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Distractor Devaluation in a Flanker Task: Object-Specific Effects Without Distractor Recognition Memory

Torsten Martiny-Huenger
University of Konstanz

Peter M. Gollwitzer
New York University and University of Konstanz

Gabriele Oettingen
New York University and University of Hamburg

Previous research has shown that ignored stimuli are affectively devalued (i.e., *distractor devaluation effect*). Whereas previous research used feature-based selection tasks to investigate distractor devaluation, we used an object-based paradigm, allowing us to investigate open questions regarding underlying mechanisms. First, by using an object-based paradigm, we expected to find distractor devaluation for specific distractors (in contrast to general effects for certain categories). Second, we expected distractor devaluation in the absence of explicit recall of the to-be-evaluated stimulus' prior status (e.g., distractor), which is an important and previously untested factor, in order to exclude alternative explanations for distractor devaluation. Third, derived from the devaluation-by-inhibition hypothesis, we predicted that conditions of stronger distractor interference would result in stronger distractor devaluation. These predictions were confirmed in two experiments. We thus provide evidence that distractor devaluation can be a consequence of selective attention processes and that the evaluative consequences of ignoring can be tied to the mental representation of specific distractors.

Keywords: distractor devaluation, evaluation, selective attention, interference

Attentional and evaluative processes are important in the prioritization of action-relevant objects. Whereas selective attention prioritizes objects in a top-down manner according to current goals (Allport, 1989; Tipper, 1992), evaluative processes can provide quick information about objects to initiate adequate responses in a bottom-up manner (Chen & Bargh, 1999; Eder & Rothermund, 2008). Whereas there is evidence that evaluative processes can direct attention (e.g., Roskos-Ewoldsen & Fazio, 1992), in the last decade, different studies have indicated that attentional selection processes also influence evaluative processes. More precisely, previously ignored stimuli (i.e., distractors) have been found to be affectively devalued. Devaluation refers to decreased (i.e., more negative or less positive) evaluations (*distractor devaluation effect*; Raymond, Fenske, & Tavassoli, 2003; see Fenske & Raymond, 2006, for a review), and it is proposed to be a result of attentional inhibition that becomes associated with the distractor (*devaluation-by-inhibition hypothesis*; Fenske & Raymond, 2006; Raymond et al., 2003).

The aim of our present research is to investigate three questions concerning the underlying processes of distractor devaluation: (a) Does distractor devaluation occur for specific previously ignored distractors (i.e., object-specific distractor devaluation)? (b) Does distractor devaluation occur in the absence of explicit identification of the to-be-evaluated stimulus' prior status as a distractor? (c) Does stronger distractor interference result in stronger distractor devaluation, as would be predicted by the devaluation-by-inhibition hypothesis?

Distractor Devaluation

The effects of attentional selection on evaluations were initially observed in a two-item search task (Raymond et al., 2003). Participants saw abstract patterns and indicated the location of a target in the presence of one distractor. After each selection trial, participants evaluated one of the previously presented stimuli (target or distractor) or a stimulus not presented previously (novel). The authors found that distractors were evaluated more negatively than targets and novels. From the observation that the effects of attentional selection resulted in a devaluation of distractors (leaving targets unaffected), the authors proposed an explanation based on distractor-related processes. They argued that inhibitory states become associated with the distractor stimulus. If the stimulus is encountered again, the inhibitory state is reinstated and influences the evaluation negatively (i.e., devaluation-by-inhibition hypothesis; Raymond et al., 2003; Raymond, Fenske, & Westoby, 2005). Thus, whereas the unreinforced perception of stimuli results in more positive evaluations (i.e., mere exposure effect; Zajonc,

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Torsten Martiny-Huenger, Department of Social Psychology and Motivation, University of Konstanz, Konstanz, Germany; Peter M. Gollwitzer, Department of Psychology, New York University, New York, NY, and Department of Social Psychology and Motivation, University of Konstanz, Konstanz, Germany; and Gabriele Oettingen, Department of Psychology, New York University, New York, NY, and Department of Psychology, University of Hamburg, Hamburg, Germany.

Correspondence concerning this article should be addressed to Torsten Martiny-Huenger, Department of Social Psychology and Motivation, University of Konstanz, Universitätsstraβe 10, 78465 Konstanz, Germany. E-mail: torsten.huenger@uni-konstanz.de

1968; see Bornstein, 1989, for a review), perceptually available but ignored stimuli seem to undergo the opposite evaluative consequences, that is, evaluations become more negative.

Distractor devaluation has been demonstrated using selection tasks with one (e.g., Goolsby et al., 2009; Raymond et al., 2003) or more distractors (e.g., Raymond et al., 2005), a paper-and-pencil selection task (Veling, Holland, & van Knippenberg, 2007), and with different stimuli, including abstract images (Raymond et al., 2003; Raymond et al., 2005), letters (Veling et al., 2007), line drawings of common objects (Griffiths & Mitchell, 2008), and faces (Kiss et al., 2007; Martiny-Huenger, Gollwitzer, & Oettingen, 2013; Raymond et al., 2005). The term distractor devaluation is interchangeably used to refer to more negative distractor evaluations compared with novel stimuli (e.g., Raymond et al., 2003), to more negative distractor evaluations compared with targets (e.g., Goolsby et al., 2009; Raymond et al., 2005), and to more negative evaluations compared with baseline evaluations of the same stimuli (Martiny-Huenger et al., 2013).

Whereas the above-mentioned research concerned selection processes in visual attention, another line of research, concerned with attentional response selection, has also provided evidence for a link between attentional selection and evaluations. This research investigated processes to stop or suppress responses to certain stimuli, but not others, in so-called stop tasks or go/no-go tasks. These studies showed that stimuli associated with stopping a response (i.e., stimuli presented in no-go trials) were evaluated more negatively than similar stimuli not associated with stopping a response (i.e., stimuli presented in go trials; Buttaccio & Hahn, 2010; Doallo et al., 2012; Fenske, Raymond, Kessler, Westoby, & Tipper, 2005; Frischen, Ferrey, Burt, Pistchik, & Fenske, 2012; Kiss, Raymond, Westoby, Nobre, & Eimer, 2008; see Veling, Holland, & van Knippenberg, 2008, for positive stimuli).

We will use the term *distractor devaluation* to refer to the evaluative consequences of both visual and response selection. Although both lines of research have provided evidence that attentional selection processes influence evaluations, there are still important issues that need to be addressed to support this conclusion: There are inconsistencies regarding the level at which distractor devaluation occurs, and these inconsistencies point to a possible alternative explanation of distractor devaluation that is not based on attentional selection processes. We will address these two issues in the following two sections.

Inconsistent Evidence for Object-Specific Distractor Devaluation

Prior research on distractor devaluation has only used feature-based selection tasks, and there is evidence that distractor devaluation depends on the critical selection-relevant feature (Goolsby et al., 2009). *Feature based* means that a certain feature of the stimulus (e.g., color, shape) defines its status as target or distractor. In a line of studies, Goolsby et al. (2009) showed a distractor devaluation effect with a similar procedure as the above-described study by Raymond et al. (2003). The dependency of distractor devaluation on the critical selection feature became evident when the selection feature (color) was not present at the time of evaluation (Goolsby et al., 2009, Study 2). In that study, no distractor devaluation was observed. The authors concluded that the affective consequences of ignoring are tied to the critical (ignored) selection feature, but not to the whole object that was previously ignored.

However, there are other studies in which the selection feature was not present at the time of evaluation and distractor devaluation was nevertheless observed (Fenske et al., 2005; Kiss et al., 2007; Raymond et al., 2005, Study 3; Veling et al., 2007). Although these studies employed similar (feature-based) selection tasks as Goolsby et al. (2009, Study 2), they found positive evidence for object-specific distractor devaluation. How could these inconsistencies be resolved? There is evidence that inhibitory processes are flexibly applied according to the requirements of the selection task (De Houwer, Rothermund, & Wentura, 2001; Frings & Wentura, 2006; Tipper, Weaver, & Houghton, 1994), that is, inhibitory processes are not necessarily applied to task-irrelevant aspects (e.g., object identity in a feature-based selection task). Thus, it seems reasonable that Goolsby et al. (2009) did not find an object-based distractor devaluation effect because the object identity was irrelevant to the feature-based selection task. When focused on a particular feature, the object itself might have never been subject to inhibition; and, at the time of evaluation, the inhibition associated with the critical ignored selection feature was removed with the feature and, thus, had no negative effect on the evaluation of the object. Following this reasoning, to test whether distractor devaluation can be object specific, we concluded that it would be necessary to use an object-based selection paradigm, that is, a task in which object identity would be relevant to the selection processes.

Before we present such a paradigm in our current research, the question remains why object-based distractor devaluation has been observed in some studies using feature-based tasks. This inconsistency may point to an alternative explanation for distractor devaluation that depends on the identifiability of the stimulus' prior status as a target or distractor in the selection task, which we will address in the following section.

Category Label Identification

In most distractor devaluation studies, the explicit identification of to-be-evaluated stimuli as prior targets or distractors was very likely due to the following features of the studies: the stimuli used in the task were highly distinctive, target-distractor categorization was based on features inherent to the stimuli (e.g., color, basic shapes, gender), these features were often present at the time of the evaluation (e.g., Fenske, Raymond, & Kunar, 2004; Raymond et al., 2003; Raymond et al., 2005, Studies 1−2), and the time between selection and evaluation was very short (< 5 s), with no intermediate selection trials. To give an example, participants in the studies by Raymond et al. (2003) searched for patterns consisting of circles and ignored patterns of squares. Immediately after each search trial, a circle, square, or polygon (novel) pattern was presented for evaluation. Thus, the identification of a square pattern as a distractor from the ongoing search task was very likely. Could the identification of a to-be-evaluated stimulus as a distractor influence evaluations in a way that produces distractor devaluation?

Attitude construal theories (reviewed by Schwarz, 2007) have proposed that the evaluation of a stimulus is a composite evaluation of associated concepts that are activated together with the to-be-evaluated stimulus (see also Gawronski & Bodenhausen, 2011). This accounts for findings that evaluations are often context dependent (e.g., Bodenhausen, Schwarz, Bless, & Wänke, 1995; Wittenbrink, Judd, & Park, 2001). Identifying a stimulus as a distractor provides context information about relevance or irrelevance that is activated along with the stimulus. Category-dependent activation of concepts may thus systematically influence evaluations. In the case of categorizing a stimulus as a distractor, negatively valenced content may be activated that negatively affects the evaluation of the stimulus. In support of this assumption, Dittrich and Klauer (2012) used a two-item search task adapted from Raymond et al. (2003) and turned a distractor devaluation effect into a target devaluation simply by exchanging the evaluative meaning of targets and distractors.

The aforementioned studies showing object-specific distractor devaluation (Fenske et al., 2005; Kiss et al., 2007; Raymond et al., 2005, Study 3; Veling et al., 2007) were designed in such a way as to make category identification likely (even in the absence of the critical selection feature at the time of evaluation). For example, Raymond et al. (2005) used face stimuli taken from college yearbooks (including individuals with different ethnicities, facial expressions, hair, and ears) and observed distractor devaluation with these highly discriminative stimuli. On the other hand, the lack of object-specific distractor devaluation in the studies by Goolsby et al. (2009) was observed with face stimuli created from one prototype using a face morphing software. All created faces were of one ethnicity (White), did not vary in facial expression, and had secondary facial features like hair and ears removed. With these highly indiscriminable stimuli and the selection feature (in this case, color) removed, the authors found no distractor devaluation (Goolsby et al., 2009, Study 2). Thus, these results could be interpreted as evidence that distractor devaluation depends on the explicit identification of stimulus categories, either as a consequence of obvious stimulus features present at the time of evaluation or because of otherwise highly discriminable stimuli. Thus, we argue that the previously used feature-based selection tasks are suboptimal to address the label identification issue. With a feature-based task, the alternative explanation involving the evaluative influence of category labels cannot be eliminated for the following two reasons: (a) If the critical selection feature is present at the time of evaluation, then the identification of the category is unavoidable and distractor devaluation could be the result of the evaluative influence of the category labels. (b) Simply removing the critical selection feature, however, is not viable either, because this removes the inhibited feature and only the selection-irrelevant object remains. For the selection-irrelevant object, distractor devaluation is not expected to occur (or only as a result of other processes like a generalization effect from the feature to the object). With an object-based selection task, however, and a large amount of different stimuli, the likelihood of category identification could be minimized and object-specific distractor devaluation could be expected. This design would ensure that the to-be-evaluated stimulus is the same stimulus ignored earlier in the selection task, and that the stimulus cannot be identified as a distractor.

The Present Research

The following two studies were designed to test whether distractor devaluation effects can be observed at the object level and in the absence of participants' explicit recall of the to-be-evaluated stimulus' category. To achieve this goal, we used a flanker task paradigm (B. A. Eriksen & Eriksen, 1974) that is commonly used to investigate processes related to distractors (C. W. Eriksen, 1995). In our flanker task, participants were continuously required to report the symmetry of centrally presented target Chinese characters and to ignore two identical laterally presented distractor Chinese characters (Task 1). Thus, because targets and distractors were defined solely by their position in each flanker task display, this method allowed us to have participants attend to targets and ignore distractors without the need for stimulus-inherent features to define targets and distractors. Although the flanker task selection was location based, we assumed that the task to report the targets' symmetry would afford the processing and selection of the stimuli as whole, individual objects, because symmetry can only be accessed by the perception of the stimulus as a whole and not from certain features. Thus, due to the lack of any stimulus-inherent selection features, all systematic evaluative consequences for the stimuli must have been object based.

In regard to reducing participants' ability to identify the to-be-evaluated stimulus' category, the object-based paradigm did not allow for simple identification of categories on the basis of a certain stimulus feature. Instead, the identification of a stimulus as prior target or distractor would be possible by recognizing the identity of a specific stimulus. To make this identification of individual stimuli even more unlikely, we used 108 complex and (in Western cultures) highly unfamiliar stimuli (Chinese characters). Furthermore, the evaluations (Task 2) did not immediately follow after each selection trial. Evaluations were assessed in a separate experimental block, a few minutes after the selection task (i.e., after the completion of all selection trials). To check the success of these provisions, participants performed a recognition task (Task 3) after the evaluation task. To have a conservative indicator of whether participants were able to identify certain stimuli as previously presented distractors, we asked them to categorize previously presented distractors (old) and not previously presented stimuli (new) as "old" or "new."

Finally, to test the aforementioned alternative explanation for distractor devaluation based on the influence of category labels against the devaluation-by-inhibition hypothesis, we experimentally manipulated distractor inhibition processes by manipulating the strength of distractor interference. Interference from distractors and distractor responses is assumed to be inhibited in order to execute the intended target response (e.g., C. W. Eriksen, 1995; Houghton & Tipper, 1994; Houghton, Tipper, Weaver, & Shore, 1996; Tipper, 1992, 2001). Thus, conditions of high distractor interference result in stronger distractor inhibition compared with conditions of low distractor interference (Giesen, Frings, & Rothermund, 2012). This manipulation allowed us to compare evaluations of the same category (e.g., distractors) instead of comparing different categories (targets vs. distractors or novels vs. distractors). In contrast, an explanation of distractor devaluation based on category labels would predict a similar distractor devaluation effect for all distractors (high and low interference/inhibition) because the label conveyed by the instructions (e.g., distractors are irrelevant) were the same for both distractor categories. However, the devaluation-by-inhibition hypothesis results in a different prediction: If one accepts that higher distractor interference leads to higher distractor inhibition, then high interference distractors should be evaluated more negatively than low interference distractors.

For general predictions of the evaluative consequences of the flanker task for the targets and distractors, we needed to take both the devaluation-by-inhibition hypothesis and the mere exposure effect (i.e., increased positivity after repeated exposure; Bornstein, 1989) into account. Whereas targets were predicted to be only subject to a positive mere exposure effect, distractors were expected to be subject to a positive mere exposure effect, but, at the same time, to the negative evaluative consequences of distractor devaluation (Fragopanagos et al., 2009). Thus, overall, we expected distractors to be evaluated more negatively than targets. Distractor evaluations included evaluations of both low interference/inhibition and high interference/inhibition distractors. In line with the devaluation-by-inhibition hypothesis, we expected more negative evaluations of high interference distractors compared with low interference distractors (in contrast to the equal evaluations expected from the influence of category labels). With novel control stimuli as a reference for distractor devaluation, we expected only high interference/inhibition distractors to be evaluated more negatively compared with novel control stimuli. Importantly, we expected these evaluative consequences even in the absence of participants' recall of previously presented distractors as distractors and in an object-based paradigm.

Study 1: Distractor Devaluation in a Flanker Task

In the first study, participants completed a flanker task in which they repeatedly decided whether a centrally presented target Chinese character was horizontally symmetrical or asymmetrical while ignoring symmetrical or asymmetrical distractor Chinese characters. In Study 1, we manipulated response inhibition processes by creating interference from distractor responses (C. W. Eriksen, 1995). These distractor-elicited responses were either incompatible (high interference/inhibition) or compatible (low interference/inhibition) with the required target responses. Whereas incompatible responses must be inhibited in order to execute the intended target response, compatible distractor responses do not necessarily have to be inhibited. Thus, in half of the flanker task trials, target and distractors were of the same symmetry (response-compatible trials; low interference); in the other half of the trials, target and distractor symmetry differed (response-incompatible trials; high interference).

After the flanker task, in a separate block of the experiment, participants indirectly evaluated some of the previously encountered targets, distractors, and some not previously seen novel stimuli by indicating whether they thought that the presented stimulus represented a positive or negative word in the Chinese language on a 7-point Likert scale (see Zajonc, 1968, Study 2). Finally, participants completed a recognition test, in which some of the previously encountered distractors and some novel stimuli were presented. Participants' task was to indicate whether the presented stimuli were old (previously presented) or new (not previously presented). None of the stimuli presented in the recognition task appeared in the evaluation task. In line with our general predictions, we expected distractors in general to be evaluated more negatively than targets and response-incompatible distractors (high interference/inhibition) to be more negatively evaluated compared with response-compatible distractors (low interference/inhibition) and novel stimuli.

Method

Participants. Fifty-two students (31 women) from Konstanz, Germany, with ages ranging from 14−38 years ($M = 22.13$, $SD = 3.87$), participated in return for 3 Euros. All participants were naive about the purpose of the study, and they reported normal or corrected-to-normal visual acuity. One participant was identified as an extreme outlier (i.e., beyond the "outer fence"; third quartile plus three times the interquartile range; Tukey, 1977), with a flanker task error rate of 38.02% compared with the whole distribution's mean error rate of 6.99% ($SD = 8.74$). Thus, all statistical analyses were conducted on the remaining 51 participants.

Apparatus and ambiance. The study was conducted on an IBM personal computer, running DirectRT software (2006), and connected to a 43 cm color CRT display (at 85 Hz; pixels = 1,024 × 768). Participants were seated in a small, quiet laboratory room with the experimenter sitting behind a divider. Participants' viewing distance to the screen was about 80 cm and was enforced by a fixed screen, response keyboard, and chair.

Stimuli. We used 108 mock Chinese characters as stimuli. Real Chinese characters were selected from Chinese online news websites. The characters were manipulated to form 54 vertically symmetrical and 54 vertically asymmetrical stimuli. All stimuli were presented in black on a white background. Each stimulus, as presented on the screen, was approximately 3 cm high and 2 cm wide.

Design. The study followed a 2 × 2 (stimulus category [distractor vs. target] × response compatibility [compatible vs. incompatible]) within-participant design. Evaluations of novel stimuli served as the neutral baseline. The dependent variable was assessed on a 7-point Likert scale. Participants judged the valence of the Chinese characters original meaning. The scale anchors were labeled with *rather negative* and *rather positive*.

Procedure. Participants were told that the study investigated visual perception and decision-making processes. The study started with a flanker task, followed by an evaluation task, a recognition task, and a postexperimental questionnaire.

Flanker task. The sequence of events of three flanker task trials is depicted in Figure 1. The flanker task consisted of 192 experimental trials, divided by a break into two blocks of 96 trials. The first block was preceded by eight practice trials and the second block by two practice trials. Each flanker task trial consisted of the presentation of one centered target and two identical distractors presented directly to the left and right of the target. In each trial, participants indicated whether the target stimulus was vertically symmetrical or asymmetrical. Responses were made by pressing either the "F" or the "J" key on a keyboard. The key assignment was counterbalanced between participants. The stimuli were presented up to 5,000 ms. Flanker task responses made faster than 200 ms and slower than 3 *SD* from the individual participant's mean response times per compatibility condition were treated as errors. This eliminated 1.92% of the 9,984 total responses. The time between participants' response and the presentation of the subsequent stimulus was 500 ms.

Response-compatibility manipulation. The 192 experimental flanker task trials consisted of 96 trials with a response-compatible

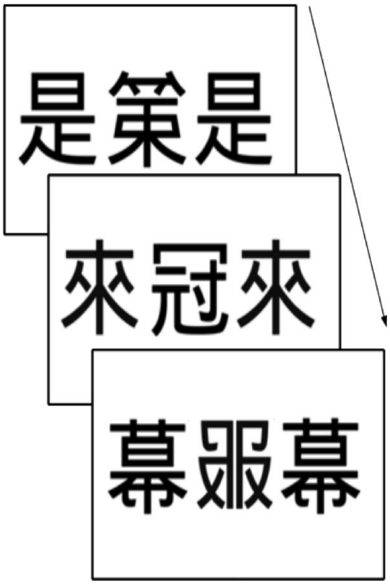

Figure 1. Distractor and target presentation of three flanker task trials in Study 1. Whereas the first two trials depict incompatible distractors and a central target, the third trial depicts compatible distractors and a central target. Each trial was presented until the participant responded, but no longer than 5,000 ms.

target-distractor configuration. Response-compatible trials consisted of stimuli that were either both symmetrical or both asymmetrical. Thus, distractors primed a response that was not in conflict with the required target response. The other 96 trials had a response-incompatible target-distractor configuration. Response-incompatible trials consisted of stimuli that did not share the same symmetry. Thus, distractors primed a response that was in conflict with the required target response.

Evaluation task. Participants started the evaluation task after they had completed all 192 flanker task trials. We assessed evaluations in the following indirect manner: Participants were told that each Chinese character represents a word in the Chinese language. Participants guessed the valence of the meaning of the Chinese characters. Twenty critical stimuli (see section below) were presented in a random order, one at a time, in the center of the screen. After a fixation cross, a single stimulus was presented for 1,000 ms. Participants then guessed the valence of the meaning of the stimulus on a 7-point Likert scale (1 = *rather negative* and 7 = *rather positive*).

Critical (evaluation) stimuli. Twenty of the 108 Chinese characters presented in the study were critical stimuli. Four critical stimuli were never presented during the flanker task. These stimuli were presented only once in the evaluation task (novels). The remaining 16 critical stimuli were each presented four times in the flanker task and once in the evaluation task. Eight of these stimuli were presented as distractors—half were presented in compatible flanker task trials (compatible distractors) and the other half in incompatible flanker task trials (incompatible distractors). The remaining eight stimuli were presented as targets—half were presented in compatible flanker task trials (compatible targets) and the other half in incompatible flanker task trials (incompatible targets). To avoid systematic effects of stimulus attractiveness, each participant received a unique selection of 20 critical stimuli taken randomly from the whole set of 108 Chinese characters at the beginning of the experiment. Stimulus symmetry was counterbalanced over all factors (i.e., stimulus category and response compatibility).

Recognition task. After the evaluation task, participants were instructed to categorize the presented stimuli as old (previously presented) or new (not previously presented). Sixteen Chinese characters were presented one at a time, together with two buttons labeled "Yes, appeared previously" and "No, did not appear previously." Each stimulus was presented until the participant made a response. The 16 Chinese characters were composed of eight new stimuli (i.e., not presented previously in the study) and eight old distractors (i.e., presented in the flanker task as compatible [$n = 4$] or incompatible [$n = 4$] distractors). To avoid systematic stimulus effects, each participant received a unique selection of 16 stimuli taken randomly from the remaining set of 88 Chinese characters (after critical evaluation stimuli were selected) at the beginning of the experiment. Stimulus symmetry was counterbalanced over all factors. Note that the recognition task stimuli differed from the critical (evaluation) stimuli.

In sum, participants responded to targets and ignored response-compatible or response-incompatible distractors in a flanker task paradigm. After the flanker task, critical stimuli were evaluated in an indirect evaluation task, and recognition memory was assessed.

Results

Manipulation checks. Before analyzing the evaluative consequences of the flanker task for the targets and distractors, we tested whether the response compatibility manipulation in the flanker task produced the expected interference effects. Further, we tested whether participants were able to distinguish between old and new stimuli in the recognition task.

Interference manipulation in the flanker task. Response-incompatible distractors were assumed to produce more (response) interference than response-compatible distractors. This assumption was confirmed using two t tests, with response errors and response times as dependent variables. Participants made more incorrect target responses in the presence of incompatible distractors ($M = 9.10$, $SD = 15.37$) than in the presence of compatible distractors ($M = 2.69$, $SD = 3.07$), $t(50) = 2.76$, $p < .01$ (one-tailed); and participants showed marginally significant slower target response times in the presence of incompatible distractors ($M = 818.45$ ms, $SD = 318.52$) than in the presence of compatible distractors ($M = 803.70$ ms, $SD = 307.23$), $t(50) = 1.46$, $p = .07$ (one-tailed). Thus, as expected, the higher error rates and slower response times in the presence of incompatible distractors compared with compatible distractors confirmed that incompatible distractors produced more interference than compatible distractors.

Recognition memory. The mean rate of correctly identifying distractors as distractors (hits) was 50.24% ($SD = 17.41$), and the mean rate of wrongly identifying novel stimuli as distractors (false hit) was 46.64% ($SD = 17.35$). We calculated the d'' score ($M = 0.10$, $SD = 0.57$) according to Stanislaw and Todorov (1999), and tested whether d' differed significantly from 0, which would indicate the ability to distinguish distractors from novels. The analysis showed no significant difference from 0, $t(50) = 1.18$, $p = .24$, *ns*. Thus, participants could not reliably distinguish the previously seen distractors from (new) novel stimuli.

Evaluations. We will begin by analyzing the evaluative differences between the three stimulus categories (targets, distractors, and novels), not including the interference manipulation as the factor cannot be applied to novel stimuli. Then we will continue to analyze the effects of the interference manipulation on target and distractor evaluations.

Distractor, target, and novel evaluations. To test whether the evaluations of the three stimulus categories (i.e., targets, distractors, and novels) differed, we conducted a 3 × 2 (stimulus category [targets vs. distractors vs. novels] × stimulus symmetry [symmetrical vs. asymmetrical]) repeated-measures analysis of variance (ANOVA) with stimulus evaluations as the dependent variable. The analysis revealed a significant main effect of stimulus symmetry, $F(1, 50) = 11.86$, $p < .01$, $\eta_p^2 = .19$, with symmetrical stimuli ($M = 4.44$, $SD = 0.70$) being evaluated more positively than asymmetrical stimuli ($M = 3.81$, $SD = 0.75$). Most importantly, we observed a marginally significant main effect of stimulus category, $F(2, 49) = 2.60$, $p = .09$, $\eta_p^2 = .10$. Post hoc *t* tests showed that targets ($M = 4.28$, $SD = 0.62$) were evaluated more positively than distractors ($M = 4.03$, $SD = 0.51$), $t(50) = 2.26$, $p = .01$ (one-tailed), and marginally more positively than novels ($M = 4.07$, $SD = 0.54$), $t(50) = 1.63$, $p = .06$ (one-tailed). No other effects were significant.

Interference effect on evaluations. To assess the effect of response compatibility on evaluations of distractors and targets (by controlling for stimulus symmetry), we conducted a 2 × 2 × 2 (stimulus category [distractors vs. targets] × response compatibility [compatible vs. incompatible] × stimulus symmetry [symmetrical vs. asymmetrical]) within-participant repeated-measures ANOVA (see Figure 2). Note that novel stimuli could not be included in this analysis because the response-compatibility factor could not be applied to them. The analysis revealed a significant main effect of stimulus category, $F(1, 50) = 5.11$, $p = .03$, $\eta_p^2 = .09$, with distractors ($M = 4.03$, $SD = 0.51$) being evaluated more negatively than targets ($M = 4.28$, $SD = 0.62$), and a significant main effect of stimulus symmetry, $F(1, 50) = 9.26$, $p < .01$, $\eta_p^2 = .16$, with symmetrical targets and distractors ($M = 4.45$, $SD = 0.81$) being evaluated more positively than asymmetrical targets and distractors ($M = 3.85$, $SD = 0.81$).

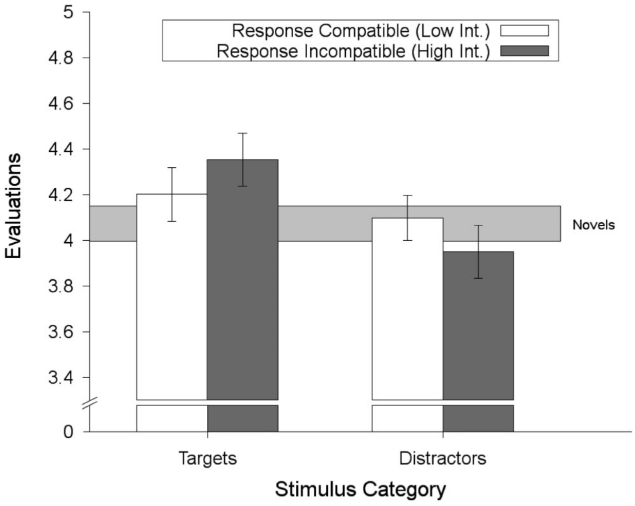

Figure 2. Study 1 mean distractor and target evaluations as a function of response compatibility. The gray area represents ± 1 standard error of the mean (*SEM*) evaluation of novel stimuli. Error bars show ± 1 *SEM*. Int. = interference.

However, these main effects were qualified by a marginally significant two-way interaction effect between stimulus category and response compatibility, $F(1, 50) = 2.88$, $p = .096$, $\eta_p^2 = .05$, and a marginally significant three-way interaction effect between stimulus category, response compatibility, and stimulus symmetry, $F(1, 50) = 3.70$, $p = .06$, $\eta_p^2 = .07$. The marginally significant 2-way interaction indicates that targets and distractors tended to be evaluated differently for response-compatible and response-incompatible stimuli (see Figure 2). Descriptively, the result pattern was as expected; evaluations of incompatible distractors ($M = 3.95$, $SD = 0.83$) were more negative compared with evaluations of compatible distractors ($M = 4.10$, $SD = 0.70$), whereas this was not the case for targets (incompatible targets: $M = 4.35$, $SD = 0.82$; compatible targets: $M = 4.20$, $SD = 0.84$).

The marginally significant three-way interaction effect suggests that stimulus symmetry interacted with the other two factors. Because our prediction about the effect of the interference manipulation on evaluations only concerned distractor evaluations (with target evaluations as the control), it was important to eliminate the possibility that stimulus symmetry interacted with response compatibility for distractor evaluations. Therefore, we conducted two separate ANOVAs—one for targets and one for distractors. We found a marginally significant interaction effect of stimulus symmetry and response compatibility for targets, $F(1, 50) = 3.11$, $p = .08$, $\eta_p^2 = .06$, but *not* for distractors, $F(1, 50) = 1.08$, $p = .30$, $\eta_p^2 = .02$. Thus, symmetry had no influence on the stimuli and factors of interest (distractors and category by interference).

Novel stimuli as reference for distractor devaluation. To test for an actual devaluation below the baseline level, we tested whether high interference distractors were evaluated more negatively than novel stimuli. Again, the response-compatibility factor could not be applied to novel stimuli, so we could not test for an interaction between response-compatible/-incompatible distractors and novel stimuli, and had to rely on *t* tests alone. Against our prediction, evaluations of response-incompatible distractors ($M = 3.95$, $SD = 0.83$) did not differ significantly from novel stimuli ($M = 4.07$, $SD = 0.54$), $t(50) = 0.85$, $p = .40$. Furthermore, evaluations of response-compatible distractors ($M = 4.10$, $SD = 0.70$) also did not differ significantly from novel stimuli, $t(50) = 0.19$, $p = .85$.

Discussion

In line with our predictions, distractors in general were evaluated more negatively than targets. Thus, we showed a distractor devaluation effect (with targets as reference; Raymond et al., 2005) in a paradigm that allowed only object-specific effects, because the task was not based on stimulus-inherent features that defined targets and distractors. Whereas previous evidence indicated that, in a feature-based selection task, distractor devaluation is based on the critical selection feature (Goolsby et al., 2009), our current study provides evidence that distractor devaluation can occur for specific ignored objects, at least if the selection task requires object-based selection processes.

The selection tasks used in most previous distractor devaluation research were designed in a way that made the identification of to-be-evaluated stimuli very likely. We designed our task to make explicit category identification unlikely, and showed that participants were not even able to reliably identify whether a distractor was previously presented. We minimized the possible evaluative consequences of explicit identification of category labels and, thus, assume that the observed distractor devaluation was a consequence of attentional selection, as proposed by Raymond and colleagues (Raymond et al. 2003; Raymond et al., 2005).

In line with the assumption that more distractor interference would result in stronger distractor inhibition (Giesen et al., 2012) and the devaluation-by-inhibition hypothesis, we found a tendency for the interference manipulation to affect target and distractor evaluations differently. Descriptively, the pattern is in line with our prediction that stronger distractor interference would result in more negative distractor evaluations, but not more negative target evaluations. Because the effect was rather small, in Study 2, we sought to replicate the pattern using a stronger experimental manipulation.

Initially, distractor devaluation was defined as more negative distractor evaluations compared with novel stimuli (Raymond et al., 2003), constituting a real devaluation below the baseline level. Contrary to our predictions, we did not find such a strong devaluation effect for distractors in general, and, more surprisingly, we did not find this devaluation even for high interference distractors in our first study. This may have been the case for two reasons. First, distractor location changed from the selection task to the rating task. Because, as Raymond et al. (2005, Study 2) showed, a location change decreases the distractor devaluation effect compared with when the distractors are rated in their original location, we may have underestimated the distractor devaluation effect in the current study. Second, the finding that even distractors presented in the high interference condition were not devalued compared with novel stimuli might be due to the weak effect of the interference manipulation on distractor evaluations. Thus, to test whether high interference distractors are indeed devalued if the interference created by the distractors is strong enough, and to replicate the results of Study 1 (object-specific effects without explicit category identification), we conducted a second study in which we strengthened the interference manipulation by combining two different kinds of interference (response and visual). We predicted that the stronger interference manipulation would result in a similar but clearer result pattern compared with Study 1.

Study 2: Distractor Devaluation and Distractor Interference

Study 2 followed the same procedure as Study 1. That is, participants completed a flanker task, followed by an evaluation task, and ended with an old−new recognition task. However, in the flanker task, we combined the manipulation of response interference from Study 1 with a manipulation of visual interference. In line with evidence that distractors presented close to targets are subject to stronger distractor inhibition compared with distractors presented farther from targets (Cave & Zimmerman, 1997; Cutzu & Tsotsos, 2003), the visual interference manipulation was implemented by presenting distractors either close to the targets (high interference/inhibition) or farther from the targets (low interference/inhibition; see also Raymond et al., 2005). Distractors presented in response-*incompatible* flanker task trials with targets and distractors presented *close* to each other constituted *high interference* distractors; distractors presented in response-*compatible* flanker task trials with distractors presented *farther* from the targets constituted *low interference* distractors. The hypotheses were the same as in Study 1. We expected distractors to be evaluated more negatively compared with targets, high interference distractors to be evaluated more negatively compared with low interference distractors, and only high interference distractors to be evaluated more negatively compared with novel stimuli.

Method

Participants. Fifty-three students (27 women) of the University of Konstanz, Germany, with ages ranging from 18−29 years ($M = 22.79$, $SD = 2.71$), participated in return for 3 Euros. All participants reported normal or corrected-to-normal visual acuity. Three participants were identified as extreme outliers (i.e., beyond the "outer fence"; third quartile plus three times the interquartile range; Tukey, 1977) with one participant having a flanker task error rate of 13.02% and two participants having an error rate of 21.35% compared with the whole distribution's mean error rate of 3.23% ($SD = 3.83$). Thus, all statistical analyses were conducted on the remaining 50 participants.

Design and procedure. Study 2 followed the same procedure as Study 1, with the exception of the additional manipulation of the target-distractor distance in the flanker task. Adding the distance factor resulted in a 2 × 2 × 2 (stimulus category [target vs. distractor] × target-distractor distance [close vs. distant] × response compatibility [compatible vs. incompatible]) within-participant design. As in Study 1, a third stimulus category (novels) served as a neutral baseline. For the dependent variable, we assessed evaluations on a 7-point scale.

The flanker task procedure of Study 2 was the same as in Study 1, with the additional variation of the distance between distractors and targets. In half of the 192 flanker task trials, distractors were presented close to the targets (approximate distance = 2.8°; close condition) and in the other half of the flanker task trials distractors were presented farther away (approximate distance = 5.7°; distant condition). The distance factor was counterbalanced with the response-compatibility factor to create an equal number of incompatible−close, incompatible−distant, compatible−close, and compatible−distant flanker task trials. Flanker task responses made faster than 200 ms and slower than 3 *SD* from the participant's mean response times per compatibility and distance condition were treated as errors. This eliminated 1.89% of the 10,176 responses from the analysis.

Critical (evaluation) stimuli. Twenty-eight critical stimuli were used. Sixteen critical distractors and eight critical targets were equally distributed over the four different flanker task conditions (i.e., compatible−distant, compatible−close, incompatible−distant, incompatible−close). Four critical stimuli were presented as novels in the evaluation task only. The evaluation task followed the same procedure as in Study 1, but consisted of 28 evaluation trials in which all critical stimuli were evaluated once. Stimulus symmetry was counterbalanced over all factors. The recognition task also followed the same procedure as in Study 1, except for the selection of the distractor categories: the eight distractor stimuli presented in the recognition task consisted of two distractors from each of the four flanker task conditions.

In sum, participants responded to targets and ignored distractors in a flanker task paradigm. Critical stimuli were always presented as either distractors or targets in response-compatible/-incompatible and close/distant flanker task trials. After the flanker task, critical stimuli were evaluated in an indirect evaluation task and recognition memory was assessed.

Results

Manipulation checks. Similar to Study 1, before analyzing the evaluative consequences of the flanker task for the targets and distractors, we tested whether the response compatibility and distance manipulation in the flanker task produced the expected interference effects. Further, we tested whether participants were able to distinguish between old and new stimuli in the recognition task.

Interference manipulation in the flanker task. Response-incompatible distractors presented close to the targets (high interference trials) were assumed to produce more interference than response-compatible distractors presented farther from the targets (low interference trials). This assumption was tested using two *t* tests, with target response times and response errors as the dependent variables. Participants' target response times were slower in the high interference trials (M = 732.28 ms, SD = 291.35) compared with low interference trials (M = 700.05 ms, SD = 205.93), $t(49) = 2.06$, $p = .02$ (one-tailed). Descriptively, participants also made more errors in the high interference trials (M = 1.06, SD = 1.78) compared with the low interference trials (M = 0.82, SD = 1.32). However, this difference failed to reach a significant level, $t(49) = 0.96$, $p = .17$ (one-tailed). However, because response times and error rates did not show a trade-off effect, taken together, the pattern indicates that response-incompatible distractors presented close to the targets (high interference) produced more interference compared with response-compatible distractors presented farther from the targets (low interference).

Recognition memory. The mean rate of correctly identifying distractors as distractors (hits) was 45.28% (SD = 22.50), and the mean rate of wrongly identifying a novel stimulus as distractors (false hit) was 48.59% (SD = 18.45). We calculated the d' score ($M = -0.07$, $SD = 0.69$) according to Stanislaw and Todorov (1999), and tested whether d' differed significantly from 0, which would indicate the ability to distinguish distractors from novels. The analysis showed no significant difference from 0, $t(49) = 0.75$, $p = .46$, *ns*. Thus, participants could not reliably distinguish the previously seen distractors from (new) novel stimuli.

Evaluations. Similar to Study 1, we will begin by analyzing the evaluative differences between the three stimulus categories (targets, distractors, and novels), not including the interference manipulations as the factor cannot be applied to novel stimuli. Then we will continue to analyze the effects of the interference manipulations on target and distractor evaluations.

Distractor, target, and novel evaluations. To test whether the three stimulus categories (i.e., target, distractor, novel) differed in their evaluations, we conducted a 3 × 2 (stimulus category [targets vs. distractors vs. novels] × stimulus symmetry [symmetrical vs. asymmetrical]) repeated-measures ANOVA with stimulus evaluations as the dependent variable. The analysis revealed a significant main effect of stimulus symmetry, $F(1, 49) = 9.73$, $p < .01$, $\eta_p^2 = .17$, with symmetrical stimuli (M = 4.43, SD = 0.71) being evaluated more positively than asymmetrical stimuli (M = 3.95, SD = 0.59). Most importantly, we again found a marginally significant main effect of stimulus category, $F(2, 48) = 2.90$, $p = .07$, $\eta_p^2 = .11$. Post hoc *t* tests showed that, similar to the results in Study 1, targets (M = 4.32, SD = 0.59) were evaluated more positively than distractors (M = 4.10, SD = 0.40), $t(49) = 2.23$, $p = .02$ (one-tailed), and distractors were evaluated more negatively than novels (M = 4.23, SD = 0.59), although this difference was only marginally significant, $t(49) = 1.39$, $p = .09$ (one-tailed). No other effects were significant.

Stimulus category, response compatibility, and distance. For the sake of completeness, before presenting the analyses for the high and low interference stimuli (combination of response compatibility and distance manipulation) alone, we report an ANOVA for the full 2 × 2 × 2 × 2 (stimulus category [distractor vs. target] × response compatibility [compatible vs. incompatible] × target-distractor distance [distant vs. close] × stimulus symmetry [symmetrical vs. asymmetrical]) within-participant design. The analysis revealed a main effect of stimulus category, $F(1, 49) = 4.97$, $p = .03$, $\eta_p^2 = .09$, with distractors (M = 4.10, SD = 0.40) being evaluated more negatively than targets (M = 4.32, SD = 0.59) and a main effect of stimulus symmetry, $F(1, 49) = 9.22$, $p < .01$, $\eta_p^2 = .16$, with symmetrical targets and distractors (M = 4.41, SD = 0.77) being evaluated more positively than asymmetrical targets and distractors (M = 3.93, SD = 0.63). As in Study 1, we found a marginally significant two-way interaction effect between stimulus category and response compatibility, $F(1, 49) = 3.25$, $p = .08$, $\eta_p^2 = .06$ (see Figure 3a), but no interaction effect between stimulus category and target-distractor distance, $F(1, 49) = 3.25$, $p = .31$, $\eta_p^2 = .02$ (see Figure 3b).

Furthermore, we observed a marginally significant two-way interaction effect between stimulus category and stimulus symmetry, $F(1, 49) = 3.60$, $p = .06$, $\eta_p^2 = .07$. The difference between symmetrical distractors (M = 4.29, SD = 0.85) and symmetrical targets (M = 4.66, SD = 0.94) tended to be bigger compared with the difference between asymmetrical distractors (M = 3.91, SD = 0.68) and asymmetrical targets (M = 3.98, SD = 0.90). Thus, distractor devaluation tended to be more pronounced for symmetrical stimuli than for asymmetrical stimuli.

Finally, but unrelated to our hypotheses, we observed a marginally significant two-way interaction effect of target-distractor distance and stimulus symmetry, $F(1, 49) = 2.99$, $p = .09$, $\eta_p^2 = .06$. Thus, there was a tendency for the symmetry main effect to be more pronounced for stimuli presented in the close target-distractor distance condition compared with the distant target-distractor distance condition. All other main or interaction effects were not significant ($ps \leq .14$).

High and low interference effect on evaluations. The main aim of the second study was to strengthen the interference manipulation compared with Study 1, by combining two interference manipulations to test whether high distractor interference (compared with low interference) would result in the predicted effect on distractor evaluations. The full design analysis reported above replicated Study 1 with a similarly weak (marginally significant)

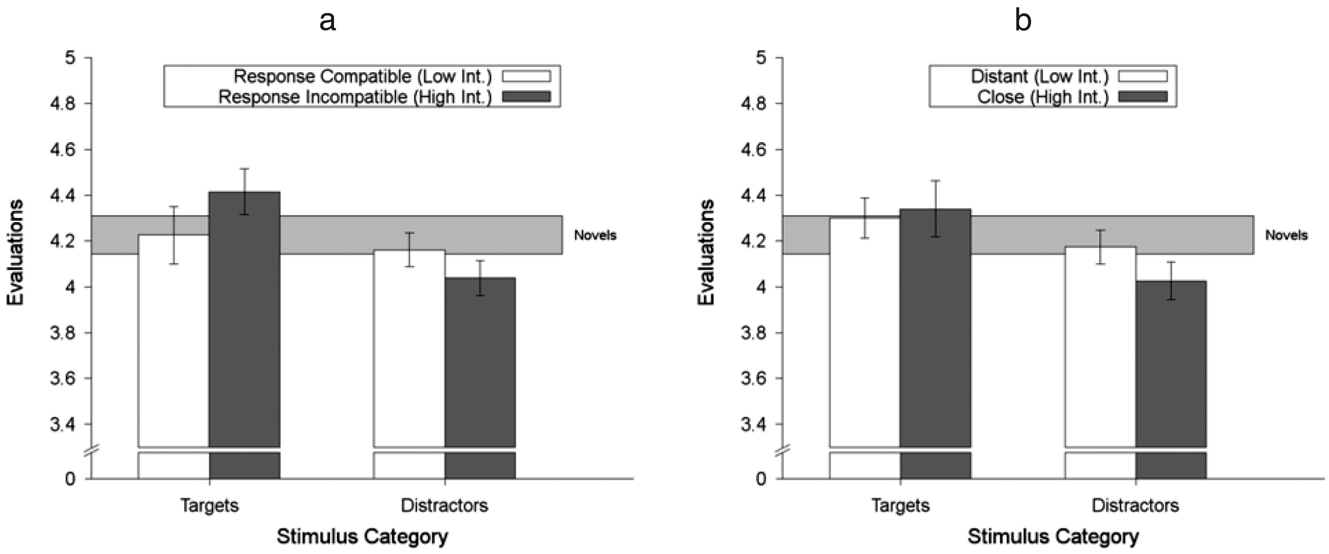

Figure 3. Study 2 mean distractor evaluations as a function of (a) response compatibility and (b) target-distractor distance. The gray area represents ± 1 *SEM* evaluation of novel stimuli. Error bars show ± 1 *SEM*. Int. = interference.

effect for the response-compatibility manipulation, and introduced a second interference manipulation (target-distractor distance) that resulted in an unreliable (nonsignificant) effect that was, nonetheless, descriptively in line with the response interference manipulations in both Studies 1 and 2. The following main analysis is comprised only of the high and low interference combinations of the compatibility and distance manipulation. That is, we compared distractor and target evaluations for response-incompatible and close flanker task trials (high interference) with response-compatible and distant flanker task trials (low interference). This was done by means of a 2 × 2 × 2 (stimulus category [distractor vs. target] × interference [high vs. low] × stimulus symmetry [symmetrical vs. asymmetrical]) within-participant factor, repeated-measures ANOVA (see Figure 4). The analysis revealed a main effect of stimulus symmetry, $F(1, 49) = 9.82$, $p < .01$, $\eta_p^2 = .17$, with symmetrical stimuli ($M = 4.43$, $SD = 0.94$) being evaluated more positively than asymmetrical stimuli ($M = 3.90$, $SD = 0.70$). Furthermore, similar to the whole design analysis, we found a significant two-way interaction effect between stimulus category and stimulus symmetry, $F(1, 49) = 5.97$, $p = .02$, $\eta_p^2 = .11$. The difference between symmetrical distractors ($M = 4.27$, $SD = 1.10$) and symmetrical targets ($M = 4.74$, $SD = 1.11$) was greater than the difference between asymmetrical distractors ($M = 3.93$, $SD = 0.82$) and asymmetrical targets ($M = 3.83$, $SD = 1.06$).

Importantly, however, we found the predicted interaction effect between stimulus category and interference, $F(1, 49) = 4.51$, $p = .04$, $\eta_p^2 = .08$. Post hoc analyses showed that high interference (incompatible/close) distractors ($M = 3.97$, $SD = 0.69$) were evaluated significantly more negatively than low interference (compatible/distant) distractors ($M = 4.24$, $SD = 0.79$), $t(49) = 1.89$, $p = .03$ (one-tailed). In contrast, there was no significant difference between high interference (incompatible/close) targets ($M = 4.40$, $SD = 1.00$) and low interference (compatible/distant) targets ($M = 4.17$, $SD = 0.93$), $t(49) = 1.24$, $p = .11$ (one-tailed).

Novel stimuli as reference for distractor devaluation. To test for an actual devaluation below the baseline level, we examined whether high interference distractors were evaluated more negatively compared with novel stimuli. Note that we could not test for an interaction because the interference factor could not be applied to novel stimuli. As expected from the devaluation-by-inhibition hypothesis, high interference (incompatible/close) distractors ($M = 3.97$, $SD = 0.69$) were evaluated more negatively than novels ($M = 4.23$, $SD = 0.59$), $t(49) = 2.25$, $p = .02$ (one-tailed), but low interference (compatible/distant) distractors ($M = 4.24$,

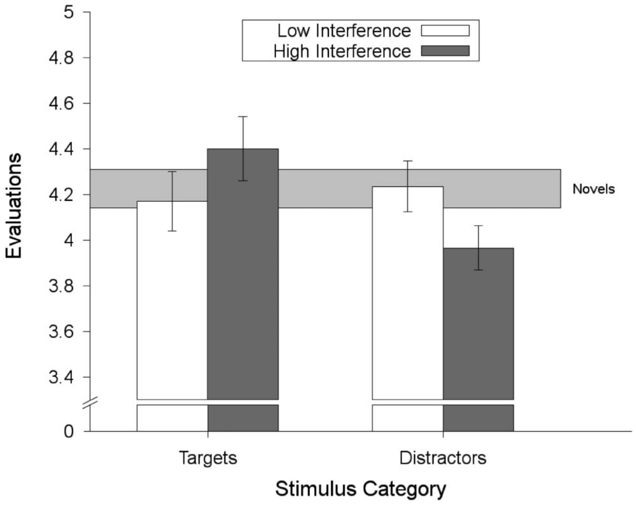

Figure 4. Study 2 mean distractor evaluations of only high and low interference distractors as a function of interference (combination of response and visual interference). The gray area represents ± 1 *SEM* evaluation of novel stimuli. Error bars show ± 1 *SEM*.

SD = 0.79) were not, $t(49) = 0.08$, $p = .94$. Thus, high interference distractors were indeed devalued, in that the evaluations of distractor stimuli were significantly more negative than the baseline (i.e., novels).

Discussion

In line with Study 1, in the full design analysis, we found that distractors in general were evaluated more negatively compared with target evaluations (by trend, more pronounced for symmetrical stimuli). Thus, we replicated the results from Study 1 and found distractor devaluation in a paradigm that allowed only for object-specific effects and in the absence of the explicit identification of distractors as stimuli that were presented previously.

As predicted and in line with the trend in Study 1, the interference manipulation (i.e., the combination of response and visual interference) interacted significantly with the stimulus category. High interference distractors were evaluated more negatively than low interference distractors, whereas no reliable difference was observed for targets presented in the high and low interference conditions. We thus provide strong evidence that distractor interference in a selection task negatively affects distractor evaluations. Finally, as expected, with the stronger interference manipulation, high interference distractors were evaluated more negatively than novel control stimuli. Thus, they did indeed become more negative compared with the baseline, even though they were presumably also subject to a positive mere exposure effect and novels were not.

General Discussion

In two studies, participants responded to centrally presented targets and ignored laterally presented distractors in a flanker task, then evaluated some of the previously encountered (and some novel) stimuli, and concluded with a recognition task in which they had to categorize prior distractors and novels as old or new. We found a distractor devaluation effect (with targets as the reference) in both studies. Furthermore, as predicted from the devaluation-by-inhibition hypothesis (Fenske & Raymond, 2006; Raymond et al., 2003) and the assumption that more interference results in more inhibition (Giesen et al., 2012), we found evidence that more distractor interference resulted in more negative distractor evaluations. Whereas this pattern was only a weak tendency in Study 1, by strengthening the interference manipulation in Study 2, we reliably replicated this pattern. With the boosted interference manipulation in Study 2, we also found a distractor devaluation effect as defined by more negative distractor evaluations compared with novel stimuli for high interference distractors, that is, they were devalued below the baseline level.

To better resolve the status of the marginally significant interactions of stimulus category and response compatibility in both studies we conducted an additional analysis across studies with study as a between-participants factor. This analysis showed that none of the experimental factors significantly interacted with the study factor (*F*s < 1). Of note, the hypothesized critical interaction effect between stimulus category and response compatibility was significant, $F(1, 99) = 6.12$, $p = .02$, $\eta_p^2 = .06$. Thus, the predicted result pattern was seen more clearly both with more power in the manipulation by combining two interference manipulations (Study 2) and with more statistical power by combining the response-compatibility manipulation across Studies 1 and 2. The results from the pooled analysis of the response-compatibility manipulation add to previous research by providing experimental evidence that the inhibitory processes of response inhibition negatively affect evaluations. In contrast to prior research, this evidence is not based on a comparison of different stimulus categories (go/no-go stimuli; e.g., Fenske et al., 2005), or on correlational data (Kiss et al., 2008), but by comparing same category stimuli (distractors) presented in conditions of either high or low response interference.

Object-Based Distractor Devaluation

Previous research concluded that distractor devaluation is tied to the critical selection features, at least in a feature-based selection task (Goolsby et al., 2009). Because we found distractor devaluation following a selection task that did not depend on stimulus-inherent features to define targets and distractors, we ensured that the procedure only allowed for object-based effects. Thus, we showed that distractor devaluation can be object specific, that is, the traces from being ignored can be tied to mental representations of specific objects and later affect evaluations of these specific objects. Taken together, distractor devaluation seems not to be fixed at a certain level of mental representation, but is applied flexibly at the level of the relevant selection process. This parallels evidence that inhibitory processes are also flexibly applied according to the characteristics of the selection task (De Houwer et al., 2001; Frings & Wentura, 2006; Tipper et al., 1994).

Evaluative Influences of Category Labels

In the introduction, we identified critical procedural aspects of prior distractor devaluation research (e.g., the prevalence of feature-based selection tasks and the identifiability of categories) that pointed to an alternative explanation for the effect based on the evaluative connotation of category labels. The current studies were designed to avoid these issues, and tested whether distractor devaluation would nonetheless occur. All the aspects operationalized in the present research, such as the object-specific selection task, the numerous unfamiliar but distinct stimuli, and the evaluation task temporally separated from the selection task, resulted in participants' inability to identify previously encountered distractors as "old" (i.e., previously seen) and novel stimuli as "new" (i.e., not encountered previously). We interpret this general inability to even tell whether they had seen a stimulus previously or not as evidence that they were not able to make the even finer distinctions of differentiating targets from distractors or high interference distractors from low interference distractors. This conclusion, however, must be handled with care. The number of critical test trials used in our experiments may underestimate the true sensitivity of the discrimination (Verde, MacMillan, & Rotello, 2006). Still, the relatively few critical test trials are partly compensated for by a relatively high number of participants in both experiments. Thus, we conclude that the evaluative consequences observed in our studies are unlikely to be the result of explicit category identification.

What about evaluative consequences of category labels that do not necessarily rely on the explicit identification of the categories at the time of evaluation? Recently, Dittrich and Klauer (2012) proposed an alternative explanation for distractor devaluation. Based on the evaluative coding principle (Eder & Rothermund, 2008), they assumed that the wording used to instruct participants for the selection task influences how participants mentally code the selection process. Instructions to ignore a stimulus are processed as a negative code assigned to the distractors, resulting in more negative evaluations (i.e., distractor devaluation). In two studies, they found evidence for these assumptions by turning a distractor devaluation effect into a target devaluation, simply by switching the evaluative meaning of the target and distractor labels.

However, we think that the results of our interference manipulation cannot be explained by such a labeling effect. Participants in our studies did not receive different instructions concerning what to do with the high and low interference distractors. In fact, participants may not even have realized that they encountered different distractor categories at all. Thus, from the label perspective, high and low interference distractors are merely to-be-ignored distractors and, thus, should be devalued equally. However, in line with the devaluation-by-inhibition hypothesis, we showed that high interference distractors were devalued, but not low interference distractors. Thus, although we agree with Dittrich and Klauer (2012) that category labels are a possible confounding variable in previous distractor devaluation research, this could not have been the cause of the observed effects in our studies.

Distractor Interference, Inhibition, and Distractor Devaluation

As outlined above, the interference manipulation allowed us to directly test the label account against the devaluation-by-inhibition hypothesis, and our results are better explained by the latter. However, inhibitory processes in general are not without controversy (reviewed by MacLeod, Dodd, Sheard, Wilson, & Bibi, 2003). However, there is converging evidence in favor of the view that attentional selection is driven by both excitatory *and* inhibitory processes (Houghton & Tipper, 1994; Houghton et al., 1996; Wühr & Frings, 2008) and that distractor interference is related to distractor inhibition (Giesen et al., 2012). Thus, our current studies, especially the results from the interference manipulations, are in line with the assumption that inhibitory processes negatively affect evaluations. This also coincides with evidence that higher activation levels before the evaluation increases distractor devaluation, because higher activation levels require greater inhibition (Frischen et al., 2012).

The conclusion drawn from our interference manipulation is valid to the extent that we can exclude the possibility that the interference itself negatively affected evaluations. One possibility as to how interference could affect evaluations is by a kind of evaluative conditioning effect (recently reviewed by Walther, Weil, & Duesing, 2011). If the interference created a (negative) irritation, this irritation might become associated with the currently displayed stimuli. This could indeed result in more negative evaluations of stimuli presented in high interference conditions compared with low interference conditions. However, this would affect both distractors and targets similarly. This is not in line with the overall pattern found in our studies. A simple interference-evaluative conditioning account cannot explain the different evaluative consequences for distractors and targets. The selective effect on distractors, leaving simultaneously presented targets unaffected, is difficult to explain by an evaluative conditioning account, because both stimulus categories were perceptually available at the time of the irritation and, thus, would have been equally associated with the irritation. Furthermore, it is particularly unlikely that the stimuli at the center of attention (i.e., targets) would not be affected, compared with those stimuli that were actually ignored (and thus less deeply processed). Inhibitory processes, on the other hand, are assumed to specifically affect the interference-creating distractors. Thus, the devaluation-by-inhibition account seems much better fitted to explain the distractor-specific evaluative effects observed in our studies.

Outlook

The prioritization of appropriate actions is important for the survival of any living creature. Whereas previous research has shown that bottom-up prioritization can influence top-down attentional control (recently reviewed by Yiend, 2010), the distractor devaluation effect provides evidence that the interaction between selective attention and affective processes is bidirectional. Distractor devaluation is an intriguing effect because stimulus valence is adaptively regulated by goal-directed selection processes. Goal-directed selection results in negative consequences for (effortfully) avoided stimuli. This negativity might subsequently support avoiding these stimuli in a bottom-up fashion by an automatically activated avoidance orientation (see Chen & Bargh, 1999). Thus, in the long run, distractor devaluation might steadily reduce the need for effortful top-down control by transferring this control to less effortful bottom-up processes via *affective automatization*. We provided evidence that distractor devaluation is indeed a consequence of attentional selection and inhibitory processes, and that it can occur on the basis of the identity of unique objects; the intriguing ideas concerning its behavioral consequences and function should be subject to future research.

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