier determines the change in CS valence. However, given clear US valence, this influence all but vanishes, and the nature of the CS-US relation determines the change in CS valence.

The present results go beyond research by Fiedler and Unkelbach (2010) in showing that reversed EC effects can be found when perceivers only passively observe CS-US relations. Fiedler and Unkelbach only found these effects when participants actively engaged in encoding the provided information about CS-US relations. This discrepancy can be explained procedurally: Fiedler and Unkelbach varied relational qualifiers as a between factor; this renders the qualifier much less informative, salient, and powerful. In contrast, we varied the relational qualifier within participants. And while these authors argued for top-down encoding schemes, we show that relational qualifiers can directly moderate EC effects.

One might argue that by introducing loves/loathes as relational qualifiers the current experiment does not represent an instance of EC anymore. Yet, procedurally the experiment follows the definition of EC by De Houwer (2007; also Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). The change in CS valence is an EC effect because it can be attributed to CS-US pairings. However, this effect was moderated by semantic qualifiers specifying the CS-US relationship, leading to standard or reversed EC effects.

Furthermore, one might consider Heider's Balance Theory (1946) as an alternative explanation for the moderated EC effects. According to Balance Theory, a triad (here: participant, CS, and US) is balanced if all three relations are positive, or if two are negative and one is positive. The theory states that people generally strive for balanced triads. For example, if participants loathe a US which is also loathed by a neutral CS, they generally like the CS, thereby creating a balanced triad (i.e., two negative relations and one positive). Thus, we have to acknowledge that Balance Theory explains standard and our reversed EC effects. Yet, Balance Theory can be seen as a particular type of propositional learning model: It assumes that changes in stimulus liking are mediated by qualifiers that specify the nature of the relation between stimuli in a triad. In particular, Balance Theory predicts how different propositions (e.g., participant likes US+ and CS likes US+) lead to new propositions about the likeability of the CS. Thus, it is not a competing model, but rather a special case of propositional learning with specific predictions.

However, there is one general caveat. The present experiment only used direct CS ratings to measure EC effects. Thus, we cannot exclude demand effects. It is possible that participants guessed the experiment's intentions and rated CSs according to their memory about a CS being paired with a specific US and a specific relational qualifier, even though CS valence did not change for them at all. Although direct CS ratings are a well-established and widely used measure for EC effects, further research is necessary showing these effects with indirect measures (e.g., affective priming) as a safeguard against demand effects during measurement.

If we accept this limitation, the present data show that semantic qualifiers specifying the CS-US relation moderate CS likeability changes due to CS-US pairings. This supports a propositional EC account, because in contrast to associative accounts, it allows to learn not only *that* CS and US are related, but *how* they are related.

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Beyond evaluative conditioning!
Evidence for transfer of non-evaluative attributes

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Abstract

Evaluative conditioning is the valence transfer from positive/negative stimuli to initially neutral stimuli through repeated co-occurrences of those stimuli. Theoretically, it should also be possible to condition non-evaluative attributes. Three experiments show the transfer of a non-evaluative attribute: By repeatedly presenting neutral people with athletic or non-athletic people, initially neutral people became more athletic while valence was controlled for statistically and experimentally. A fourth experiment generalizes the effect to shapes and non-words as neutral stimuli. Athleticism transfer was found on direct ratings and indirect measures (a modified Affect Misattribution Procedure and a categorical priming task). These data broaden the applicability of conditioning as a procedure for trait acquisition with important practical implications for advertising and brand image formation.

Keywords: evaluative conditioning, associative transfer, non-evaluative attribute, affective misattribution procedure, categorical priming

Beyond evaluative conditioning! Evidence for transfer of non-evaluative attributes

The question how people acquire preferences, their likes and dislikes, is central in social psychology. Evaluative conditioning (EC) provides an elegant and parsimonious answer: People *learn* to like or dislike initially neutral stimuli through mere spatial and temporal proximity to other positive or negative stimuli (Levey & Martin, 1975). In a typical EC procedure neutral stimuli (CSs) repeatedly co-occur with positive or negative stimuli (USs); for example, a neutral person is repeatedly presented with a liked or disliked person. The CS acquires the US' valence and the initially neutral person is liked or disliked afterwards.

The EC phenomenon is robust and has been demonstrated across many areas and paradigms (De Houwer, Thomas, & Baeyens, 2001). In a recent review, Hofmann, De Houwer, Perugini, Baeyens, and Crombez (2010) discuss five theoretical EC accounts. Interestingly, none of these accounts explicitly restricts EC to valence only. As social evaluations are hardly confined to simple likes and dislikes, it is an intriguing question whether this learning mechanism is limited to a basic like–dislike dimension or whether conditioning of other, non-evaluative attributes and traits is also possible. While it makes intuitively sense that valence has a central and special role, the theoretical accounts allow learning of non-evaluative attributes through repeated co-occurrence of two stimuli. Following this idea, we will show the transfer of the attribute *athletic* using an EC procedure.

One might argue that using the term "non-evaluative" conditioning is then a misnomer when we refer to EC procedures and theories. We use this term in the sense that we want to condition specific evaluative responses towards stimuli, for example "athletic", that are not driven by evaluative responses of liking and disliking. As almost all attributes and traits have some positive or negative connotation, we will show conditioning of such attributes beyond valence by controlling for valence experimentally and statistically; the resulting effect is what we will call *non-evaluative conditioning*.

Existing evidence for non-evaluative conditioning

Empirical evidence for non-evaluative conditioning is mixed; Kim, Allen, and Kardes (1996) showed transfer of "speed" and "softness" to a pizza delivery brand and a facial tissue brand. The pizza delivery was thought to deliver faster when repeatedly paired with racing cars and the facial tissue seemed to be softer after pairing it with kittens. Yet, Olson, Kendrick, and Fazio (2009) failed to condition the attributes “size” or “speed” to Pokémons (Exp. 1). Only when “size” was primed before conditioning (Exp. 2) an effect was found. They argued that non-evaluative attributes are not as attention-evoking as evaluative information and hence needed to be highlighted artificially to be conditioned. However, they used a great amount of distraction stimuli within a dual task situation. This might have reduced cognitive resources and awareness for pairings, and consequently reduced conditioning especially for the less salient non-evaluative attributes (compare Pleyers, Corneille, Yzerbyt, and Luminet, 2009).

So far, only one set of experiments showed non-evaluative transfers involving human CSs: Meersmans, De Houwer, Baeyens, Randell, and Eelen (2005) conditioned gender to babies. After repeatedly pairing pictures of gender-ambiguous babies (CSs) with female/male faces (USs), participants rated the babies to be girls or boys depending on the respective US-gender. However, this effect was only found in 2 out of 6 experiments (Exp. 2, 6) on direct rating scales and in Experiment 6 only for CS of which pairings participants were contingency-aware of. Similarly, when Kanji served as CSs (Exp. 7, 8), conditioning effects were only found for “aware” stimuli and only in Experiment 7 an EC effect was found on an associative priming measure. Besides the inconsistent data pattern, the observed effects could be due to simple valence transfers, as female faces are generally perceived more positive than male faces, by men and women alike (e.g., Rhodes, 2006). Hence, it is possible that pairings with female/male USs conditioned positive/negative valence to the CSs. When participants were asked to assess gender, they might have inferred their gender rating from the positive or negative feeling they had about those babies.

Thus, although transfer of non-evaluative attributes through EC procedures seems possible theoretically, unequivocal empirical evidence is lacking so far (see above). Using the attribute *athleticism*, the present study aims to show that people (CSs) can acquire attributes via EC procedures even when valence is excluded as an alternative explanation; this will be shown on direct and indirect dependent measures.

Preview of the Experiments

Experiment 1 will show that conditioning of athleticism is possible beyond simple valence transfer. To ensure that CSs indeed acquire the attribute (i.e., neither task demand characteristics nor explicit memory during measurement cause the effect) we will show conditioning effects in an indirect measure, a semantic version of the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005). While Experiment 1 includes the relational qualifier "is friend with" to connect the two stimuli during the conditioning phase, which is based on De Houwer's (2009) propositional EC account, Experiment 2 and 3 replicate the athleticism transfer without this qualifier. Experiment 3 uses a categorical priming measure, replicating the effect on latencies instead of response proportions (i.e., the AMP effect). Experiment 4 uses shapes and non-words as CSs, to show that the effect for human CSs is a special case of a more general conditioning effect.

Experiment 1

Experiment 1 used a standard EC procedure (e.g., Walther, 2002) to transfer the attribute *athletic* with one deviation: Following De Houwer's (2009) propositional account (see also Fiedler & Unkelbach, 2011), we provided the relational qualifier "is friend with", linking CSs with USs. As athleticism is most likely a positive concept, we controlled for valence experimentally by selecting USs rated equal in valence, and statistically by collecting ratings of CSs' athleticism as well as likeability.

To ensure that conditioning effects are not due to deliberate inferences or memory effects during measurement, we included a modified version of the AMP (Payne et al., 2005). Originally, the AMP assesses peoples' affective reactions: Participants see an affective picture flashed immediately followed by a Chinese character (Kanji). They are asked to decide if the Kanji gives a pleasant or unpleasant impression. The idea is that participants misattribute their affective reaction caused by the affective picture (prime) to the Kanji (target). Following the approach of Imhoff, Schmidt, Bernhardt, Dierksmeier, and Banse (2010), we established a Semantic Misattribution Procedure (SMP): Instead of affective pictures, CS pictures were used and the critical question for participants was if Kanji represent words with an athletic or non-athletic meaning. We expected that people misattribute the athleticism from athletic CSs to the Kanji following these CSs. The procedural details (see below) of this method make strategic inferences or explicit memory effects during measurement unlikely.

Method

Participants, design, and materials. Forty-nine Universität Heidelberg psychology students (33 women, 16 men) participated either for 3€ payment or course credit. We manipulated within-participants whether initially neutral persons (CSs) were paired with athletic or non-athletic persons (USs). Eight portrait photographs of men served as CSs. For each participant, four CSs were randomly assigned to be paired with athletic USs; the remaining four were paired with non-athletic USs. USs were selected based on pretest data ensuring athletic and non-athletic USs only differed in athleticism and not in likeability ratings[1]. To check for measurement order effects, we counterbalanced direct athleticism and likeability ratings and the SMP trials. A Visual Basic program controlled instructions, stimulus presentation, and recorded the dependent variables.

Procedure. Experimental sessions included up to six participants. Participants were seated in front of a PC and told they would see a series of pictures they should evaluate afterwards. In the conditioning phase, CS-US pairs were presented; they were assigned randomly anew for each participant. Each of the eight pairs was presented eight times, resulting in 64 pairings. CSs were visible for 1s alone, then the label “is friend with” was added for another 0.5s and the respective US appeared for another 2.5s. CSs were presented in the upper half of the screen and USs in the lower half. After a pause of 1.5s the next pairing was presented. For the dependent measures, half of the participants completed the SMP first and then rated each CS on athleticism and likeability on 8-point scales, with higher values indicating higher rated athleticism and likeability; the other half completed the ratings first, and afterwards the SMP.

For the SMP, participants were instructed they would see two pictures in rapid succession, the first being a familiar picture and the second being a Kanji. They were told that the first picture served as an orientation stimulus and they should decide whether a Kanji represents a word with an athletic or non-athletic meaning as fast as possible. They should only react to the Kanji and not to the preceding picture. Each trial consisted of a CS being visible for 75ms, followed by a blank screen for 125ms, and a Kanji for 100ms[2]. A black-and-white noise picture immediately replaced the Kanji until participants made their decision by pressing one of two marked keys on the keyboard. After finishing the dependent measures, they were thanked, paid, and debriefed.

Results

Measurement order had no effects in all analyses, all Fs < 1, *ns*; therefore, we omit this factor from the analysis report.

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[1] Athletic US pictures: beach volleyball player, cycler, cross country runner, short track runner. Non-athletic USs: a man in front of a PC, one recording sounds, and two playing with different game consoles. USs strongly differed in athleticism ratings (athletic USs: $M = 7.16$, $SD = 0.22$; non-athletic USs: $M = 3.82$, $SD = 0.41$; on a scale from 1 to 8), but did not differ in likeability ratings (athletic US: $M = 4.70$, $SD = 0.49$; non-athletic US: $M = 5.36$, $SD = 0.50$).

[2] Presentation times were used according to Experiment 1 of Payne and colleagues (2005).

Direct ratings. We calculated participants' mean athleticism ratings for the four athletic CSs and the four non-athletic CSs and compared them in a repeated-measures ANOVA. As predicted, CSs repeatedly paired with athletic USs were rated more athletic (M = 5.33, SD = 1.30) than CSs paired with non-athletic USs (M = 4.10, SD = 0.93), $F(1, 48)$ = 25.07, $p < .001$, d = 1.40. Likeability ratings for athletic (M = 4.12, SD = 1.15) and non-athletic CSs (M = 3.95, SD = 1.01) did not differ significantly, $F(1, 48)$ = 0.99, *ns*. Figure 1's first part presents the full pattern.

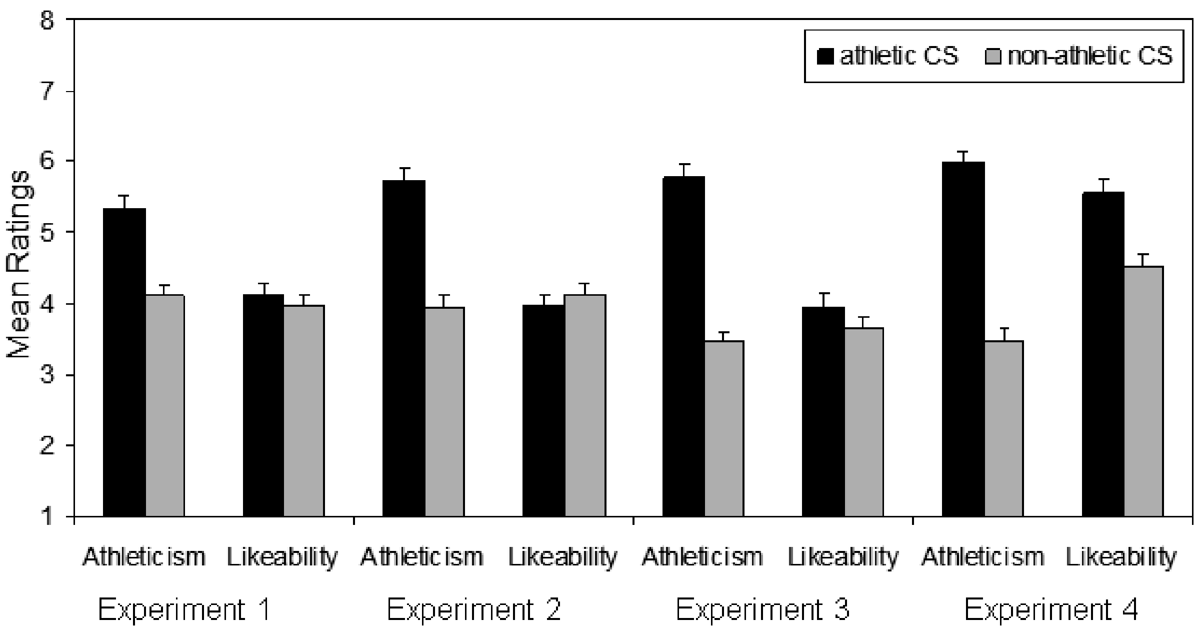

Figure 1. *Mean athleticism and likeability ratings of athletic and non-athletic CS in Experiments 1 to 4. Error bars represent standard errors of the means.*

Although likeability ratings were not affected, to control for valence, we predicted the athleticism ratings from the likeability ratings in a regression analysis; the residuals from this regression are therefore adjusted for likeability. We then repeated the analysis based on these likeability-adjusted residuals, which are now centered around zero. Still, CSs paired with athletic USs were rated more athletic (M = 0.58, SD = 0.90) than CSs paired with non-athletic USs (M = -0.58, SD = 1.14), $F(1, 48)$ = 22.52, $p < .001$, d = 1.36.

SMP. Overall, participants responded fast to the Kanji (M = 870ms, SD = 340ms). We computed the probability to judge Kanji as having athletic meaning when they appeared after athletic compared to non-athletic CSs. Figure 2's left part presents these probabilities; we analyzed them with the same ANOVA as the direct ratings (Lunney, 1970): Kanji following athletic CSs were more likely judged as athletic than Kanji following non-athletic CSs, $F(1, 48) = 14.04$, $p < .001$, $d = 1.03$.[3]

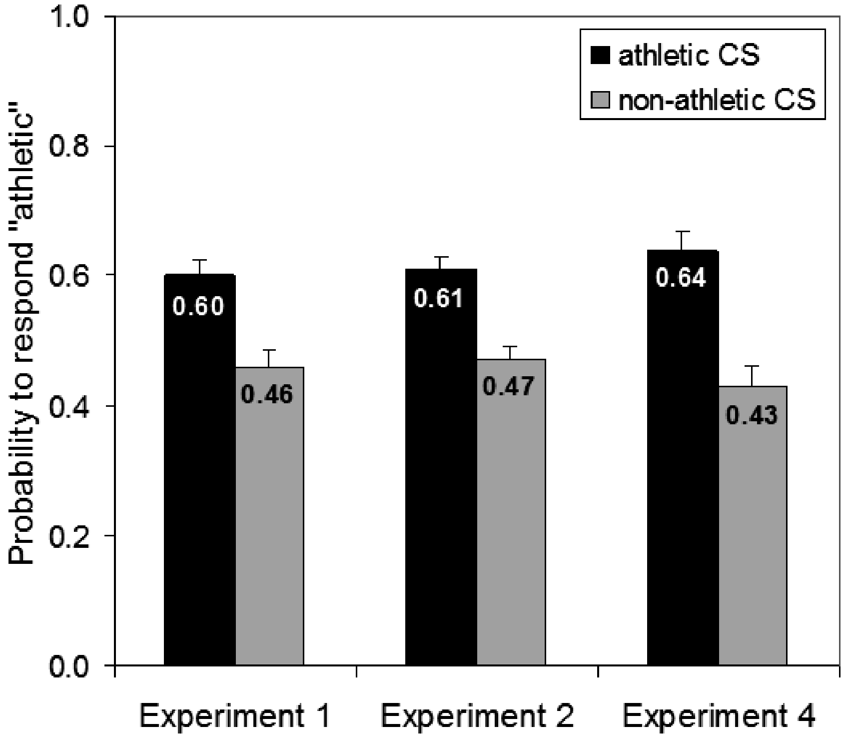

Figure 2. *Mean probabilities of "athletic" responses to Kanji following athletic and non-athletic CSs in the SMP in Experiment 1, 2 and 4. Error bars represent standard errors of the means.*

Discussion

Experiment 1 showed higher athleticism ratings for initially neutral persons when they were repeatedly paired with athletic USs compared to non-athletic USs. This effect remained stable even when we statistically controlled for valence influences. Yet, can we call this effect non-evaluative conditioning? Did the CSs indeed acquire the attribute athleticism? Participants might have simply remembered the pairings and made their judgments based on simple inferences from their observations: If they remember a CS was paired with an athletic US, they could infer that the CS must be athletic as well. Similarly, participants might have guessed the experiment's purpose and responded in line with the situational demands.

[3] Direct ratings of athleticism and SMP-effects were correlated significantly in this and the following experiments (Exp. 1 $r = .43$, $p = .002$; Exp. 2 $r = .51$, $p < .000$; Exp. 4 $r = .58$, $p < .000$). Direct ratings of athleticism and congruency effect in the priming task were not correlated (Exp. 3 $r = -.04$, *ns*), which is most likely due to the lesser reliability of the priming measure.

To exclude such deliberate inferences, demand or memory effects, the SMP was included. As predicted, Kanji shown after athletic CSs were judged *athletic* significantly more often than Kanji shown after non-athletic CSs. Based on the CSs' short presentation times and the task's instructions, we are confident that CSs indeed acquired the attribute *athleticism*.

However, based on De Houwer's (2009) propositional EC account, we included the link "is friend with" in the conditioning procedure. To test whether the effect depended on this relational qualifier, we omitted this link in Experiment 2.

Experiment 2

Experiment 2 replicated Experiment 1 without the qualifier "is friend with" linking neutral CSs and athletic/non-athletic USs in the conditioning phase. If successful conditioning of athleticism depends on this qualifier, the non-evaluative conditioning effects should be smaller or eliminated completely.

Method

Participants. Thirty-nine visitors (26 women, 13 men) of a Heidelberg student cafeteria were recruited and paid 5€ for their participation.

Procedure. The experiment took place at the cafeteria where participants were recruited from. In an adjacent room, participants were seated in front of laptops. During the conditioning phase, "is friend with" was omitted - everything else was identical to Experiment 1.

Results

Measurement order had again no influence, all Fs < 1, *ns*, and is therefore omitted from all following analyses.

Direct ratings. As predicted, CSs paired with athletic USs were rated more athletic ($M = 5.72$, $SD = 1.07$) than CSs paired with non-athletic USs ($M = 3.94$, $SD = 1.17$), $F(1, 38) = 32.65$, $p < .001$, $d = 1.83$. Likeability ratings did not differ (athletic CSs: $M = 3.96$, $SD = 1.12$; non-athletic CSs: $M = 4.13$, $SD = 1.00$), $F(1, 38) = 0.59$, *ns*. Figure 1's second part shows the full pattern of the means.

When we controlled for likeability statistically using regression analysis, the difference between athletic ($M = 0.91$, $SD = 1.10$) and non-athletic CSs ($M = -0.91$, $SD = 1.03$) was even more pronounced, $F(1, 38) = 35.94$, $p < .001$, $d = 1.92$.

SMP. Participants mean response latency was again fast (M = 1096ms, SD = 448ms). As in Experiment 1, Kanji following athletic CSs were more likely judged to have athletic meaning than Kanji following non-athletic CSs, $F(1, 38) = 18.19$, $p < .001$, $d = 1.33$. Figure 2's middle part displays the respective probabilities.

Discussion

Even without the relational qualifier linking CSs and USs, Experiment 2 showed highly significant athleticism effects beyond valence. As in Experiment 1, we found clear SMP effects, supporting actual non-evaluative conditioning, independent form explicit memory or strategic inferences. However, one might question the SMP as indirect measure. Experiment 3 will therefore use a categorical priming task to indirectly measure conditioning of athleticism. While the SMP uses on response proportions, the priming task uses participants' categorization latencies.

Experiment 3

Experiment 3 replicated Experiment 2 using a categorical priming task instead of the SMP. If CSs acquire the attribute athleticism, they should facilitate the categorical classification of targets as *athletic* and hinder the classification of targets as non-athletic (see McNamara, 2005).

Method

Participants, design, and materials. Forty-nine University Heidelberg psychology students (39 women, 10 men) participated either for 3€ payment or course credit. The basic design was identical to Experiment 2. For the categorical priming task, CSs served as primes and 16 athletic and 16 non-athletic objects from 8 categories served as targets. Athletic categories were balls, sport shoes, bikes, and rackets with four target stimuli per category. Non-athletic categories were computers, microphones/earphones, game pads, and guitars; with four target stimuli per category. Measurement order, categorical priming followed by direct ratings, was fixed.

Procedure. Experimental sessions took again place in the laboratory and conditioning procedures were identical to Experiment 2. After conditioning, participants completed the categorical priming. They were instructed that they would see two pictures in rapid succession but should only react to the second picture. Their task was to decide as fast as possible whether a target picture showed an athletic or non-athletic object. Each trail consisted of a fixation cross (visible for 700ms), followed by a CS (visible for 150ms), followed by a blank screen for 50ms (SOA = 200ms), and the target. The target was visible until participants pressed one of two marked keys on the keyboard; key assignment (athletic vs. non-athletic) was counterbalanced. The intertrial-interval was 750ms. For each participant, CS-target pairings were randomized: each athletic and non-athletic CS was paired with one athletic and non-athletic target out of each target-category; the same applied to non-athletic CSs, resulting in 64 trials. After the priming measure, participants directly rated CS athleticism and likeability on 8-point scales. Then they were thanked, paid, and debriefed.

Results

Direct ratings. Again, CSs paired with athletic USs were rated more athletic (M = 5.76, SD = 1.47) than CSs paired with non-athletic USs (M = 3.45, SD = 1.05), $F(1, 48) = 72.97$, $p < .001$, $d = 2.42$. Likeability ratings did not differ (athletic CSs: M = 3.94, SD = 1.42; non-athletic CSs: M = 3.63, SD = 1.12), $F(1, 48) = 0.14$, *ns*. Figure 1's third part shows the full pattern of the means.

When we controlled for likeability statistically as above, athletic CSs (M = 1.07, SD = 1.37) were still rated more athletic than non-athletic CSs (M = -1.07, SD = 0.92), $F(1, 48) = 73.87$, $p < .001$, $d = 2.44$.

Categorical priming. For each participant trials which were categorized incorrectly were deleted (6% total); latencies longer than 1000ms were trimmed to 1000ms, and 5 trials with latencies faster than 250ms were deleted. Based on these data, we calculated participants mean latencies for athletic and non-athletic objects, separately for athletic and non-athletic CSs, and compared them in a repeated-measures ANOVA. Figure 3 present the full pattern of means, showing the interaction: Decisions in congruent trials (athletic CS – athletic target; non-athletic CS – non-athletic target) were significantly faster (M = 616ms, SD = 85ms) than in incongruent trials (athletic CS – non-athletic target; non-athletic CS – athletic target; M = 628ms, SD = 91ms), $F(1,47) = 4.37$, $p < .042$, $d = 0.53$. Besides the important interaction, there was a main effect for target category: decisions on athletic targets are significantly faster (M = 598ms, SD = 84ms) than on non-athletic targets (M = 645ms, SD = 100ms), $F(1,47) = 51.22$, $p < .001$, $d = 2.04$.

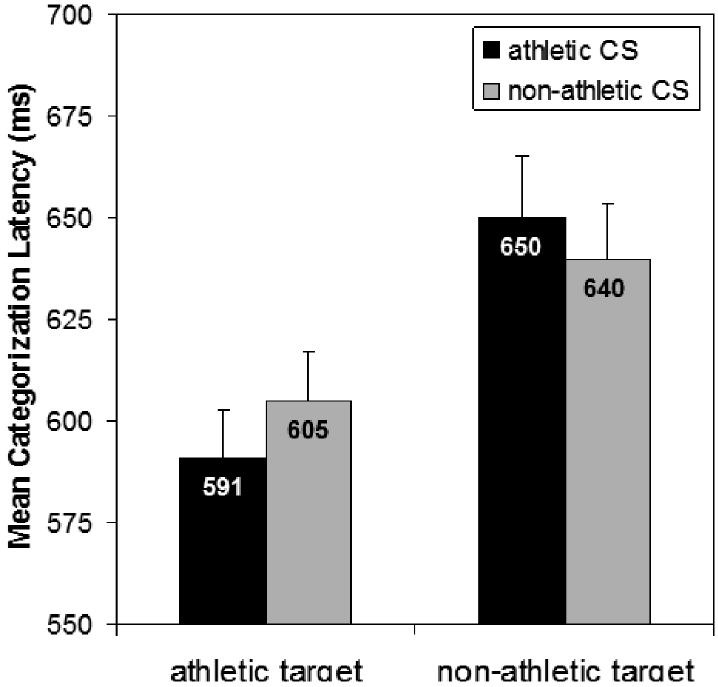

Figure 3. *Mean latencies for athletic and non-athletic targets following athletic and non-athletic CSs. Error bars represent standard errors of the means.*

Discussion

Experiment 3 replicates Experiment 1 and 2; moreover, conditioning effects were also found in a categorical priming task. When athletic targets were preceded by athletic CSs, participants categorized targets faster than when preceded by non-athletic CS; and vice versa for non-athletic targets. Using this well-established indirect measure, we are confident that the CSs indeed acquired the attribute “athletic”. The faster responses for the “athletic” category are easily explained with the idea of “markedness” (Clark & Clark, 1977): The athletic category is marked in comparison to the non-athletic category, which leads to overall faster classification responses (see also Unkelbach, Fiedler, Bayer, Stegmüller, & Danner, 2008, for the processing of marked and unmarked categories).

Finally, to show that the phenomenon is indeed conditioning applied to social cognition and not only a very special case of social perception, Experiment 4 broadens the scope by using shapes and non-words as CSs.

Experiment 4

Experiment 4 replicated Experiment 2 with shapes and non-words as CSs instead of humans, thereby showing that non-evaluative conditioning is a general phenomenon.

Method

Materials. We created eight mono-colored shapes which were clearly distinguishable, but no standard shapes (e.g., circles or rectangles). Non-words were selected from internet name-generators and pre-rated: Five raters consensually agreed that the shapes ware neutral with respect to athleticism and valence. Eleven students pre-rated 25 non-words on 7-point-scales. We selected 8 non-words for which athleticism (M = 3.64, SD = 0.29) and valence ratings (M = 3.93, SD = 0.47) did not differ.

Participants and design. Forty-three Universität Heidelberg psychology students (35 women, 8 men) participated either for 3€ payment or course credit. They were randomly assigned to one of the two CS-type conditions (“shape” vs. “non-words”). US athleticism (athletic vs. non-athletic) was again varied within participants.

Procedure. Procedures were similar identical to Experiment 2, except for the materials: Depending on condition, mono-colored shapes and non-words served as CSs. Further, as participants needed to be able to process the non-words in the SMP, we extended the prime presentation times in the SMP from 75ms to 150ms and therefore reduced the blank screen from 125ms to 50ms. According to Payne et al. (2005), longer prime presentations do not create a problem for the interpretation of AMP results.

Results.

CS-Type and measurement order had no effects in the analyses, all Fs < 1, *ns*, and are therefore omitted from the following presentation.

Direct ratings. Shapes and non-words as CSs paired with athletic USs were rated more athletic (M = 5.99, SD = 1.02) than CSs paired with non-athletic USs (M = 3.47, SD = 1.21), $F(1, 43) = 75.69$, $p < .001$, $d = 2.60$. CSs ratings did also differ in likeability (athletic CSs: M = 5.56, SD = 1.13; non-athletic CSs: M = 4.52, SD = 1.52), $F(1, 43) = 19.39$, $p < .001$, $d = 1.29$. Figure 1’s rightmost part displays the full pattern.

When we computed the means from the residuals of predicting athleticism from likeability, athletic CSs were still rated more athletic (M = 0.85, SD = 1.09) than non-athletic CSs (M = -0.85, SD = 1.05), $F(1, 43) = 44.89$, $p < .001$, $d = 2.07$,paralleling the previous experiments.

SMP. Participants mean response latency was again fast (M = 862ms, SD = 350ms). SMP results are given in Figure 2's rightmost part. Kanji following athletic CSs were more likely judged to have athletic meanings than Kanji following non-athletic CSs, $F(1, 43) = 17.08$, $p < .001$, $d = 1.21$.

Discussion

Both shapes and non-words acquired the attribute "athletic" over and above valence through repeated paring with athletic or non-athletic people. This was true for direct ratings and the SMP. Thus, we believe that the present effects are due to a general conditioning mechanism by which shapes, non-words, and people can acquire specific attributes through simple spatial and temporal contiguity to stimuli holding those attributes.

General Discussion

Across all experiments, we found transfer of the attribute *athleticism* from stimuli possessing that specific attribute to neutral stimuli by simple repeated pairings: As shown in Figure 1, across three experiments, neutral people (CSs) paired with athletic people (USs) were rated more athletic than people (CSs) paired with non-athletic others (USs) and Experiment 4 shows the same effects for shapes and non-words.

We believe the present experiments are the first clear demonstration of transfer of a specific attribute through EC procedures independent from and beyond valence. They go beyond prior work by consistently showing conditioning of *athleticism* on direct and indirect measures (in contrast to Meersmans et al., 2005) and without the need of highlighting the attribute through priming (compare Olson et al., 2009).

Uncontested, the attribute *athleticism* possesses valence, and this is probably true for every attribute of interest. However, the athleticism effect persisted even when we statistically removed the variance in the ratings due to likeability. Further, three out of four studies did not even show systematic likeability effects for athletic and non-athletic CSs. Thus, we believe the likeability effect in Experiment 4 was rather due to an inference from athleticism to likeability, and not the other way round.

Yet, the direct ratings in all four experiments are open to the alternative explanation of strategic inferences or explicit memory effects during measurement. Having no other information, participants might simply remember with whom a CS was paired and infer their athleticism ratings from that. The inclusion of the SMP and the categorical priming task ameliorate this problem: Participants were clearly instructed to guess the meaning of the

Kanji and ignore the shortly flashed CS. If CSs did not acquire the attribute, participants would need to recognize the CS, remember the paired US, and judge the Kanji accordingly. However, this seems very unlikely in light of participants' fast responses (see latency data), and the facilitation effect in the categorical priming task.

Table 1

Percentages of CSs for whom participants were aware or un-aware for US-athleticism.

Experiment	1	2	3	4
aware	80.10	75.96	81.12	91.57
un-aware	19.90	24.04	18.88	8.43

This feature is important, because memory for the pairings was high in all experiments: We additionally measured participants' awareness of CS-US parings with procedures similar to Stahl, Unkelbach, and Corneille (2009; awareness of the attribute athletic, not of the US identity), revealing high awareness rates (cf. Table 1); that is, they could report whether specific CSs were presented with athletic or non-athletic USs. Moreover, awareness was significantly correlated with direct ratings and SMP results (cf. Table 2), suggesting that awareness is a central requirement for successful non-evaluative conditioning, like it is for EC (see Hofmann et al., 2009; Meersmans et al., 2005; Pleyers, Corneille, Luminet, & Yzerbyt, 2007). This feature could explain previous failures to show non-evaluative conditioning (Meersmans et al., 2005) and the necessity of highlighting the respective attribute (Olson et al., 2009). As argued by Stahl and colleagues (2009), awareness is a pre-requisite for successful conditioning, leading to the empirical challenge to show conditioning beyond memory and demand effects. We believe the present experiments met this challenge using two indirect measures. In addition, based on these finding and the current line of research (Fiedler & Unkelbach, 2011; Förderer & Unkelbach, 2011), we subscribe to a propositional account (De Houwer, 2009) which can best integrate our awareness data. Yet, the present studies aimed at substantiating basic non-evaluative conditioning effects and further research is needed to delineate which theoretical process is at work.

Table 2

Correlations of direct and indirect dependent variables with awareness for CS-US athleticism separate for athletic and non-athletic CSs.

		athletic CS	non-athletic CS
Experiment 1	Direct Rating	.14*	-.29**
	SMP	.20**	-.24**
Experiment 2	Direct Rating	.17*	-.35**
	SMP	.11	-.27**
Experiment 3	Direct Rating	.40**	-.25**
	Categorical Priming	.02	
Experiment 4	Direct Rating	.28**	-.11
	SMP	.01	-.17*

Note. Direct ratings and SMP: For athletic CSs positive correlations show higher athleticism ratings for higher awareness; for non-athletic CSs negative correlations show lower athleticism ratings for higher awareness. Categorical Priming: For athletic and non-athletic CSs positive correlations show higher priming effects for higher awareness.

*p < .05

**p < .01

Another interesting aspect is that both direct and indirect effects were mainly caused by athletic CSs. In hindsight, this pattern is to be expected: The attribute *athletic* is clearly defined and strongly associated with *doing sports*. However, *non-athletic* is less well-defined: is it being inactive, being lazy, or playing computer games? Thus, it is difficult to capture *non-athleticism* in one picture. The neutral people (respectively shapes/non-words) paired with pictures of people doing sports acquired the attribute athletic; but the neutral people (shapes/non-words) paired with pictures of people doing something else than sports stayed neutral.

Beyond the theoretical significance that non-evaluative conditioning is possible, the data has clear practical implications: Especially Experiment 4, as it used shapes and non-words, which are part of brand logos, provides an explanation how differentiated brand images are formed (e.g., Batra & Homer, 2004); for example, when cereal bar brands become by itself symbols for healthiness and athleticism, due to sportive celebrities endorsing this brand. Simply the repeated co-occurrence of brand and celebrity might lead to a transfer of some celebrity attributes to the brand. Future research will test if non-evaluative conditioning also works with brands as CSs and how specific celebrity attributes as US can be highlighted to ensure only these desired ones are conditioned (Förderer & Unkelbach, in preparation).

Conclusions

We demonstrated how people, and more generally, any stimulus, can acquire a specific attribute through simple spatial and temporal co-occurrences with stimuli possessing this attribute. These demonstrations of non-evaluative conditioning broaden the understanding of how stimuli acquire attributes through a simple learning mechanism. Transferring non-evaluative attributes through EC procedures shows how differentiated preferences and specific stimulus aspects are acquired, providing an elegant and parsimonious explanation of attribute and trait acquisition.

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Non-evaluative conditioning of specific attributes with multi-attribute US

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Non-evaluative conditioning (NEC) refers to changes in attribute associations of initially neutral stimuli (CSs). Due to mere spatial and temporal contiguity of CSs with stimuli representing an attribute (USs), CSs are associated with this attribute. Empirical research showed that changing and creating attribute associations via conditioning is possible; however, proof for conditioning only specific attributes is pending. In three experiments we show specific NEC: Using celebrities as USs, Experiment 1 and 2 show conditioning of specific attributes to logos beyond valence within one conditioning phase; additionally, these effects persist over time and thereby might influence behavior afterwards. Experiment 3 shows how priming celebrity attributes allows conditioning specific attributes even when multi-attribute USs are used. These data show that conditioning of specific attribute associations is controllable and have theoretical as well as practical implications for brand image formation.

key words: evaluative conditioning, associative learning, priming, brand image, celebrity endorsement

Non-evaluative conditioning of specific attributes with multi-attribute US

People and objects are associated with more or less specific attributes. Our friend Peter might be associated with the attributes smart, strong, and athletic; and a BMW might be associated with the attributes sporty, luxurious, and high quality. An intriguing question within social cognition research is how these associations are created and how the association process can be controlled. Here, we suggest *non-evaluative conditioning* (NEC[1]) as a procedure to create and change attribute associations with objects. Similar to *evaluative conditioning* (EC), mere spatial and temporal contiguity of a neutral stimulus (CS) with a stimulus representing an attribute (US) should be sufficient to associate the CS with the respective attribute. We assume that very *specific* attribute associations can be conditioned instead of mere general positive or negative “feelings” about the CS. Moreover, we assume that when USs represent multiple attributes (i.e., multi-attribute USs), it is still possible to condition very specific attributes.

The question how stimuli acquire their associated attributes is central for studying preferences. Although, preferences refer to the liking or disliking of stimuli, they are not limited to mere positive or negative feelings about a stimulus. They also include specific attributes associated with a stimulus, like a person who is nice, but also smart and athletic. Thus, the central aim of the current study was to show how attribute associations as created. Levey and Martin (1975) suggested EC as a parsimonious phenomenon causing preference formation in terms of learning likes and dislikes through conditioning procedures. EC procedures refer to the repeated pairing of neutral stimuli (CSs) with liked or disliked stimuli (USs); as a result, initially neutral CSs are liked or disliked post-conditioning. This change in valence is what it known as the EC effect (cf., De Houwer, 2007). Research showed that EC is a very robust phenomenon applicable to all kinds of stimuli and stimuli modalities (for an overview, see Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). Yet, EC effects refer only to changes in valence; they do not imply changes in associated attributes. On the other hand, EC accounts about possible processes causing EC effects do not limit EC procedures to causing only changes in valence (Förderer & Unkelbach, 2011a). We assume that specific attribute associations beyond valence can also be created and changed through repeated pairing of stimuli (i.e., through EC procedures), which is what we call NEC.

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[1] Prior research also used terms like associative transfer of non-evaluative stimulus properties (Meersmans et al., 2005), associative learning of non-evaluative co-variations (Olson, Kendrick, & Fazio 2009), and semantic conditioning (Galli & Gorn, 2011) to refer to the same phenomenon.

Moreover, if multi-attribute USs are paired with CSs it can be controlled that only specific attributes will be conditioned, but not all attributes associated with the USs.

Empirical evidence of conditioning attributes, that is, of NEC is rather scarce: Kim, Allen, and Kardes (1996) made a pizza delivery brand (CS) seem to deliver faster by repeatedly pairing it with a racing car (US); and a facial tissue brand (CS) seemed to be softer after pairing it with kittens (US). Meersmans, De Houwer, Baeyens, Randell, and Eelen (2005) conditioned gender to either babies or Kanji (CSs) through repeatedly pairing them with pictures of either male or female persons (USs). Although both studies found changes in CSs attribute ratings, they suffered from a methodological problem: The experiments did not control for valence effects per se. It might be possible that simply US valence was conditioned, which led to the observed effects on the provided rating scales (e.g., fast = good in the context of pizza delivery; female = good/cute in the context of face perception). Recently, Förderer and Unkelbach (2011a) provided clear evidence for conditioning of attributes beyond valence: They conditioned athleticism to neutral men, shapes, and non-words (CSs) by repeatedly pairing them with athletic or non-athletic men (USs) and controlled for valence statistically. NEC effects were found on direct athleticism ratings as well as on indirect measures (in a semantic misattribution procedure and in a semantic priming procedure).

The term *non-evaluative* might be a bit misleading as nearly all attributes possess valence and will result in a positive or negative evaluation of a person or object (e.g., soft tissue, fast delivery, and athletic men are all positive). By using the term “non-evaluative” conditioning we refer to creating and changing attribute associations beyond valence changes (Förderer & Unkelbach, 2011a). Thus, it is not *only* the athlete’s positive valence which is associated with the neutral man due to conditioning. Instead, it is indeed the attribute “athletic” which is associated with the man. Beyond that, it is yet unclear whether attributes are *transferred* through NEC procedures implying the CS *is* athletic, or whether the CS is merely *associated* with the attribute athletic which *does not mean it is* athletic. Förderer and Unkelbach (2011a) referred to NEC as a phenomenon of transferring attributes; yet, this is imprecise. First, there is no data showing that attributes were really transferred instead of merely associated with the CS. Second conditioning cannot make people athletic or make the pizza delivery faster; the stimuli do not *acquire* the attribute. Especially for logo or brand CSs it is difficult to assume that attributes are transferred; that is, that logos/brands *become* athletic, sexy, or smart. A *smart* logo has no meaning outside of marketing contexts; the more precise assumption is that people and objects are associated with those attributes. Thus, in the current study we refer to NEC as a phenomenon referring to creating and changing attribute associations for CSs.

So far, prior studies conditioned only one attribute in a conditioning phase. USs were either male or female emphasizing gender as prominent attribute (Meersmans et al., 2005), or either clearly athletic or non-athletic emphasizing athleticism as prominent attribute (Förderer & Unkelbach, 2011a). However, no study tried to condition several attributes within one procedure and never examined NEC effects when multi-attribute USs were used. The refined questions thus are: Is it possible to condition several attributes within one conditioning phase where attributes are not further emphasized by clearly opposed USs? Moreover, is it possible that only specific attributes are conditioned even if USs represent more than one attributes? And is it possible to control which specific attribute of a multi-attribute US is associated with a paired CS? Therefore, the first aim of the current study was to condition several specific attributes and ensure CSs will be associated with only one specific attribute which their paired US represents. That is, participants should rate CSs high on one specific attributes, but not on other attributes even if these have the same valence. The second aim was to implement a procedure to control specific NEC effects and ensure only intended attributes will be conditioned.

In Experiment 1, we used celebrity USs each associated with one of five attributes and paired them with neutral logo CSs. After conditioning, CSs should be associated only with the attribute their paired US represents, but not with other also positive attributes. Thereby, we aimed to show two things: First, we intended to provide first evidence for conditioning several attributes within one conditioning phase. The critical question was whether attributes can be conditioned even if they are not further emphasized by using USs which were clearly opposed on the attribute in question. Thus, similar to the valence focus that seems necessary for EC (Gast & Rothermund, 2011), the question was whether attributes were prominent enough to be recognized by participants and conditioned to CSs. Second, we aimed to show that not only valence was changed into a positive direction and logos were consequently rated high on all positive attributes; but that in fact logos were associated with specific attributes and rated high only on the attribute their paired US represented. Additionally, we implemented two US-conditions: In one condition, CSs were paired with only one US representing an attribute; in the other condition, CSs were paired with three USs representing the same attribute. Some EC studies already showed differences in EC effects between CSs paired with one or many USs of the same valence (e.g., Stahl & Unkelbach, 2009; Sweldens, Van Oesslaer, & Janiszewski, 2010). Here, we intended to test whether participants can infer the respective attribute from one US or whether several USs are needed to emphasize the respective attribute; that is, we tested whether NEC effects differ in their strength.

Experiment 2 examined whether NEC effects persist over time. Therefore, we used the same conditioning procedures as in Experiment 1, but measured NEC effects with a delay of one day. Providing evidence for persisting NEC effects is very interesting for applying NEC procedures in real live settings. Only if conditioned preferences last over time they are able to influence behaviour.

In Experiment 3, we implemented a procedure to accentuate specific US attributes and thereby control that only specific attributes were associated with CSs. Prior NEC studies used USs for which one attribute was clearly prominent; however, stimuli and people in particular are commonly associated with several attributes. Some of these attributes might be positive, others however might be negative and should not be associated with the CS. Especially when NEC is systematically used to create associations (e.g., to form brand images), it should be controllable which attributes will be conditioned. Therefore, we used celebrity USs who represent more than one attribute (e.g., sexy and familial for Angelina Jolie) and implemented a priming procedure (cf., Higgins, Rholes, and Jones, 1977) to control NEC effects. For each celebrity US one of two attributes was primed by providing information emphasizing one specific attribute prior conditioning. Afterwards, we analysed whether CSs were associated with only the primed attributes or also with the other not-primed attributes of USs.

Experiment 1

Experiment 1 used a NEC procedure to condition the attributes *humorous, sexy, educated, athletic,* and *soft* to neutral logos by repeatedly pairing them with celebrities representing these attributes. As we assume that NEC procedures can be successfully used to create brand images (see final discussion), we chose these attributes because they are important within current advertisement to create specific brand images. The chosen attributes do not overlap with each other, allowing to test whether specific attributes were associated with CSs beyond positive valence in general. Ideally, participants should rate logo CSs high only on the specific attribute of paired celebrity USs, but not on other attributes which were also positive, thereby, providing evidence for specific attribute conditioning beyond valence.

We implemented two US-conditions to test whether one celebrity US is sufficient to change attribute associations: Thus, CSs were either paired with one US or with three USs representing the same attribute. As associations of specific attributes should be changed, these attributes should be more prominent when more celebrities, which represent the same attribute, are paired with one logo, leading to stronger NEC effects.

Pretest

To select appropriate celebrity USs, we conducted a paper-and-pencil pretest. The test showed 25 pictures of celebrities widely known in Germany (e.g., Vladimir Klitschko, George Clooney, and Barack Obama). Twenty-nine participants rated all celebrities on the attributes humorous, sexy, educated, athletic, and soft on 8-point likert-scales ranging from "absolutely" to "not at all". In addition, they rated how much they liked each celebrity. Based on the means and standard deviations for each celebrity, we selected three celebrities for each of the five attributes, resulting in 15 USs. Therefore, only celebrities were chosen who scored high on just one attribute (with a minimal SD) but not on the other four and who were neutral in likeability (representing valence). Chosen celebrities were for example Jim Carrey for humorous and George Clooney for sexy.

Main Experiment – Method

Participants, design, and materials. Forty-nine Universität Heidelberg psychology students (38 women, 11 men) participated either for a chocolate bar and 2€ payment or course credit. Five neutral logos served as CSs; the logos were successfully used in previous research and consisted of a colorized shape and a non-word (Förderer and Unkelbach, 2011a, Experiment 4). The celebrity pictures selected in the pretest served as USs. As a within-participants factor, we manipulated which CS was randomly assigned to be paired with *humorous*, *sexy*, *educated*, *athletic*, or *soft* celebrity USs, constituting the within factor *attribute*. Between-participants we manipulated whether CSs were paired with only one US (US-condition: *single-US*), which was randomly selected out of the three celebrities per attribute, or with all three celebrities per attribute (US-condition: *multiple-USs*). A Visual Basic program controlled instructions, stimulus presentation, and recorded the dependent variables.

Procedure. Experimental sessions included up to four participants. The experimenter seated participants in front of PCs and told them they would see a series of pictures and should evaluate logos afterwards. In the conditioning phase, the computer program presented CS-US pairings; these parings were assigned randomly anew for each participant. In the single-US condition, each of the five CSs was presented nine times with the US representing the to-be-conditioned attribute; in the multiple-USs condition, each of the five CSs was presented three times with each of the three USs, also resulting in nine pairings and 45 pairings overall.

CSs were visible for 1s alone, then the respective US appeared for another 2.5s with the CS still on the screen. CSs were presented in the upper half of the screen and USs in the lower half. After a pause of 1.5s the next pairing followed. Afterwards, participants rated each logo CS on the attributes humorous, sexy, educated, athletic, and soft and on likeability on 11-point scales (ranging from for example 0 = “not sexy” to 10 = “very sexy”). After finishing their ratings, the experimenter thanked, paid, and debriefed participants.

Results

The between-participants factor US-condition (single-US vs. multiple-USs) had no main or interaction effects; it is omitted from the following report, all related Fs < 1, *ns*.

First, we tested whether the five logo CSs differed in their likeability ratings using a repeated measurement ANOVA: The logos did not differ significantly in valence, $F(4, 45) = 0.99$, *ns*; thus, the conditioned attribute had no influence on overall logo-valence[2].

Next, we compared the specific attribute ratings *across CSs*: We tested whether participants rated logos paired with celebrities representing specific attributes higher on that attribute than other logos paired with celebrities representing other attributes. Therefore, we built contrasts for each logo: The rating of the attribute the logo was conditioned with was weighted with +1; the rating of this attribute for the other logos was weighted with -0.25. The resulting contrast score is positive when the attribute rating of the logo conditioned with this attribute was higher than the average attribute rating of the other logos. These contrast scores were tested against zero using t-tests. For all five logos, contrast scores were positive and significantly differed from zero: humorous logo $M = 2.53$, $SD = 2.82$, $t(48) = 6.29$, $p < .001$; sexy $M = 1.16$, $SD = 2.46$, $t(48) = 3.30$, $p < .001$, educated logo $M = 1.63$, $SD = 2.18$, $t(48) = 5.25$, $p < .001$; athletic logo $M = 1.37$, $SD = 3.11$, $t(48) = 3.07$, $p = .004$; and soft logo $M = 1.56$, $SD = 3.49$, $t(48) = 3.13$, $p = .003$. Accordingly, the overall mean of all contrasts significantly differed from zero, $M = 1.65$, $SD = 1.89$, $t(48) = 6.10$, $p < .001$. In sum, these analyses showed that respective attributes were successfully conditioned to the; that is, each logo was rated higher on its conditioned attribute than other logos.

[2] As we have no control condition, the logos might all have increased in likeability due to celebrity pairings; yet, the main argument is about the conditioning of specific attributes beyond valence.

We also compared attribute ratings *within CSs*[3]*:* For each CS, we tested whether only the intended attribute (e.g., humorous for logo paired with humorous celebrities) was conditioned and rated higher than the other attributes (i.e., sexy, educated, athletic, soft, and likeability). To control for rating tendencies we *z*-standardized participants' ratings for each attribute (as it might be possible that a participant overall gives higher ratings on humorous than on sexy independent of the conditioned attribute). Thus, positive values indicate high ratings of a given attribute relative to the participant's mean rating of that attribute across logos. Then, we calculated mean scores of "remains" for each logo based on the *z*-standardized attribute- and likeability-scores of this logo except for the score of the attribute the logo was conditioned with (e.g., for a logo paired with a humorous celebrity, "remains" equals the mean of *z*-standardized scores of sexy, educated, athletic, soft, and likeability). Table 1's upper half shows the full pattern of results; as this table shows, for all logos the to-be-conditioned attribute received the highest scores.

Table 1

Z-standardized logo (CSs) ratings on attributes and likeability, and mean of "remains" in Experiment 1 and 2 (standard deviations in parentheses).

	humorous	sexy	educated	athletic	soft	likeability	remains
				Experiment 1 (*n* = 49)			
humorous CS	**.72** (.75)	-.25 (.82)	-.24 (.76)	-.10 (.93)	-.14 (.83)	.07 (.85)	-.13 (.47)
sexy CS	.00 (.82)	**.35** (.89)	-.10 (.89)	.06 (.71)	.09 (.82)	.11 (.82)	.03 (.45)
educated CS	-.25 (.85)	-.25 (.85)	**.68** (.78)	-.18 (.82)	-.31 (.81)	-.05 (.86)	-.21 (.52)
athletic CS	.00 (.87)	.05 (.91)	-.17 (.86)	**.36** (.95)	-.07 (.91)	.10 (.85)	-.02 (.52)
soft CS	-.47 (.74)	.09 (.89)	-.16 (.88)	-.14 (.92)	**.42** (.97)	-.23 (1.06)	-.18 (.51)
				Experiment 2 (*n* = 38)			
humorous CS	**.35** (.99)	-.14 (.91)	-.31 (.87)	-.10 (.96)	-.27 (.90)	.24 (.87)	-.12 (.51)
sexy CS	.16 (.72)	**.24** (.84)	.06 (.79)	-.09 (.92)	.02 (.86)	.04 (.80)	.04 (.40)
educated CS	.04 (.93)	-.05 (.85)	**.20** (.99)	-.16 (.84)	.03 (.91)	-.25 (.96)	-.09 (.51)
athletic CS	-.29 (.95)	-.23 (.91)	.04 (.86)	**.32** (.83)	-.12 (.91)	-.01 (.88)	-.12 (.54)
soft CS	-.26 (.74)	.18 (.93)	.01 (.94)	.03 (.89)	**.34** (.85)	-.02 (.94)	-.01 (.53)

Note. For each CS conditioned attribute is highlighted bold.

[3] We know there is an overlap in variance of the analyses *across/within CSs* (respectively in Experiment 3, of mixed models for CSs ratings) as both analyzed partly the same data. Yet, both analyses are highly informative and emphasize different aspects of the data.

To test this pattern, we ran separate repeated measures ANOVAs and tested the *z*-standardized scores of the conditioned attribute against the “remains”-score. For all attributes, a logo’s conditioned attribute was rated higher than the remains: The humorous logo was rated higher on humorous than on remains, $F(1, 47) = 35.81$, $p < .001$. The sexy logo was rated higher on sexy than on remains, $F(1, 47) = 7.35$, $p = .009$. The educated logo was rated higher on educated than on remains, $F(1, 47) = 42.40$, $p < .001$. The athletic logo was rated higher on athletic than on remains, $F(1, 47) = 5.75$, $p = .021$. And finally, the soft logo was rated higher on soft than on remains, $F(1, 47) = 16.55$, $p < .001$. In sum, these results showed that participants rated each logo significantly higher on the intended attribute than on other attributes; that is, CSs were associated with only one specific attribute.

Discussion

Experiment 1 showed that it is possible to create specific attribute associations of neutral logo CSs through mere spatial and temporal contiguity with celebrity USs representing these attributes (i.e., through NEC procedures). Thus, initially neutral logos were associated with the attributes humorous, sexy, educated, athletic, or soft. Specifically, the data showed that logos conditioned with a specific attribute were rated higher on that attribute than other logos conditioned with different attributes (analysis across logo CSs). This equals *basic* NEC effects. Moreover, logos were rated higher on the conditioned attribute compared to the other attributes (analysis within logo CSs). This equals *specific* NEC effects: CSs were associated with one specific attribute the paired USs represents, but not with other also positive attributes. Thus, specific attributes were conditioned with CSs beyond general positive valence, which otherwise might have influenced all attribute ratings. It seems that within a short conditioning phase participants inferred attributes of celebrity USs which were consecutively associated with paired logo CSs. Interestingly, results did not differ between US-conditions (single-US vs. multiple-USs); participants correctly inferred intended attributes from one celebrity and it was not necessary to further accentuate attributes by using three celebrities representing the same attribute.

Experiment 2

Experiment 2 intended to show that the NEC effects observed in Experiment 1 persist over time. This is especially important for practical use of NEC as there is generally a delay between conditioning/learning and behavior influenced by learned associations. For example, consumers might see an advertisement using a celebrity (US) to condition a brand’s (CS) image, but the purchase decision (which should be influenced by the conditioned brand image) will be made several days later in a store. Thus, we replicated Experiment 1 with one modification: Logos were rated one day after conditioning.

Method

Participants. Thirty-eight Universität Heidelberg psychology students (28 women, 10 men) participated for 3€ payment or course credit. Design and materials were the same as in Experiment 1.

Procedure. Experimental sessions included up to six participants. Instructions and conditioning were identical to Experiment 1. The only modification was measurement time: After conditioning, participants were asked to return the next day to complete the study. When they returned, participants rated each logo on the five attributes and likeability. After completing the rating scales, experimenters thanked, paid, and debriefed participants.

Results

Thirty-two participants returned the next day; six participants returned two days after conditioning. This delay variation did not influence results in any way. The analyses and results in general were overall similar to Experiment 1. First, logos did not significantly differ in valence, $F(4, 34) = 0.85$, *ns* (but see also Footnote 2). However, US condition (single vs. multiple) showed an effect and is included in the following report.

Across CSs, we tested whether logo CSs paired with celebrity USs representing a specific attribute were rated higher on that attribute than other logo CSs paired with celebrity USs representing other attributes, using the same contrasts as in Experiment 1. Four of the contrast scores differed significantly from zero: humorous logo $M = 0.99$, $SD = 2.90$, $t(37) = 2.11$, $p = .042$; sexy logo $M = 0.85$, $SD = 2.32$, $t(37) = 2.26$, $p = .030$; athletic logo $M = 0.97$, $SD = 2.59$, $t(37) = 2.32$, $p = .026$; and soft logo $M = 1.08$, $SD = 2.85$, $t(37) = 2.34$, $p = .025$. Only the "educated logo" contrast did not differ significantly from zero, $M = 0.64$, $SD = 2.66$, $t(37) = 1.48$, *ns*. Overall, the mean of all contrasts significantly differed from zero, $M = 0.91$, $SD = 1.39$, $t(37) = 4.03$, $p < .001$. US-condition (single-US vs. multiple-USs) had no significant main or interaction effects, all $Fs < 1$, *ns*. In sum, analyses showed that all attributes were successfully conditioned to the respective logo, except for educated.

Similar to Experiment 1, we tested *within CSs* (see Footnote 3) whether only the intended attribute was rated higher than the other attributes. We used separate mixed ANOVAs with US-condition (single-US vs. multiple-USs) as between factor and remains vs. intended attribute as repeated measure. Again, we tested *z*-standardized scores of the conditioned attribute against the remains-score. Table 1's lower half shows the full pattern of the *z*-standardized means. While the analysis *across CSs* replicates Experiment 1 perfectly, the pattern of the comparison *within CSs* was less clear. The ratings of the humorous and athletic logos replicated Experiment 1's results: The humorous logo was rated higher on humorous than on remains, $F(1, 36) = 7.69$, $p = .009$; and the athletic logo was rated higher on athletic than on remains, $F(1, 36) = 8.12$, $p = .007$. For the other logos, we found interactions with US-condition (single- vs. multiple-USs): The sexy logo was not rated higher on sexy than on remains, $F(1, 36) = 2.35$, *ns*; however, there was a significant interaction of conditioning and US-condition, $F(1, 36) = 4.77$, $p = .036$. When a logo was paired with only one celebrity (single-US condition), the logo was rated higher on sexy ($M = 0.48$, $SD = 0.75$) than on remains ($M = -0.01$, $SD = 0.45$); this was not true in the multiple-USs condition (sexy: $M = 0.00$, $SD = 0.88$ vs. remains: $M = 0.09$, $SD = 0.33$). Also, the educated logo was not rated significantly higher on educated than on remains, $F(1, 35) = 2.61$, *ns*. However, there was a significant main effect of US-condition, $F(1, 35) = 7.72$, $p = .009$. In the single-US condition overall ratings were higher (sexy: $M = 0.54$, $SD = 1.02$ vs. remains: $M = 0.03$, $SD = 0.51$), than in the multiple-USs condition (sexy: $M = -0.17$, $SD = 0.83$ vs. remains: $M = -0.22$, $SD = 0.48$). Finally, the soft logo was rated higher on soft than on remains, $F(1, 36) = 5.52$, $p = .024$. Above that, the significant interaction of conditioning and US-condition ($F(1, 36) = 5.48$, $p = .025$) shows that a logo paired with only one celebrity (single-US condition) was rated higher on soft ($M = 0.55$, $SD = 0.68$) than on remains ($M = -0.15$, $SD = 0.47$); this was not true in the multiple-USs condition (soft: $M = 0.13$, $SD = 0.96$ vs. remains: $M = 0.12$, $SD = 0.55$).

Discussion

Experiment 2 showed that NEC effects persisted over time. Even after a delay of one or two days, logos were rated higher on their conditioned attribute than other logos were on this attribute (analysis across CSs, equaling *basic* NEC effects). These results replicated Experiment 1. Furthermore, in the analysis within CSs, we found the expected effects that logos paired with humorous, athletic, and soft celebrities were rated higher on the conditioned attribute than on the other attributes (equaling *specific* NEC effects). Yet, for sexy and educated logos this was only true in the single-US condition. Thus, the results are less clear than in Experiment 1, but we are still confident to say that NEC effects for logos paired with celebrities endure over time. Given the fact that participants saw multiple CS-US pairings for less than five minutes, they made quite differentiated logo ratings even one or two days after conditioning.

So far, we chose USs pre-tested to represent only one attribute; however, celebrities or other US-entities might be associated with a great number of miscellaneous attributes. It is not clear yet whether only the intended attribute was associated with the logo, or if other US attributes were conditioned, too. Therefore, Experiment 3 accentuated specific celebrity attributes by providing participants with information about celebrity USs prior conditioning. By using this strategy of accentuating attributes we intended to provide first evidence for a strategic control of NEC effects.

Experiment 3

Experiment 3 intended to show that by priming a specific US attribute of a multi-attribute US only this particular attribute will be associated with a paired CS. This method is based on early findings on impression formation by Higgins and colleagues (1977). They showed that priming (i.e., activating) a specific trait category by unobtrusively exposing participants to traits during a color detection task influences the evaluation of a following stimulus. We selected four celebrities widely known in Germany (i.e., Angelina Jolie, Anke Engelke, Joey Kelly, and Vitali Klitschko) that represent at least two distinct attributes which were not correlated with all other attributes in the set. For each celebrity we chose an easily accessible dominant attribute (e.g., sexy for Angelina Jolie) and an also known, but less accessible non-dominant one (e.g., familial for Jolie). The selected attributes were distinct from each other (e.g., sexy, familial, strong, educated), thereby ensuring that it is possible to obtain differential conditioning effects on these attributes. We assumed that by providing participants with information priming one particular celebrity attribute, USs would be categorized in accordance with the primed information, and thus, only the primed attribute would be associated with CSs afterwards. Further, it was of interest whether priming and afterwards conditioning would be equally successful for dominant compared to non-dominant attributes.

Method

Participants, design, and materials. Seventy-seven visitors (56 women, 21 men) of a Heidelberg student café participated for 5€ payment. Four neutral logos from Experiment 1 and 2 served as CSs and were randomly assigned to one of four celebrity USs for each participant. USs were pictures of Angelina Jolie, Anke Engelke, Joey Kelly, and Vitali Klitschko. For each celebrity we chose two attributes which should be primed: *familial* vs. *sexy* for Jolie, *socially committed* vs. *funny* for Engelke, *athletic* vs. *musical* for Kelly, and *educated* vs. *strong* for Klitschko. The attributes were chosen so that one of them was a *dominant* attribute (sexy, funny, musical, strong), which is easily accessible for the respective celebrity; and one was a *non-dominant*, less accessible but still known attribute of the celebrity (familial, socially committed, athletic, educated). To analyze possible differences for dominant and non-dominant attributes, we introduced the within-participant factor *dominance*. *Priming* was a between-participants factor and we counterbalanced between-participants which celebrity attributes were primed in newsfeeds prior conditioning. As we used four celebrity USs and two different attributes for each USs, we decided against a completely counterbalanced design (resulting in six conditions), because full counterbalancing would have created an unreasonable number of conditions. For example, to prime *familial* for Angelina Jolie the newsfeed read "Angelina Jolie is mother of six children; three of them are adopted. Jolie is always keen to be a good mother and spends as much time with her family as possible"; to prime *sexy* it read "Angelina Jolie is one of Hollywood's most attractive actresses. In many movies she outstands by her strong sex appeal. 2004, she was elected 'sexiest woman alive'". Additionally to the verbal attribute priming, different celebrity pictures were used to further emphasize the primed attribute. For example, to prime familial Jolie was shown walking down a street with three of her kids; to prime sexy she was depicted in a wet soaked white shirt and tight leather pants. To minimize demand awareness we also used four additional celebrities as filler stimuli in the newsfeed phase. A Visual Basic program controlled instructions, stimulus presentation, and recorded the dependent variables

Procedure. Experimental sessions included up to six participants. Experimenters recruited participants from a Heidelberg student café and led them to an adjacent room. They were seated in front of laptops and provided with ear-cushions against distracting noise. Then the Visual Basic program started and nstructions informed participants that they would participate in a media study. For the newsfeed phase, they were asked to read some short information about celebrities. When they clicked a button the first celebrity picture was shown with a short text priming a specific attribute of this celebrity. To ensure participants would not simply click through the newsfeeds, the button to go on with the next celebrity was enabled not until 4s of reading time. After reading the newsfeeds for all celebrity USs and filler-celebrities, the program instructed participants that next they would see a series of pictures and should evaluate logos afterwards. In the conditioning phase, each CS was randomly assigned to a US and was paired nine times with the same US; resulting in 36 pairings. Conditioning procedures were the same as in Experiment 1 and 2. After conditioning, participants rated each logo (CS) on all attributes (educated, strong, athletic, musical, socially committed, funny, familial, sexy) and on likeability on 11-point scales (ranging from e.g. 0 = "not sexy" to 10 = "very sexy"). Finally as a manipulation check, participants were asked to rate the celebrities (USs) on the same attributes and likeability. After finishing the rating scales, the experimenter thanked, paid, and debriefed participants.

Results

To check whether priming was successful, we analyzed whether celebrities (USs) were rated differently on their two respective attributes depending on the *priming* condition. To ensure that probable differences in scale usage did not distort results, we z-standardized participants' ratings for each attribute. Due to the not completely counterbalanced design, we used the SAS Proc Mixed procedure instead of an ordinary ANOVA to analyze this mixed linear model and control for dependencies in the data. We ran the Proc Mixed procedure over all celebrities including *priming* and *dominance* as class variables to predict the attribute ratings. There were main effects of priming, $F(1, 48) = 34.66$, $p < .001$, and of dominance, $F(1, 76) = 135.25$, $p < .001$. That is, when non-dominant attributes were primed attribute ratings were generally higher than when dominant attributes were primed; and independent of which attribute was primed dominant attributes were rated higher than non-dominant ones. Showing that manipulation of attribute priming was successful, there was a significant priming-dominance interaction, $F(1, 48) = 82.88$, $p < .001$. Celebrities were rated low on the non-dominant attribute when the dominant attribute was primed ($M = -0.27$, $SD = 0.81$); however, priming the non-dominant attribute increased the non-dominant attribute's rating ($M = 0.61$, $SD = 0.65$). Celebrities were rated very high on the dominant attribute when it was primed ($M = 0.95$, $SD = 0.67$); but also when the non-dominant attribute was primed celebrities were rated high on the dominant attribute ($M = 0.76$, $SD = 0.77$). In sum, the priming manipulation was successful.

To be used in the analyses of logo (CSs) ratings, we z-standardized participants' logo ratings for each attribute. Positive values indicate high ratings of a given attribute relative to the participant's mean rating of that attribute across logos. In the first analysis, we analyzed whether a logo's rating on a specific attribute (i.e., for each logo the two attributes the respective celebrity was associated with) was influenced by the attribute priming; and whether there was a difference for dominant and non-dominant attributes. Therefore, we ran the same Proc Mixed procedure over all logos including *priming* and *dominance* as class variables to predict the logos' attribute rating (cf., analyzing celebrity USs ratings). There was no main effect of priming ($F < 1$, *ns*), but a main effect of dominance, so that logos were rated higher on the dominant attributes than on the non-dominant attributes of the celebrity USs they were paired with, $F(1, 76) = 13.54$, $p < .001$. More important, the ratings were qualified by a significant priming-dominance interaction, $F(1, 48) = 11.94$, $p = .001$. As can be seen in Figure 1, logos were rated low on the non-dominant attribute when the dominant attribute was primed; however, priming the non-dominant attribute increased the non-dominant attribute's rating. Logos were already rated quite high on the dominant attribute when the non-dominant attribute was primed; however, they were rated even higher on the dominant attribute when it was primed.

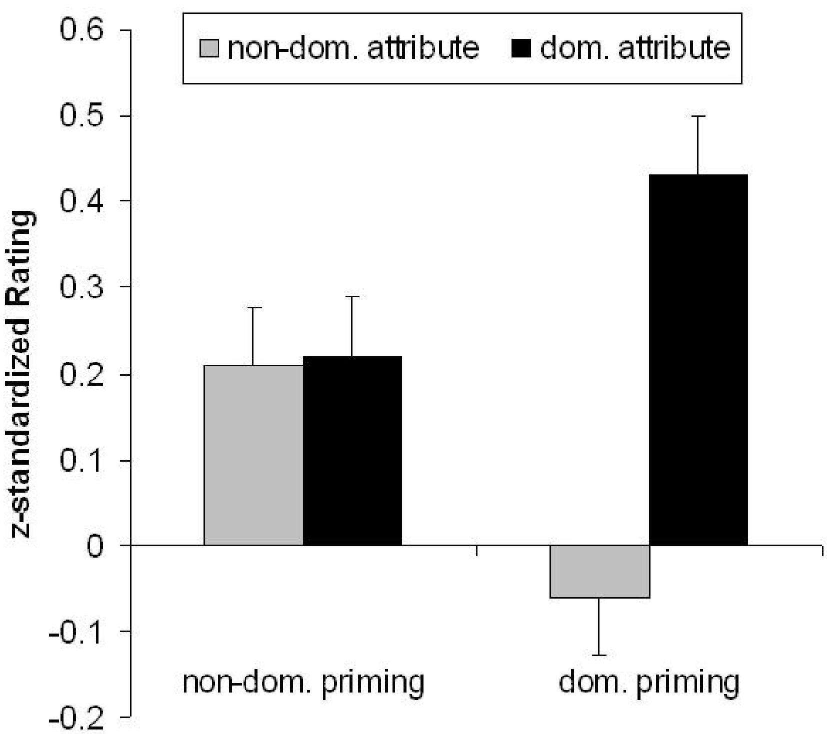

Figure 1: *Mean z-standardized ratings of logo CSs on dominant and non-dominant attributes dependent on attribute priming (dominant vs. non-dominant). Error bars represent standard errors of the means.*

In a further analysis (see Footnote 3), we checked for the specific NEC effect by analyzing whether a logo was rated higher on the primed attribute of its respective celebrity than on all other attributes (similar to the analysis *within CSs* of Experiment 1 and 2); and whether there was a difference for dominant and non-dominant attributes. Therefore, we ran another Proc Mixed model over all logos including *priming*, *dominance* and *attribute-focus* as class variables to predict attribute ratings. *Attribute-focus* was defined as a new variable with the levels *target attribute* and *remains*: *Target attribute* was either the dominant or non-dominant attribute rating of the respective logo dependent on the factors priming and dominance (e.g., for CS paired with Angelina Jolie, when non-dominant attribute (familial) is primed and when non-dominant attribute (familial) is considered, *target attribute* is familial; when however non-dominant attribute is primed but dominant attribute (sexy) is considered, *target attribute* is sexy). *Remains* was the mean of the z-standardized logo ratings on the remaining attributes and likeability excluding the respective target attribute's rating. The full pattern of results is shown in Figure 2.

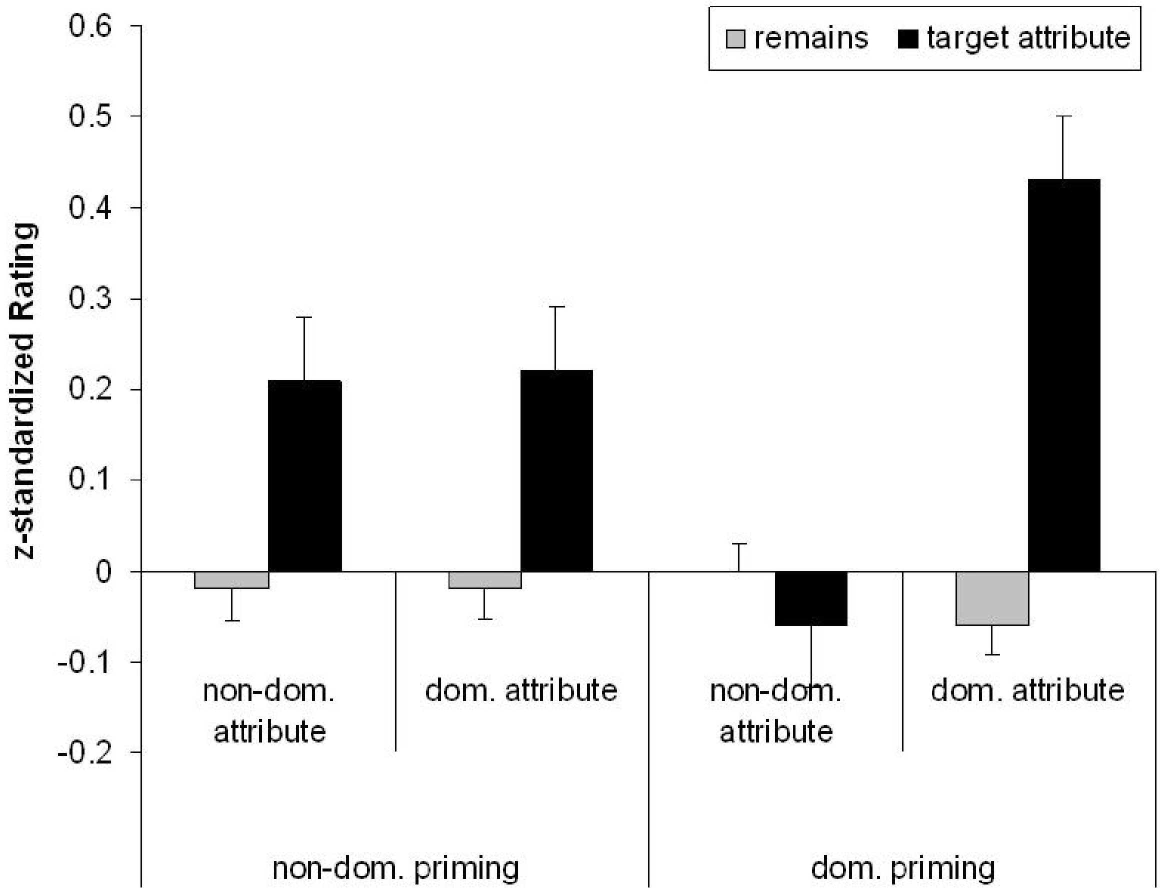

Figure 2: *Mean z-standardized ratings of logo CSs on target attribute and remains split up for dominance (dominant vs. non-dominant) and for attribute priming (dominant vs. non-dominant). Error bars represent standard errors of the means.*

There was no main effect of priming and no interaction of priming and attribute-focus, all *F*s < 1, *ns*. There were significant main effects of dominance, $F(1, 76) = 8.51$, $p = .005$, and attribute-focus, $F(1, 76) = 35.50$, $p < .001$. Thus, the dominant attribute was rated higher than the non-dominant one; and the target attribute (i.e., the dominant or the non-dominant) was rated higher than the remaining attributes. Further, there were significant interactions of priming and dominance, $F(1, 48) = 7.51$, $p = .009$, dominance and attribute-focus, $F(1, 76) = 14.07$, $p < .001$, and the most interesting one, the 3-way interaction of priming, dominance and attribute-focus, $F(1, 48) = 14.41$, $p < .001$. When the dominant attribute was primed the dominant attribute – as target attribute – was rated much higher than the remaining attributes; the non-dominant attribute, however, was not rated higher than the remains. Yet, when the non-dominant attribute was primed, the non-dominant *but also* the dominant attribute – as target attributes – were rated higher than the respective remaining attributes. Thus, NEC of specific attributes was successful, yet, with an advantage for dominant celebrity attributes.

Discussion

Experiment 3 showed how specific NEC effects can be strategically controlled: By priming a US attribute this specific attribute was associated with a CS after repeated CS-US pairing. For example, a logo that was repeatedly paired with Angelina Jolie, for whom the attribute familial was primed prior to conditioning, was rated more familial than when the attribute sexy was primed for Jolie. Moreover, the same logo's familial rating was higher than the mean of the remaining attribute ratings when familial was primed (analysis within CSs). Furthermore, the results revealed that dominant attributes (i.e., Jolie – sexy, Engelke – funny, Kelly – musical, Klitschko – strong) were rated higher than non-dominant ones independent of which attribute was primed. It seems as if even when other, less prominent USs attributes are primed, dominant attributes are still prominent and consequently will be associated with the paired CSs as well.

General Discussion

The current study showed that non-evaluative conditioning (NEC) procedures allow conditioning very differentiated and specific attributes to neutral stimuli. Further, although US entities represented more than one attribute (i.e., multi-attribute USs) it was possible to condition only intended attributes. In three experiments, we repeatedly paired neutral logos (CSs) with celebrities representing an attribute (USs). Experiments 1 and 2 showed that CSs were subsequently associated with only the specific attribute their paired US represented, but were not associated with other, also positive, attributes. Although, all attributes were positive in valence, CSs were not associated with all positive attributes due to a general positive feeling associated with the CSs after conditioning. Thus, the study showed that the attribute associations with a person or object are acquired through a simple learning mechanism, namely NEC. That is, mere spatial and temporal contiguity of CSs and USs is sufficient to associate specific attributes with initially neutral stimuli.

Experiment 1 and 2 conditioned the attributes humorous, sexy, educated, athletic, and soft to logo CSs within one conditioning phase. As CSs were rated high only on the respective conditioned attribute, we could provide first evidence for *specific NEC* (i.e., changing only specific attribute associations). This finding provides further evidence for the assumption already made by Förderer and Unkelbach (2011a): Through repeated pairing of stimuli not only valence can be changed but also specific attribute associations can be created. Moreover, Experiment 2 showed that, after less than five minutes of conditioning, participants gave differentiated CS ratings even one or two days after conditioning. Contrary to our initial hypothesis in nearly all analyses there was no difference in NEC effects when one (*single-US* condition) or three USs (*multiple-USs* condition) were used. Thus, it seems that for each celebrity US the respective attribute was easily accessible and consequently was associated with paired logo CSs. It was not necessary to further accentuate the attribute by pairing a logo with several celebrities representing the same attribute.

In Experiment 1 and 2, we selected the celebrities which were pre-rated high on only one of the relevant attributes. Thus, although celebrity USs are in general associated with many attributes, we did not use celebrity USs strongly associated with several attributes. Therefore, Experiment 3 used celebrity USs definitely associated with more than one attribute. Moreover, to control which attributes should be conditioned we implemented a priming procedure prior to conditioning. The procedure was based on findings in research on person perception from Higgins and colleagues (1977; Ford, Stangor, & Duan, 1994) who showed that primed/activated trait categories influenced stimulus evaluation. We provided participants with newsfeeds about celebrity USs to accentuate either one or the other attribute they represent. Results showed that attribute priming was successful and NEC effects were moderated by priming. That is, participants rated CSs higher on the primed attribute than on other attributes. Further, there was an interesting difference for dominant and non-dominant attributes: Independent of which attribute was primed, dominant attributes which were easily accessible (e.g., sexy for Angelina Jolie) were always associated with CSs. Non-dominant attributes which were less accessible (e.g., familial for Jolie) were only associated with CSs when they were primed and, thus, made accessible. Thus, for the practical use of the priming procedure in conditioning attributes one has to know which celebrity attributes are dominant and easily accessible dominant attributes as they will be conditioned in any case.

At this point, it is interesting to highlight differences to prior studies on NEC. Prior studies trying to condition attributes used USs which were clearly opposed on the to-be-conditioned attribute. For example, Meersmans and colleagues (2005) used male and female USs, and Förderer and Unkelbach (2011a) used athletic and non-athletic USs. Thus, the conditioning context (i.e., stimuli presented) accentuated the attribute which should be conditioned. This might have shifted participants' focus of attention to the attribute and, thus, made conditioning of this attributes possible. Gast and Rothermund (2011) already showed for EC that EC effects depend on a valence focus of participants. If participants focused their attention on other stimulus dimensions instead of valence no EC effects emerged. We assume it is the stimulus dimension primarily distinguishing between USs (either valence or a specific attribute) which will be attended and conditioned to CSs. In classical EC studies using pictures of positive and negative USs, valence was the primarily distinguishing dimension and, thus, valence was conditioned (e.g., Walther, 2002). In prior NEC studies, an attribute like US gender was the primarily distinguishing dimension which was consequently conditioned. In the current study, multi-attribute USs were used to condition several distinct attributes; yet, there were no clearly opposed USs accentuating specific attributes. This makes it even more intriguing that we found differentiated conditioning of specific attributes within one conditioning phase. We assume that within the current conditioning contexts for each celebrity US the attribute primarily distinguishing him/her from the other celebrity USs was prominent and consequently conditioned. In another context using other celebrity USs, other attributes might be the primarily distinguishing ones and consequently other attributes of the same celebrity US might be conditioned. Thus, in the context of Obama, Clooney, and Carrey the primarily distinguishing attribute of Vladimir Klitschko (cf., Experiment 1/2) is athletic; however, in a context of Tyson and Valuev the distinguishing attribute might rather be educated as only Klitschko owns a Ph.D. degree.

We would like to stress that in Experiment 1 and 2 celebrity attributes were not extra primed visually or verbally; they were easily accessible on their own (as they were selected on this basis of a pre-test). Even in Experiment 3, dominant attributes were associated with CSs in both the dominant and non-dominant priming condition (where US attributes were primed verbally and visually) and, thus, must have been easily accessible as well. Thus, no specific priming was necessary to condition attributes which were already prominent; we assume participants made indirect inferences about these attributes on their own. Some EC studies already showed that not only bottom-up, but also top-down processes play an important role in moderating EC effects supporting a propositional process causing EC effects (e.g., De Houwer, 2009; Mitchell, De Houwer, & Lovibond, 2009; Fiedler & Unkelbach, 2010; Förderer & Unkelbach, 2011b). Yet, further research is needed to examine the cognitive processes underlying NEC and to understand which factors, in addition to the priming implemented in the current study, moderate which US's attributes will be conditioned. So far, we can only hypothesize that top-down processes for NEC are even more important than for

EC, as it might require more cognitive effort to infer specific attributes than recognizing a US's valence.

Practical Implications

Our findings provide intriguing practical implications for the formation of brand image and offer a parsimonious explanation for the mental processes involved. Brand image is defined as a "set of associations linked to the brand that consumers hold in memory" (Keller, 1993; p. 2). Some of these associations can stem from inferences made about entities like brand users, company employees, or celebrities endorsing a brand (Aaker, 1997). The meaning transfer model of McCracken (1989) postulates that brand image is created through attribute transfer from a celebrity endorsing a brand to the brand itself. However, McCracken only describes the phenomenon without providing any empirical evidence or psychological process causing meaning transfer. NEC procedures provide a possible cause for this meaning transfer: Through repeated co-occurrence of brand (CS) and celebrity (US) attributes will be associated with the brand and thereby form the brand image. Thus, the current study provides first empirical evidence for meaning transfer according to McCracken's model and explains celebrity endorsement effects on brand image through NEC. Moreover, our study shows that mere contiguity of logo/brand and celebrity is sufficient for meaning transfer. This makes NEC a more parsimonious phenomenon to transfer meaning to brands than celebrity endorsement. Actual celebrity endorsement would need active commitment to and usage of the brand by the celebrity, which NEC does not.

When brand image should be formed through mere brand-celebrity pairings (i.e., NEC procedures) there are some things marketers should keep in mind: As our findings on attribute priming in Experiment 3 showed marketers can make use of different celebrity attributes and accentuate specific ones with different information provided about the celebrity or using different ad contexts, for example. However, they need to notice which attributes are readily associated with the celebrities, respectively which attributes are dominant. This is especially important when a celebrity's image recently suffered from negative publicity. After Tiger Woods cheated on his wife, he was not only associated with smart, athletic, and handsome, but also with unfaithful. Thus, this new prominent attribute might be associated with the endorsed brand, too. Although the use of one or more celebrity USs did not cause any differences in NEC effects in Experiment 1 and 2, a strategy to minimize the risk of associations of unintended negative attributes is to use more than one celebrity endorsing the brand. Thereby, marketers further accentuate the intended attribute and minimize the risk that probable negative celebrity attributes might be associated with the endorsed brand (see also US-revaluation effects in Sweldens et al., 2010).

Limitation and further research

A limitation of our study but also of (N)EC studies in general is that assumptions are based on lab experiment using computer programs to condition valence or attributes. Participants see the repeated pairing of stimuli on a grey computer screen and are afterwards asked to rate the CSs on valence or attributes. These procedures do clearly not resemble a natural learning context in which associations with a person or object are learned and preferences are acquired. Moreover, the artificial setting can draw attention to the experiment's purpose which often raises the question about the influence of demand awareness. In the current study, we did not gather data about demand awareness; prior studies however detected NEC effects also on indirect measures which are less prone to the influence of demand effects (e.g., Förderer & Unkelbach, 2011a; Meersmans et al., 2005, Exp. 7). Independent of the demand effects, future EC and NEC research should strive for more natural learning settings to see whether effects would still emerge. Yet, based on the negative influence of cognitive load on EC effects (Field & Moore, 2005; Dedonder, Corneille, Yzerbyt, & Kuppens, 2010) we assume that (N)EC effects in natural surroundings will be smaller.

Another aim for further NEC as well as EC research should be to find out which behavioral effects conditioned valence and attributes have. That is, future experiments should implement behavior measures like decision or purchase tasks in addition to mere valence/attribute ratings. This would provide first empirical prove for the assumption that conditioned preferences are strong enough to influence behavior.

Conclusions

Based on findings in three experiments, we assume that simple NEC procedures cause changes of specific attribute associations beyond changes of valence even when multi-attribute USs are used. That is, due to spatial and temporal contiguity of neutral stimuli with stimuli representing an attribute the respective attribute will be associated with the neutral stimuli. Consequently, CSs are associated only with the respective attribute, but not with other attributes of the same valence. We provided further evidence for NEC as a general associative learning phenomenon and provided a parsimonious explanation of meaning transfer to brands. Moreover, we showed how this learning phenomenon can be influenced and thereby controlled by attribute priming.

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