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Simple First: A Skeleton for an Evaluative Learning Model

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Abstract

Simple first is our name for a set of hypotheses that we have found useful in our research on evaluative learning. The hypotheses are: (1) It is easier to encode and retrieve information that two concepts are linked than information about how they are linked; (2) It is easier to store and retrieve information than to make an inference based on that information; (3) When people encounter an object and memory activates valence that is mentally linked to that object, they consider the activation valid evidence that the activated valence characterizes the object. We demonstrate how these hypotheses generate useful assumptions about Evaluative Conditioning, and open paths for further research on evaluative learning and evaluation.

Keywords

Evaluative Learning, Associative Learning, Evaluative Conditioning, Automatic Evaluation, Relational Information

Relational information is the information that two concepts are linked in a specific way. For instance, the information *Bob is similar to good* indicates that *Bob* is linked to *good* in a similarity relation. Within relational information, there is always the information that the

two concepts are linked. That is a simpler piece of information because it does not include the specific relation that links them together. In the present article, we call that simple form of information *linkage information*[1]. In this article, we present a set of hypotheses about evaluative learning that start with the distinction between linkage information and relational information.

We use the set of hypotheses that we present here to implement a general roadmap for pursuing knowledge in psychology. This roadmap is based on the assumption that human response is the product of multiple information processing processes that can run in parallel but also feed one another (Cave & Wolfe, 1990; Kunda, 1999; Marslen-Wilson, 1975; Treisman, 1985). The guiding principle of the roadmap is that some processes must be faster than others, and that the output of faster processes often serves as input for the slower processes. Based on that principle, using this roadmap entails identifying fast and slow processes, followed by investigations into what the slow processes do with the output of the fast processes. These investigations search for the factors that determine whether the slow processes reject, accept or modify the output of the fast processes. Thus, the roadmap provides general questions that help organize research and uncover general rules of human behavior.

To implement the roadmap, working hypotheses are helpful. Here, we implement the roadmap for the study of evaluative learning by hypothesizing what kind of evaluative information is processed relatively quickly, what kind of evaluative processing occurs relatively quickly, and what the relatively slow evaluative processes do with the output of the faster processes. The hypotheses that we propose here are too general to provide clear answers to many of the specific questions about the subject of this special issue – the Evaluative Conditioning (EC) effect (De Houwer, Thomas, & Baeyens, 2001; Walther, Weil, & Düsing, 2011). Nevertheless, the hypotheses can serve as a skeleton for more specific models that explicitly assume rules for the formation of memory links and for reasoning. In our own research, the hypotheses we share here were useful in generating novel research questions, uncovering novel findings, and making sense of existing findings (Moran & Bar-Anan, in press, 2018; Moran, Bar-Anan, & Nosek, 2015, 2016).

Key Hypotheses

We call our set of hypotheses *simple first* because we based the first two hypotheses on the notion that simple information is processed faster than more complex information. These are the *ease of processing* hypotheses: (1) *It is easier to encode and retrieve information that two concepts are linked than information about how they are linked*; (2) *it is easier to encode and retrieve information than to make an inference based on the information*.

We based the first hypothesis on the idea that linkage information is simpler than relational information. The encoding of linkage information requires human memory to

[1] Other possible terms are information about mere links, direct associations, associative information, unspecified relations, unqualified associations, and unspecified or unqualified links.

represent three elements: two concepts and a link between them. In the present article, we call that mental representation a *mental link* but we do not make assumptions about how memory represents the link. The retrieval of linkage information is the activation of a concept in memory as a result of the mental activation of another concept. Relational information is slightly more complex than linkage information because instead of representing a link between two concepts, memory must also represent the type of relation (how they are linked). For many relations, the memory must also include the role of each of the related concepts (i.e., Bob is the one who ended the war rather than vice versa). Retrieval of relational information would have to include all these elements.

Information complexity is only one possible reasoning that leads to *simple first*'s first hypothesis. An alternative line of reasoning is that because linkage information is more basic, memory has more experience (in one person's life and in the history of the human brain) in processing it, which leads to the hypothesized advantage. We provide that example to separate the hypothesis from the information complexity rationale that helped us generate that hypothesis. The hypothesis itself is independent of mental representations: even if memory represents a link with the complexity of a relation (e.g., *X and Y are linked*), *simple first*'s first hypothesis entails that human memory forms that representation and retrieves that representation more easily than representations of relational information. This example helps to clarify that *information* is not a synonym of *mental representation*. Information is the content of the representation, not the representation itself.

Making an inference requires memory to represent the relevant information (linkage or relational), and then translate the information (using inference rules not specified by *simple first*) to the representation of the conclusion. For instance, to make an evaluative inference from the information *Bob prevented war*, memory must first represent it, and then translate it to the information *Bob is positive*. To make an evaluative inference from the retrieval of linkage information (e.g., from the activation of negative valence when perceiving Bob), the activation must first occur, and only then can an inference follow, translating the activation to a conclusion (e.g., *Bob is negative*). The *ease of processing* hypotheses posit that (1) it is easier (i.e., takes less time and requires less cognitive effort) to encode or retrieve the information that Bob and war are linked than to encode or retrieve the information that Bob prevented war, and (2) it is even more difficult to make an inference about Bob from that information.

One might suggest that making an inference based on the linkage information is easier than making an inference based on the relational information because the linkage information is retrieved faster, which allows inference to start earlier. However, because inference from activation of valence is probably mediated by a translation of the activation into a relation (e.g., *Bob activated a negative feeling*), the early advantage might be lost. Still, because human memory can link concepts to responses, the retrieval of information can lead to a quick evaluative response *without* the mediation of inference. For instance, if thinking of Bob activates negative valence, and the negative valence activates frowning or a step backward, that is a negative evaluative response that does not require any inference (this is a process of *spread of activation*). The retrieval of relational information can automatically lead to an

evaluative response through similar non-inferential processes. For instance, the retrieval of the information *Bob hates bugs* can lead to the activation of a negative response because *hates* and *bugs* might be linked to negative evaluative responses. However, in this case, the relational nature of the retrieved information is of no consequence. Therefore, automatic evaluative response reflects the linked valence regardless of relational information stored or retrieved.

An evaluative response that occurs without the mediation of inference might be *followed* by the inference that the response indicates an evaluation. For instance, frowning or a step backward when encountering Bob could lead to the inference that Bob is disliked. That possibility is compatible with *simple first*'s third hypothesis, the *assimilative attribution* hypothesis: *When people encounter an object and memory activates valence, people consider the activation valid evidence that the activated valence characterizes the object*. In other words, retrieval of evaluative linkage information is translated by inference processes into attribution of the activated valence to the linked object. Valence activation could come in the form of an overt evaluative response, but also a valenced thought ("good") or a valenced feeling.

Situating *simple first* as the working hypotheses that implement the roadmap we mentioned earlier for the study of evaluative learning, the *assimilative attribution* hypothesis is our initial answer to the question of what slow processes do with the output of fast processes. The fast process is the activation of linkage information and the slow process is inference. According to the *assimilative attribution* hypothesis, the slow process accepts the output of the fast process as valid evidence that the activated valence characterizes the target of evaluation.

We base the *assimilative attribution* hypothesis on findings that people tend to rely on their affective reactions as valid evidence about the object they focus on (Schwarz & Clore, 1988; Slovic, Finucane, Peters, & MacGregor, 2007; Zajonc, 1980). This probably occurs because the activation of valence does not come with an indication of the source of the link between the object and valence (*source unawareness*, Gawronski, Hofmann, & Wilbur, 2006). An activation of negative valence when judging Bob might be the result of the information that Bob is related to war because he prevented it. But, when judging Bob, even if the information that Bob prevented war is accessible (i.e., retrieved from memory or externally presented), the activation of the negative valence is experienced like any other negative evaluation of an object, and is not attributed to the relation of Bob to war. As a result, the *assimilative attribution* hypothesis entails that the link between Bob and war would push the evaluation of Bob to the negative side (in parallel, other information such as the inference from Bob's relation to war could push Bob's evaluation to the positive side, and the evaluation would reflect both effects; see Figure 2, Panel H). In the rest of this article, we derive assumptions about EC based on the three hypotheses.

The Effect of Stimulus Co-occurrence on Evaluation

EC is the effect of a co-occurrence between a neutral stimulus (the conditioned stimulus; CS) and a positive or a negative stimulus (the unconditioned stimulus; US) on the evalua-

tion of the CS. The typical effect is assimilative: the CS evaluation becomes more similar to the evaluation of the US (De Houwer et al., 2001).

Why does EC occur? S*imple first* directs us to focus on the kind of information that can be encoded to memory as a result of exposure to CS-US co-occurrence, and can later lead to an evaluative response (Figure 1, Panel C): (1) A link between the CS and the US valence; (2) CS-US relations. Most common is probably the relation *CS co-occurs with US*; (3) Inference from the relation can lead to other relations that can be encoded to memory, such as *CS is similar to US*, *CS is good*, and *I like CS*; (4) The inferred relations would lead to the encoding of more links between the CS and concepts, such as *CS-US*, *CS-good* and *CS-likable*.

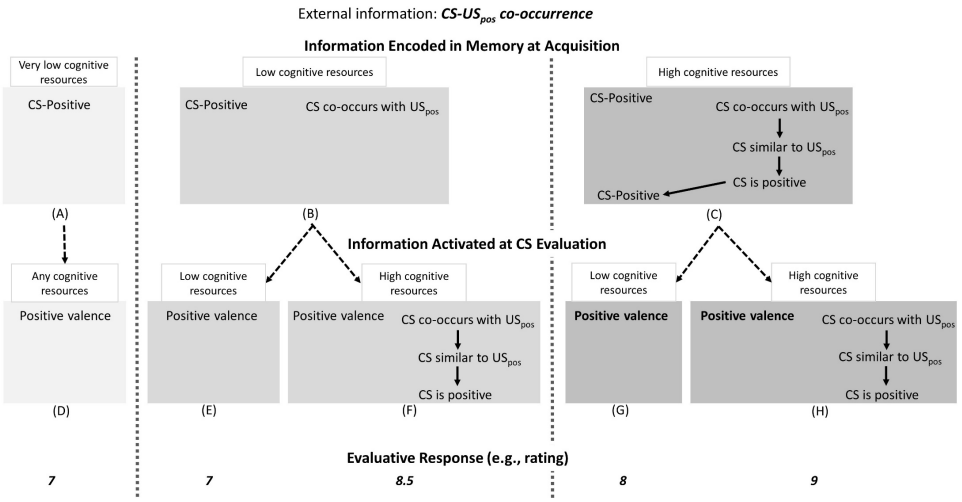

Figure 1. The effect of CS-US co-occurrence on CS evaluation, as a function of available cognitive resources at acquisition (panels A–C) and evaluation (panels D–H).

Note. The evaluative response is on a 1 (extremely negative)-10 (extremely positive) scale. The shaded boxes represent memory storage. We do not make assumptions about how the information is represented by the memory, only what information is represented. On the left side of each shaded box appears linkage information and on the right appears relational information; Within each shaded box, the vertical position illustrates time differences in processing; On panel C, the two mental links CS-Positive reflect strengthening of the same link from two sources (the mere co-occurrence and the inference that CS is positive); The bold positive valence in panels G and H reflects the stronger mental link CS-Positive formed in (C), in comparison to (A) and (B); The evaluative response is more positive in (H) and (F) than in (G) because inference at the time of the evaluation provides justification of the evaluation and therefore strengthens it; It might be difficult to find the exact level of cognitive resources for testing the encoding proposed in (B). Instead, we suggest creating settings that decrease the likelihood of making an inference from the co-occurrence (e.g., by focusing participants on other relations).

For an example of the formation of these four types of mental representations, consider exposure to the information *immigrants suffered atrocities* (Panel C in Figure 2 illustrates a similar example). The information would form mental links between immigrants and negative valence (Type 1). The perceiver can also store a mental representation of the relation itself (*immigrants suffered atrocities*; Type 2). The information *immigrants suffered atrocities* might also lead to the inference that *immigrants should be cared for*, which might lead to the inference that *immigrants are positive*. The inferred relations can be stored in memory (Type 3). The inferred relations include linkage information that is encoded as mental links, for instance, *immigrants are positive* would form the mental link *immigrants-positive* (Type 4).

How would the information stored in memory influence evaluative response? First, spread of activation would lead to an evaluative response that reflects the valence linked to the object of evaluation. Second, according to the *assimilative attribution* hypothesis, the activated valence would be attributed to the CS. Because of spread of activation and attribution, the links with the US valence would push the CS evaluation to the US valence. Links formed from the inference based on relational information (Type 4 described above) can push the evaluation to a different (or in the same) direction. Mental links are not the only memories that

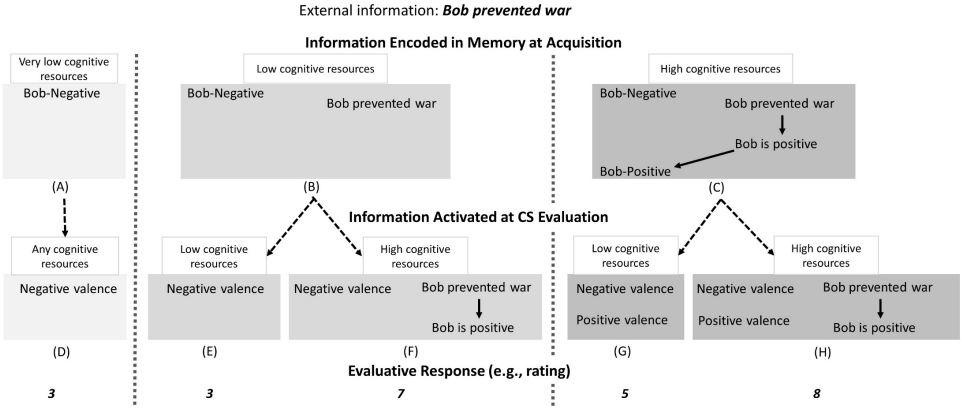

Figure 2. The effect of CS-US co-occurrence with relational qualifier, as a function of available cognitive resources at acquisition (panels A–C) and evaluation (panels D–H);
Note. The evaluative response is on a 1 (extremely negative)-10 (extremely positive) scale; The shaded boxes represent memory storage. On the left side of each shaded box appears linkage information and on the right appears relational information; Within each shaded box, vertical position illustrates time differences in processing; The evaluative response in (G) reflects equally strong activation of positive and negative valence. However, settings at acquisition (panel C) might moderate the relative strength of each mental link (Moran et al., 2015) and might even change the relative effect of the activated valence and the inference, leading to dislike even in the scenario described in Panel H, despite the availability of cognitive resources at evaluation (Moran et al., 2016); It might be difficult to find the exact level of cognitive resources for testing the encoding proposed in (B). Instead, we suggest creating settings that decrease the likelihood of making an inference from the co-occurrence (e.g., by focusing participants on other relations; Moran et al., 2015, 2016).

influence evaluation. If people remember the relation between the CS and the US, are motivated to make an inference from that relation, and are cognitively capable of making an inference about the CS, that inference can also contribute to the evaluation of the CS. In that case, the evaluative response would integrate the effects of the attribution of activated valence and other inferences, as described in the previous section (see also Panel H in Figures 1 and 2).

To continue the example that we used for the acquisition phase, consider evaluating immigrants after exposure to the information *immigrants suffered atrocities*. The *immigrants-negative* link would lead to a negative evaluation of immigrants. If learning included inference processes that formed mental links between immigrants and positive valence, the activation of those links would lead to a positive evaluation. If the relation *immigrants suffered atrocities* is retrieved upon evaluation and inference from the relation occurs, the conclusion from the inference (*immigrants are positive*) would lead to a positive evaluation. The evaluative response would reflect all these effects. How? Liking of immigrants would be attenuated (i.e., dampened) by the links between immigrants and negative valence. Settings that allow a multivalent response (e.g., separate measurement of positive and negative feelings; Kaplan, 1972) would reflect both negative and positive evaluation.

In the typical EC procedure, there is no explicit information about the CS-US relation, and no implicit information conveying opposition relation between the CS and US. In these procedures, inferences from the relations observed in the experiments (mostly, *CS co-occurs with US*) are unlikely to indicate that the CS is the opposite valence of the US. Therefore, the perceiver would store links between the CS and the US valence. Upon CS evaluation, the US valence would be activated and lead to an evaluation that is compatible with the US valence. If cognitive resources and motivation allow for inference at evaluation, the US valence would be attributed to the CS. Inference from the stored relations would similarly push the CS evaluation to the side of the US valence (e.g., *if CS co-occurred with US, it is probably similar to the US*; Bar-Anan, De Houwer, & Nosek, 2010). For that reason, the typical result of CS-US co-occurrence is an assimilative effect of the US valence on the evaluation of the CS (Figure 1, Panels C and H).

Links with Stimuli and Responses

Memory can link a CS to the US, to the valence of the US, and to the evaluative response to the US. For example, if a neutral word co-occurs with a photo of cute puppies, human memory can store links between the word and the photo, positive valence, and a smiling response. Because all these linked entities are characterized by the US valence, they would all lead to the activation of the US valence upon CS evaluation and would all have an assimilative effect on the evaluative response to the CS (i.e., the typical EC effect). According to the *assimilative attribution* hypothesis, deliberate evaluation would also be assimilative because the activated US valence would be attributed to the CS. In other words, *simple first* allows the contribution of S-S and S-R links to EC, and does not provide clear hypotheses regarding what factors would moderate the relative effect of S-S and S-R links.

Automatic and Deliberate Processes at Acquisition

According to the *ease of processing* hypotheses, the less cognitive resources are available at acquisition, the less likely it is that the relational information would be encoded; Even more cognitive resources are needed for inference. Without relational qualifiers conveyed verbally or otherwise, the effect of inference from co-occurrence on CS evaluation is generally assimilative because some perceivers tend to consider co-occurrence as a relation that indicates valence similarity (Bar-Anan et al., 2010). Therefore, the assimilative effect of co-occurrence on CS evaluation might be weaker when there are less cognitive resources at acquisition (Figure 1). We qualify this assumption because if cognitive resources upon acquisition were insufficient for inference but sufficient for the encoding of the CS-US relation, people could still make an inference from that relation upon evaluation (assuming there are enough cognitive resources at that time).

Controllability, intention, and awareness are more likely when people invest many rather than few cognitive resources. Therefore, the effect of inference from the CS-US relation on the CS evaluation would be weaker the less controllability, intention, and awareness occur at acquisition. However, *simple first* does not provide any basis to assume a causal link between controllability, intention, and awareness and EC. That is, our hypotheses cannot help to predict whether increasing awareness, intention, and controllability at acquisition would affect EC.

Automatic Evaluative Response

The less cognitive resources are recruited upon evaluation, the larger the relative effect of the mental representation of linkage information would be, in comparison to the effect of inference from the mental representation of relational information. In other words, the more automatic the evaluation is, the less likely it is that the evaluation would represent inference from relational information. However, upon evaluation, the links in memory are not limited to links between the CS and the US valence. Memory might also store links inferred from relational information at acquisition. Therefore, the settings upon acquisition determine automatic evaluation (for illustration, compare Panels D and E with Panel G in Figure 1).

Initial evidence of the influence of the settings at acquisition on automatic evaluation comes from research that manipulated participants' processing goals at acquisition (Moran et al., 2015). Participants were exposed to CS-US co-occurrence together with relational information about whether the CS and the US were similar or opposite in valence. The task demands focused some participants on memorizing with which valence each CS co-occurred by repeatedly asking participants about CS-US co-occurrence, in between acquisition blocks. Other participants were asked about the evaluative inference from the specific CS-US relation. At the end of the study, all the participants had accurate memory of the co-occurrence and the relational information. Nevertheless, participants who focused

on the co-occurrence during acquisition showed automatic evaluation that was relatively compatible with an assimilative effect of the US on the CS evaluation. In contrast, participants who focused on the inference from the relational information during acquisition showed automatic evaluation that was relatively compatible with the inference entailed by the relational information. These results are consistent with the assumption that the relative strength of the memory links formed at acquisition determines automatic evaluation. However, alternative accounts are possible. For instance, perhaps the focus manipulation also changed the importance participants ascribed to co-occurrence information versus relational information and automatic evaluation reflected the effect of a reasoning process that took these weights into account. Therefore, more research is needed to test the hypothesis that automatic evaluation reflects the relative strength of the evaluative mental links formed at acquisition.

Deliberate Evaluative Response

Deliberate evaluation allows making an inference. That means that even if inference did not occur upon acquisition but the relational information was stored, deliberate evaluation can take the relation into account (Figure 1 and 2, Panel F). Nevertheless, a strong version of the *assimilative attribution hypothesis* is that if memory stored links between the *CS* and the *US valence*, there will *always* be an assimilative effect on deliberate evaluation. Upon evaluation, the mental link between the CS and the US valence would lead to the activation of US valence, and people would consider the activation of the US valence valid evidence that that valence characterizes the CS. The activation of US valence might not be the only piece of evidence about the CS, so despite its assimilative effect on the CS evaluation, it might result only in an attenuation of a contrastive effect of the US on the CS evaluation.

There is indeed ample evidence that deliberate evaluation is sensitive to linkage information, even when relational information suggests that the CS and the US are of opposite valence (Boucher & Rydell, 2012; Förderer & Unkelbach, 2012; Gawronski, Walther, & Blank, 2005; Hu, Gawronski, & Balas, 2017a; Moran & Bar-Anan, 2013; Moran et al., 2016; Peters & Gawronski, 2011; Zanon, De Houwer, & Gast, 2012; for a review of the relevant evidence, see Moran et al., 2016, and Moran & Bar-Anan, 2018). On the other hand, there are also studies that found no effect of a CS-US co-occurrence on deliberate evaluation despite a strong effect on automatic evaluation (Gawronski & LeBel, 2008; Gregg, Seibt, & Banaji, 2006; Petty, Tormala, Briñol, & Jarvis, 2006; Wyer, 2016). Because those studies found an effect of co-occurrence on automatic evaluation, it is safe to assume that co-occurrence formed a memory link between the CS and the US valence. Yet, the deliberate evaluation measures (self-reported liking) did not find any indication for an assimilative effect of the US valence on the CS evaluation. One possible account for these results is lack of statistical power to detect the effect (which might be smaller than the effect of co-occurrence on automatic evaluation). Another possibility is that these studies found boundary conditions in which deliberate evaluation is immune to linkage information. For instance, these studies

usually involved two sources of information: a period of pairing the CS and valence, and a separate period (after the pairing) that provided relational information about the CS. Perhaps in such cases, deliberate evaluation is not sensitive to linkage information. However, *simple first*'s strong version of the *assimilative attribution* hypothesis is not compatible with those boundary conditions because it does not allow for any special cases that prevent an assimilative effect of a CS-US mental link on the CS evaluation.

A weaker version of the assumption derived from the *assimilative attribution* hypothesis is that under *special* circumstances, upon deliberate evaluation, people are able to completely reject the valence activated due to the mental link. That might occur if the perceiver does not attribute the activated valence to the evaluated object. For instance, if the perceiver considers her evaluation of immigrants and Nazis at the same time, the perceiver might attribute the negative valence activated by the *immigrants-negative* link to the Nazis. That seems even more likely if the perceiver cannot easily justify a negative feeling toward immigrants.

It is probably also possible to teach people to consider opposition relations as the reason for their activated valence. Obviously, perceivers are capable of reasoning that the negative feelings activated when judging immigrants are not about the immigrants but about the atrocities the immigrants suffered. In that case, the perceiver might be able to completely reject the activated US valence as valid evidence about the attitude object. However, the *assimilative attribution* hypothesis entails that this is not people's default behavior.

According to *simple first*, the sensitivity of deliberate evaluation to CS-US co-occurrence depends on the strength of the link that the co-occurrence formed in memory. For example, exposure to the information *immigrants suffer atrocities* would form an *immigrants-negative* link in memory, but might also form an *immigrants-positive* link. Upon deliberate evaluation, the perceiver would make an inference from the relation (assuming the relation is remembered, rather than only the linkage), contributing positive valence to the evaluation of the immigrants. But the evaluation would also be sensitive to the valence activated when judging immigrants, which would be attributed to the immigrants. Thus, just like automatic evaluation, deliberate evaluation would be sensitive to the relative strength of the *immigrants-negative* and the *immigrants-positive* links.

Two experiments provide initial support for the assumption that deliberate evaluation is sensitive to the relative strength of *CS-positive* and *CS-negative* mental links (Moran et al., 2016). Like the research we described earlier for testing the effect of processing goals on automatic evaluation (Moran et al., 2015), these two experiments manipulated, at acquisition, participants' focus on CS-US co-occurrence versus inference from the CS-US specific relation (similarity or opposition). During acquisition, some participants were repeatedly asked which valence co-occurred with each CS (focus on co-occurrence), whereas other participants were repeatedly asked to make an inference from the CS-US relation. This manipulation influenced deliberate evaluation similarly to its effect on automatic evaluation (Moran et al., 2015). Specifically, the assimilative effect of the co-occurring US on deliberate evaluation of the CS was stronger when participants focused, during acquisition,

on the co-occurrence than when they focused on inference from the information about the CS-US relation. However, as already noted, one weakness of that evidence is that the focus manipulation might have affected more than only the strength of the mental links between the CS and valence. Perhaps people who focused on co-occurrence assumed, at acquisition or upon deliberate evaluation, that co-occurrence is more important than the inference from relational information, whereas people who focused on the inference from relation made the opposite assumption. In that case, a deliberate process of preferring one relation over another influenced the evaluation, rather than the activation of memory links upon evaluation. Therefore, more tests are needed for the *assimilative attribution* hypothesis.

Another promising research direction, inspired by *simple first*, pertains to the possible effects of the automatic activation of evaluative mental links on reasoning processes during deliberate evaluation. One reasonable consequence of the *assimilative attribution* hypothesis is that activated valence motivates reasoning that would explain why that valence characterizes the object, at least to some extent. For example, if the mental *immigrants-negative* link is strong (e.g., because no inference from the relation occurred at acquisition), it might activate a search for reasons why immigrants are at least somewhat negative. Of course, people might not always need reasons for evaluation. They could simply take into account that alongside their positive feelings for immigrants they also harbor some negative feelings, and that would attenuate their liking for immigrants.

Correspondence and Discrepancy between Automatic and Deliberate Evaluation

In the typical EC procedure, inference and spread of activation both contribute to the formation of a mental link between the CS and the US valence. Therefore, automatic evaluation would reflect an assimilative effect of the US valence on the CS evaluation. Deliberate evaluation allows an inference to be made. That inference would also lead to an assimilative EC effect. So, in the typical EC procedure, both automatic and deliberate evaluation would show an assimilative EC effect. Indeed, EC is found with measures of automatic and deliberate evaluation (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010).

Based on our hypotheses, discrepancy between automatic and deliberate evaluation is most likely to occur if the following three conditions are met. First, relational information (conveyed verbally or implicitly, at the time of exposure to the CS-US co-occurrence, or in a separate period) must indicate that the CS is characterized by valence *other* than the US valence (e.g., opposite valence, less extreme valence, or neutral). Second, the mental link formed by the CS-US co-occurrence must be stronger than the mental link formed by inference from the CS-US relation. For instance, people might have had the goal to remember the co-occurrence and were uninterested in forming an evaluation of the CS. Third, people must remember, upon deliberate evaluation, the CS-US relation (for making inference). In that case, automatic evaluation would not reflect the inference from the CS-US relation, whereas deliberate evaluation would (see Figure 2, Panels E versus F). Studies

that found discrepancies between automatic and deliberate evaluation (Gregg et al., 2006; Moran & Bar-Anan, 2013, 2018; Petty et al., 2006; Ranganath & Nosek, 2008; Rydell & McConnell, 2006; Rydell, McConnell, Mackie, & Strain, 2006; Wyer, 2016) have all met the first condition. However, it was not tested whether these studies met the other two conditions, and whether violating those conditions eliminates the discrepancy.

The Role of Awareness

The *ease of processing* hypotheses assume that fewer cognitive resources are needed to form mental links than to make inferences from relational information. So, there is better chance that the *CS-US valence* link could form without awareness than links between the CS and the valence inferred from the CS-US relation. However, the hypotheses do not provide a basis to predict whether mental links can be formed without awareness of the CS-US co-occurrence. Notice also that the *ease of processing* hypotheses remain the same even if inference can occur without awareness. Even without awareness, some processes might take longer and require more cognitive resources than others.

Lack of awareness of *why* the US valence is activated when judging the CS is central for the *assimilative attribution* hypothesis. In fact, we assume that even when people perceive the relational information (e.g., read *immigrants suffered atrocities*), and immediately judge the CS, the feeling activated by the linked US is attributed to the CS because of lack of awareness that it was activated by the US.

The Role of Relational Qualifiers

People can use relational information to infer the valence of the CS (e.g., develop positive feelings toward a victim of criminal acts despite the victim's link with crime). This can happen during acquisition or upon evaluation, if people remember the relational information that was available at acquisition. If inference from relational information occurs at acquisition, it can form mental links that would influence automatic and deliberate evaluation later, as described above. As already explained, *simple first* assumes that inference does not remove the assimilative effect of the mere link between the CS and the US. It only adds to that effect.

Although relational qualifiers are not expected to moderate the effect of the mere CS-US link on evaluation, they can moderate the effect of inference from the CS-US co-occurrence. When no implicit or explicit relational qualifiers other than co-occurrence are present at acquisition, it seems likely that some people would make the inference that the CS and the US are of similar valence (Bar-Anan et al., 2010). That is, CS-US co-occurrence forms mental links between the CS and the US valence because people encode the existence of a link between the CS and the US, *and* because some people make the inference that the CS is characterized by the US valence. That inference is less likely to occur when relational qualifiers indicate (explicitly or implicitly) that the CS and the US are of opposite valence. In other words, relational qualifiers that indicate CS-US opposition would influ-

ence evaluation directly as a result of inference, and would also thwart the typical assimilative inference from the co-occurrence relation, thus reducing the assimilative effect of CS-US co-occurrence on CS evaluation.

EC by Instruction

Simple first explains the effects of information about links, not exclusively the effect of co-occurrence. Exposure to co-occurrence is not the only event that provides information that two concepts are linked. For instance, human memory can link the symbols *X* and *E* as a result of exposure to the information *X is a letter* and the information *E is a letter*, even if X and E have never co-occurred. Verbal (or other forms of symbolic) information that CS and US co-occur, will co-occur, or even were supposed to co-occur is information about a link between the CS and the US. Therefore, it can form a mental *CS-US valence* link that would influence automatic and deliberate evaluation, similarly to the effect of exposure to CS-US co-occurrence.

What Pairing Schedules Lead to EC?

Because we assume that the mere existence of a mental link between the CS and US valence would cause an assimilative effect of the US valence on the CS evaluation, we predict that various schedules of CS-US pairing can lead to EC. People can remember that a CS appeared with a positive US more often than with a negative US (statistical contingency). People can also remember that a CS appeared with an equal number of positive and negative US, but was always closer in time (temporal contiguity) and space (spatial contiguity) to positive than to negative USs. Remembering that a CS and a US are related to each other because statistical contingency, contiguity or other schedules entails memory that the CS is linked to the US. Because we assume that such a memory has an assimilative effect on the CS evaluation, we assume that all these schedules could cause EC.

If the settings at acquisition emphasize one aspect of the CS-US schedule over another, that could change the relative strength of the memory link formed by different aspects of the CS-US schedule. For instance, instructions to memorize temporal contiguity (to which valence the CS was temporally proximal) would increase the likelihood of forming memory links that reflect CS-US contiguity. Instructions to notice with which valence the CS appears more often would increase the likelihood of forming links that reflect CS-US contingency. Furthermore, people might even try to remember which CS *never* appears with a positive US, leading to a stronger CS-US mental link when the statistical contingency is *negative*. It is probable that the relative effect of different CS-US schedules can also change as a result of exposure to cues less blatant than explicit instructions.

Our hypotheses do not help predict what pairing schedule is most effective in forming a mental *CS-US valence* link, or in forming a mental representation of a CS-US relation that would lead to an inference about the valence of the CS. Regarding the statistical con-

tingency threshold needed for EC – because it is possible to remember that a CS and a US are linked even after one exposure to a co-occurrence between them, we assume that EC after a single co-occurrence trial is possible (so far, the evidence about this is mixed; Baeyens, Eelen, Crombez, & Van den Bergh, 1992; Stuart, Shimp, & Engle, 1987).

Extinction

What about schedules in which the US or the CS appear alone after the co-occurrence period (i.e., extinction schedules)? An implicit assumption within the *assimilative attribution* hypothesis is that after a memory link between the CS and the US valence has been formed, the US valence would be automatically activated when processing the CS (even if the US is not present), and would be attributed to the CS every time the CS is presented. From that perspective, it does not seem likely that occurrences of a CS without the US that previously co-occurred with the CS would eradicate EC. Further, people can remember that a CS used to co-occur with a certain valence, and does not anymore. That memory links the CS to that valence (because people are able to answer the question *with which valence does the CS not co-occur anymore?*). According to the *assimilative attribution* hypothesis, even that memory would have an assimilative effect on the evaluation of the CS.

On the other hand, it is possible that *CS-alone* or *US-alone* presentations lead to the inference that the CS is no longer characterized by the US valence, leading to the inference that the CS is characterized by less extreme valence than thought before. That inference would link the CS to a less extreme valence (e.g., to neutral valence). Therefore, although it does not seem likely that the EC would completely disappear after *CS-alone* or *US-alone* occurrences (as long as people still remember the past co-occurrences), inference processes upon (or before) evaluation might decrease it. So far, most studies on that subject did not find good evidence for complete extinction in EC (e.g., Baeyens, Crombez, Van den Bergh, & Eelen, 1988; Baeyens, Díaz, Ruiz, & 2005; Dwyer, Jarratt, & Dick, 2007; Gawronski, Gast, & De Houwer, 2015; Vansteenwegen, Francken, Vervliet, De Clercq, & Eelen, 2006), but there is some evidence for reduction in EC after extinction procedures, especially from a meta-analytical comparison (Hofmann et al., 2010).

Individual Differences in EC

It is reasonable to assume individual differences in all the factors that, according to *simple first*, influence the EC effect: the speed and efficiency with which people encode memory links, and the kind of inference people make from the CS-US co-occurrence. The *ease of processing* hypotheses call attention to individual differences in the ability to make inferences. People who are less effective in making inferences might refrain from making them when not needed (e.g., in the typical EC procedure), or would fail to make them when cognitive resources are not fully available during acquisition. That would lead to individual differences in the storage of inferred relational information and of mental links within in-

ferred relational information. Individual differences in other skills and traits (e.g., *need for cognition*; Cacioppo & Petty, 1982) might also influence the tendency to make inferences upon acquisition.

As for influential individual differences derived from the *assimilative attribution* hypothesis, perhaps some people are more prone than others to attribute the activated valence to the CS and to consider it valid evidence that the valence characterizes the CS. Prime suspects for such dispositional factors are individual differences in information processing and judgment – based on feeling and intuition versus reason-based (e.g., Epstein, Pacini, Denes-Raj, & Heier, 1996).

Predictions Summary

To demonstrate the usefulness of the three hypotheses in generating research questions that advance knowledge, we summarize the main predictions presented in this article. Most basic are the hypotheses themselves. According to the *ease of processing* hypotheses, encoding and retrieval of linkage information should be faster and more accurate than retrieval of relational information (for some relevant evidence, see Ratcliff & McKoon, 1989). An initial test of the *assimilative attribution* hypothesis would be to investigate whether when people do not remember the relation between a CS and a US, they tend to assume that the relation was similarity. A more direct but challenging test would measure attribution of the activated US valence when participants focus on the CS. A part of the challenge in that investigation would be to isolate this attribution when people also hold other information that indicates the opposite valence for the CS.

Other tests of the *assimilative attribution* hypothesis would examine the sensitivity of CS evaluation to various messages that link the CS with a certain valence without entailing that the valence characterizes the CS. We already summarized evidence compatible (Boucher & Rydell, 2012; Förderer & Unkelbach, 2012; Gawronski et al., 2005; Hu, Gawronski, & Balas, 2017a; Moran & Bar-Anan, 2013; Moran et al., 2016; Peters & Gawronski, 2011; Zanon et al., 2012) and incompatible (Gawronski & LeBel, 2008; Gregg et al., 2006; Petty et al., 2006; Wyer, 2016) with that assumption in the section that discussed deliberate evaluation, and concluded that more tests are needed. We also suggested one such strong test: participants would be tasked with memorizing with which valence each CS *never* co-occurred (and would never be asked with which US the CS actually co-occurred). That task would focus participants on negative statistical contingency, and would form a memory link between the CS and the valence with which the CS never occurred. The predicted result is a weaker assimilative effect of the (actual) co-occurring valence on CS evaluation, in comparison to a control condition, in which participants would not be focused on negative statistical contingency.

Even if the memory of a CS-US link does not *always* cause an assimilative effect on CS evaluation (above and beyond other information), the study of the *assimilative attribution* hypothesis would advance knowledge about how people use activated valence when

evaluating objects. One promising direction is the study of how, upon CS evaluation, people make sense of the activation of the US valence. We predict that people would often search for justifications that would explain why the US valence characterizes the CS. For instance, when searching memory for more information about the CS, we predict that people would be more likely to retrieve information that could confirm the hypothesis that the US valence characterizes the CS than (otherwise equally accessible) information that suggests that the CS is characterized by opposite valence. Similarly, if some information about the CS is ambiguous (e.g., behaviors that can be interpreted as evidence that the CS is positive or negative), people would favor the interpretation that assigns the US valence to the CS.

There are at least two clear assumptions regarding the effect of available cognitive resources on EC (see Figures 1 and 2 for illustrations). If relational qualifiers (verbal or less explicit) indicate that the co-occurring CS and US are of opposite valence, but there are low cognitive resources upon acquisition and evaluation, the CS evaluation would be according to the US valence (for initial evidence, see Moran & Bar-Anan, 2013, 2018). If relational qualifiers do not indicate that the co-occurring CS and US are of opposite valence, the assimilative effect of US valence on CS evaluation would be weaker when there are low cognitive resources upon acquisition and evaluation than when people have sufficient cognitive resources upon acquisition or upon evaluation. Another prediction is that measures of ambivalence would show stronger ambivalence when the CS and the US are linked in an opposition relation than in a similarity relation.

There are also clear assumptions about the effects of focus (directed by goals or other factors) during acquisition (initial evidence comes from Moran et al., 2015, 2016). We predict that different conditions at acquisition could change the strength of the effect of co-occurrence on CS evaluation. Specifically, from our hypotheses we derived the assumption that EC occurs because of two processes: (1) the mere presentation of the CS-US co-occurrence leads to the formation of a mental link between the CS and the US valence, and (2) inference from the CS-US co-occurrence leads many people to the inference that the US valence characterizes the CS. However, at acquisition, people's goals might shift them away from (or toward) making inferences based on the CS-US co-occurrence, thus reducing or even eliminating the effect of inference on CS evaluation. People might focus on other relational information (e.g., people might try to memorize whether the CS appears above or below the US), or they might receive information that the CS-US co-occurrence is not due to similarity in valence. Similar factors can moderate the effect of inferences made at evaluation.

Because linkage information is simpler than relational information, it is reasonable to assume that memory of mental links would persist longer than memory of relational information. Therefore, time passage is expected to increase the effect of mental links, relatively to the effect of stored relational information. That prediction also means that the more time passes from acquisition to evaluation, the more influential the settings during acquisition (available cognitive resources, goals, and attention) on the evaluation would be.

Simple First and other Models

As we noted at the onset of this paper, we consider *simple first* a set of working hypotheses that implement a more general roadmap for pursuing knowledge in psychology. That roadmap dictates identifying fast and slow processes, and investigating what slow processes do with the output of fast processes – do they reject, accept or modify the output of the fast processes? We treat s*imple first* as a dynamic thinking tool for generating research questions, rather than as a static set of hypotheses to confirm or refute. That explains why we chose to derive from the *assimilative attribution* hypothesis the extreme assumption that deliberate evaluation is *always* sensitive to linked valence. That assumption calls for research on the sensitivity of evaluation to various forms of external information that indicates a link between the target object and valence. If our extreme assumption is disconfirmed on some settings and confirmed on others, identifying those settings would provide knowledge about how the slow processes (deliberate evaluation in the present case) determine what to do with the output of the fast process (the activation of valence).

We learned about the driving force of extreme hypotheses from the propositional perspective on learning (Mitchell, De Houwer, & Lovibond, 2009), which made a bold assumption about learning: although it is obvious that people are unaware of most information processing that occurs in their brain, the propositional perspective for learning posits that learning cannot occur without (accessible to awareness) mental representations of propositions. EC research that contrasted the extreme assumptions derived from the propositional perspective with assumptions derived from dual-process and associative models (Baeyens et al., 1992; Gawronski & Bodenhausen, 2014; Jones, Fazio, & Olson, 2009; Martin & Levey, 1978) led to interesting findings (e.g., Gast & De Houwer, 2012, 2013; Hu, Gawronski, & Balas, 2017a, 2017b; Kurdi & Banaji, 2017; Zanon, De Houwer, Gast, & Smith, 2014) that added valuable knowledge about EC.

Another contribution of the propositional perspective on EC (De Houwer, 2009, 2018) to *simple first* is the focus on inference as a factor that contributes to EC. In our reading of the literature, prior to the propositional perspective on EC, assumptions that EC is not the result of automatic processes appeared mainly as demand characteristic threats to EC findings. In early EC research, the stimulus pairing procedure was used to investigate how low-level conditioning, as opposed to high-level reasoning, influences likes and dislikes (e.g., Levey & Martin, 1975; Olson & Fazio, 2001; Staats & Staats, 1958). However, humans reason. Even if the experimental procedure only shows them pairs of stimuli, and no other semantic symbols, participants would try to make sense of the meaning of the pairing, and might rely on that reasoning when evaluating the stimuli (Bar-Anan et al., 2010). In other words, when observing stimulus co-occurrence, people would make assumptions about other relational meanings (e.g., *CS is similar to US*). The propositional perspective provided tools for discussing reasoning processes within EC research, without falling prey to the imminent threat of the demand characteristic artifact. Similarly, *simple first* acknowledges inference as an important mediator of the effect

of co-occurrence on evaluation. Research under the *simple first* hypotheses takes into account the relational information provided to the participants. That consideration helps to reduce demand characteristic threats, and increases the correspondence between research settings and co-occurrence events in real life.

Because we assume that linkage information is processed quickly and relational information is processed slowly, our hypotheses are often similar to some dual-process models – most specifically the Associative and Propositional model of Evaluation (APE; Gawronski & Bodenhausen, 2006, 2014, 2018), and more broadly, the reflexive-impulsive model (Strack & Deutsch, 2004). However, because *simple first* assumes two different types of information rather than two mental representations or two mental processes, it could be useful as a skeleton for dual-process, single-process or multiple-process models.

Notwithstanding the similarity of our hypotheses to those of the APE model and other models of evaluation (Fazio, 2007; Petty, Briñol, & DeMarree, 2007), we found it advantageous to pursue the *simple first* hypotheses as a pragmatic roadmap for advancing knowledge about human evaluation. At the very least, *simple first* served as a simplification of the most powerful ideas that we see in the APE, based on a different guiding rationale (information complexity), and with emphasis on what we consider the most important notions in contemporary research on evaluation and evaluative learning. In our view, existing models have not made a sufficient distinction between processes at acquisition and processes at retrieval. Further, the focus of dual models on the distinction between two system or processes seems to underestimate the effect of automatic evaluation on deliberate evaluation. *Simple first* makes it clear that automatic processes upon evaluation can reflect the product of deliberate processes during acquisition (e.g., Figure 1, Panel G), and that without sufficient cognitive resources upon acquisition, even deliberate processes upon evaluation would not reflect inference from the external information observed during acquisition (Figure 1, Panel D). Unlike any of the current evaluation models, *simple first* assumes that the mere link between a CS and valence has an assimilative effect on the CS evaluation even if other information (e.g., relational information) suggests that the CS has the opposite valence. With some rare exceptions noted earlier in this article, a CS link with a US would *always* have an assimilative effect on the deliberate evaluation of the CS.

Another important aspect of *simple first*, in comparison to other evaluation models, is that it assigns much weight to inference processes, which encourages research on inference rules, in the context of evaluative learning. Another important emphasis in *simple first*, perhaps not shared with other evaluation models, is the assumption that most reasoning occurs after the linked valence has already been attributed to the CS, or at the very least, after an evaluative response to the CS has already occurred (by spread of activation). That assimilative effect on the CS is an early bias that motivates later reasoning processes, favoring information or conclusions consistent with the assimilative effect over conflicting information and conclusions.

Unlike the APE model, *simple first* does not treat exposure to stimuli co-occurrence as the main event that leads to the formation of mental links between stimuli and valence.

Co-occurrence is only one of many events that link stimuli together[2]. More practically, the APE model has a relatively large set of hypotheses, which sometimes complicated our theoretical reasoning when we tried to use it to generate predictions for our research questions. Thus, although we consider the APE as the most successful theory in its influence on evaluation research in the recent decades, in our own work, the *simple first* hypotheses served us well. Because of that, we chose to share the hypotheses in this article, hoping that they would also serve others in further pursuit of knowledge about human evaluation.

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[2] Many papers about EC use the word *pairing* when they mean *co-occurrence*. According to *simple first*, the important factor is indeed pairing rather than co-occurrence because pairing means the linking of two concepts to one another, rather than only the co-occurrence of two stimuli.

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