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The Effect of Global Versus Local Processing Styles on Assimilation Versus Contrast in Social Judgment

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The authors propose a global/local processing style model (GLOMO) for assimilation and contrast effects in social judgment. GLOMO is based on Schwarz and Bless' (1992, 2007) inclusion–exclusion model, which suggests that when information is included into a category, assimilation occurs, whereas when information is excluded from a category, contrast occurs. According to GLOMO, inclusion versus exclusion should be influenced by whether people process information globally or locally. In 5 experiments, using both disambiguation and social comparison, the authors induced local versus global processing through perceptual tasks and time perspective and showed that global processing produced assimilation, whereas local processing produced contrast. The experiments showed that processing styles elicited in one task can carry over to other tasks and influence social judgments. Furthermore, they found that hemisphere activation and accessibility of judgment-consistent knowledge partially mediated these effects. Implications for current and classic models of social judgment are discussed.

Keywords: assimilation and contrast; exclusion versus inclusion; processing styles

When primed with a concept (e.g., the word *hostile*), people might assimilate further social judgments to the prime (e.g., judge a target as more hostile than without the prime), or contrast them away from the prime (e.g., judge the same target as less hostile). In a classic demonstration of assimilation, Higgins, Rholes, and Jones (1977) invited participants to an experiment that consisted of two apparently unrelated studies. The first study was an alleged verbal learning task, in which participants had to memorize either positive words (*adventurous*, *self-confident*, *independent*, *persistent*) or negative words (*reckless*, *conceited*, *aloof*, *stubborn*). The second study was an impression formation task, in which participants read a description of a character named Donald who performed a series of ambiguous behaviors (e.g., thinking about crossing the Atlantic in a sailboat) that could be regarded as adventurous or reckless. Participants then reported their impressions of Donald. Results indicated that Donald was rated as more adventurous and less reckless by the positively primed group than by the negatively primed group. Soon after the classic demonstration of assimilation after priming, examples of contrast followed (see Herr, Sherman, & Fazio, 1983; Lombardi, Higgins, & Bargh, 1987),[1] whereby the target is perceived in a way that is opposite to the prime. The question of whether assimilation or contrast would occur after priming became one of central importance to research on social cognition.

Many of the proposed accounts of assimilation versus contrast, our model included, derive from Schwarz and Bless' (1992; 2007) inclusion–exclusion model (IEM), whose integrative role has been, in our opinion, underacknowledged in the past. In the present article, we review the basic assumptions of IEM, review other models of assimilation and contrast, and then present and test a new model, GLOMO (GLObal vs. LOcal processing Model), which introduces a process distinction between assimilation and contrast. Specifically, we propose that global processing leads to inclusion and assimilation, whereas local processing leads to exclusion and contrast.

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[1] We would like to distinguish contrast that is due to anchoring from contrast that is due to judged unusability. Our article refers to the former. In judged unusability, participants regard the influence of the prime as inappropriate or undesirable and thus attempt to correct for its influence. Anchoring, on the other hand, reflects using the prime as a standard and contrasting away from it (for a further discussion of this distinction, see DeCoster & Claypool, 2004; Förster & Liberman, in press).

The Inclusion–Exclusion Integrative Account of Assimilation Versus Contrast

Schwarz and Bless' (1992, 2007) IEM account proposes that assimilation and contrast effects are a function of the mental construal of targets and standards: Both constructions are based on what is accessible at the time of the judgment. Assimilation occurs when the target is included in the prime, whereas contrast occurs when the target is excluded from the prime. As an aid to understanding the intuition behind IEM, it might be useful to visualize the prime and the target as two blots and to think of the question of assimilation versus contrast as whether the two blots are seen as one blot or two distinct blots. Fuzzier boundaries of either of the blots and a shorter distance between them would promote assimilation, whereas stronger boundaries and greater distance would lead to contrast.

Closeness and similarity of the target to the prime suggest that they belong to the same category and therefore increase the likelihood of inclusion. Contrary to that, extreme primes are, by definition, more remote from the target and are thus more likely to be excluded and to lead to contrast than are moderate primes. Supporting this notion, Stapel and Koomen (2000, 2001; see also Stapel & Suls, 2004) showed that close, highly relevant, similar, and indistinct standards lead to assimilation rather than contrast. In a similar vein, Mussweiler and Bodenhausen (2002) found that in self-perception, psychologically proximal standards (e.g., members of the ingroup) are more likely to lead to assimilation than psychologically distant targets. Using a modified version of the priming paradigm by Higgins et al. (1977), Herr et al. (1983) primed participants with moderate versus extreme exemplars of animals in terms of ferocity and size and then asked the participants to judge the ferocity and size of a fictitious animal. Assimilation was found after moderate exemplar priming, whereas contrast was found after extreme exemplar priming (see also Herr, 1986; Mussweiler, Rüter, & Epstude, 2004).

Generally, a distal, more general perspective on both the prime and the target is likely to make them seem close to each other and thus lead to assimilation, whereas a close, detailed look is likely to produce a contrast. This concept has implications, for example, for the use of response scales. To illustrate, a subjective scale is likely to be adjusted to the range of the judged set of stimuli (Parducci, 1965; Parducci, Perrett, & Marsh, 1969): in our case, the standard and the target. If people focused on the prime and the target, a contrast would be likely, as these two stimuli would be visualized as being at a distance from each other. For example, if asked "How much alcohol do you drink" and presented with a scale anchored with the terms *a lot* and *very little*, a person who had been primed with "drinking 3 nights per month" (a low standard of comparison) may use the standard as the scale anchor (i.e., assume that 3 nights a month is at the end marked *very little*) and contrast herself away from the anchor. An objective scale, on the other hand, is more likely to cover a wider range than the distance between the standard and the target and thus places them closer to each other than when only these two stimuli are examined. For example, a scale that ranges between *three drinks a day* and *one drink a month* places the person closer to 3 nights per month if she drinks less than 3 drinks a day. Assimilation should be the result. Consistent with this logic, Mussweiler and Strack (2000) showed that priming people with moderate standards of drug consumption leads to assimilation on an objective scale (e.g., indicating the number of times per month one consumes drugs) and a tendency toward contrast on a subjective scale (e.g., indicating how extensive one's drug consumption is).

Another moderator of assimilation versus contrast in IEM should be the fuzziness of the boundaries of the prime and the targets, with fuzzy and more permeable boundaries producing more assimilation. One may argue, for example, that exemplars have clearer boundaries than do categories. Indeed, Stapel and Koomen (1998) argued that priming of exemplars produces contrast, whereas priming of traits or categories causes assimilation. Consistently, in a series of studies, they found assimilation after they primed participants with sentences related to dependency. Participants who had been primed judged a target person to be more dependent than did the nonprimed control group. In contrast, participants who read about Linda, a dependent person, and thus were primed with an exemplar, rated the same target as less dependent than did the nonprimed control group, reflecting a contrast effect.[2]

Process Models of Assimilation Versus Contrast and Their Relation to IEM: Interpretation Versus Comparison, Selective Activation, and Reflection Versus Evaluation

Several more models were derived from IEM, identifying specific processes or processing goals that are likely to yield assimilation or contrast effects. For example, in their interpretation–comparison model (ICM) of social comparison, Stapel and Koomen (2000, 2001; see also Stapel & Suls, 2004, and for a related view, Blanton, 2001) proposed a distinction between an *interpretation mindset*, in which people try to make sense of a target, and a *comparison mindset*, in which people compare a target to a standard. They suggested that the former produces assimilation, whereas the latter, if the standard is sufficiently extreme, produces contrast. To test their proposal, Stapel and Koomen (2001) primed participants with mindsets of interpretation (e.g., priming *comprehend* or *interpret*) versus comparison (e.g., priming *compare* or *differ*) and demonstrated assimilation after the former and contrast after the latter.

It is easy to see that an interpretation processing goal or mindset leads to inclusion because one has to integrate the presented

[2] In this article, we decided to focus on anchoring rather than judged usability or more conscious contrast effects. However, we would like to mention that generally, awareness of the primes helps to define the boundaries between the prime and the target. People may decide that an "aware" prime is irrelevant to the question (or category) at hand and thus exclude it, whereas with an "unaware" prime, people do not know the source (i.e., the boundary) of the activation, and judgments about its irrelevance are less likely. If the prime is close enough to the target, an illusion is created that activation is caused by the target and is therefore relevant. In line with this logic, an early account of assimilation and contrast effects (Lombardi et al., 1987) suggested that aware primes produce contrast, whereas unaware primes produce assimilation (see also Higgins, 1996). As mentioned before, however, recent research showed that even unaware primes can lead to contrast effects by means of unconscious standard use of the prime. Thus, even though the general notion that aware primes might enhance contrast and exclusion is correct and might be incorporated in an IEM model, it is important to mention that awareness of the prime is not necessary to produce contrast effects in social judgment.

information into an existing knowledge structure. Comparison, however, naturally involves juxtaposition (i.e., construal of the standard as distinct from the target) and thus fosters exclusion. Interpretation and comparison thus produce assimilation versus contrast through induction of inclusion versus exclusion.

Another account that focuses on the comparison processes is the selective activation model (SAM) proposed by Mussweiler and Strack (2000; see also Mussweiler, 2003; Strack & Mussweiler, 1997). This model focuses on the integration of knowledge that is made accessible by the comparison process. During the comparison phase, people form a hypothesis and search for hypothesis-consistent information. For example, in comparing her athletic abilities with an extremely athletic standard, a person might try to examine the hypothesis "I am not athletic" and search her memory for confirming factual information (e.g., situations in which she was lazy). Using lexical decision tasks, Mussweiler and Strack (2000) found activation of different selective information patterns (e.g., faster lexical decision for words related to *athletic* or *unathletic*) when people were exposed to high versus low standards. To demonstrate the underlying process of similarity search implicated in the SAM account, Mussweiler (2001) induced similarity or dissimilarity search in an unrelated task prior to exposure to moderate standards. Those who had been induced to search for dissimilarities by a prior task exhibited judgments contrasting from the standard, whereas those who had searched for similarities exhibited assimilation. As with ICM, it is easy to see how SAM is related to IEM. Searching for similarities between a prime and a target leads to inclusion of the prime and the target in the same category, whereas searching for dissimilarities leads to exclusion.

Recently, Markman and McMullen (2003) suggested a model of assimilation versus contrast in comparative thinking: the reflective versus evaluative model (REM). REM explicitly incorporates inclusion–exclusion processes. Specifically, it proposes that inclusion instigates reflection, which involves experiential thinking and simulating a state of the world in which the standard is true (e.g., in comparing himself to Einstein, an individual imagines being as smart as Einstein and simulates this state of affairs) and leads to assimilation. Exclusion, on the other hand, instigates evaluation, in which the standard and the target are considered separately and the target is compared with the standard, resulting in a contrast (see Epstein, Lipson, Holstein, & Huh, 1992, for a related view). REM assumes that the reflective thinking is based on simulation rather than on activation of stored semantic knowledge (as is assumed in SAM) and thus may explain assimilation in situations when no immediately relevant factual knowledge exists. For example, people who almost boarded a doomed plane and feel bad about it do not recall similar instances, but they may nevertheless imagine or simulate that situation. In REM, reflection is an open-ended, generative process, which renders accessibility less selective and less dependent on stored memories than the search for standard-consistent knowledge in SAM.

In sum, many of the moderators of assimilation versus contrast discussed in the literature, both stimuli and processes, may be integrated into the general framework of the IEM. As Schwarz and Bless noted in their recent review of IEM (2007), "It is the diversity of these variables rather than the diversity of the underlying processes that results in the richness of empirical research into assimilation and contrast effects" (p. 124).

We would like to suggest that the inclusion of information and the search for similarities between the prime and the target are enhanced by global processing, whereas the exclusion of information and the search for differences between the prime and the target are enhanced by local processing. We thus add yet another moderator to the long list of inclusion–exclusion–related moderators of assimilation versus contrast. We think, however, that such addition is justified not only because global versus local processing cannot be reduced to other moderators but also because it is a basic distinction that has many psychological ramifications. For example, global processing has been shown to be associated with psychological distance (Liberman, Trope, & Stephan, 2007), creative thought (Friedman, Fishbach, Förster, & Werth, 2003), a promotion focus on ideals (Förster & Higgins, 2005), positive moods (Gasper & Clore, 2002), interdependent selves (Kühnen & Oyserman, 2002), and right hemispheric activation (Derryberry & Tucker, 1994) as well as lower levels of obsessionality (Yovel, Revelle & Mineka, 2005), and lower levels of anxiety (Mikulincer, Kedem, & Paz, 1990; Mikulincer, Paz, & Kedem, 1990), to name a few. If assimilation versus contrast is related to global versus local processing, then it should also be related to these variables. Because of that, we believe that our model paves the way to considering assimilation versus contrast processes in a broad psychological context. We now elaborate on global and local processing and their suggested relation to assimilation versus contrast.

Global Versus Local Processing

The distinction between global and local processing originates in cognitive psychology with the classic study by Navon (1977). In order to test the hypothesis that people tend to first look at the gestalt rather than at the details of a structure (i.e., the global precedence hypothesis), Navon presented participants with large letters (global characters) that were formed with small letters (local characters) and asked them whether a target letter was present on the screen. He found a global dominance effect, showing that, in general, participants' decisions were faster when the target matched the global letters than when it matched the local letters. Simple as it seems, the distinction between global and local processing proved to be of importance in cognitive, clinical, and social psychology (Delis, Robertson, & Efron, 1986; Fink et al., 1996; Förster & Higgins, 2005; Gasper & Clore, 2002; Kühnen & Oyserman, 2002; Lamb & Robertson, 1990; Liberman, Trope, & Stephan, 2007). How are these processing styles related to inclusion and exclusion processes?

Global Versus Local Model of Inclusion Versus Exclusion

We need to go one step back in order to relate perceptual processing styles to conceptual tasks, like the task of forming judgments in relation to a comparison standard. How is perceptual processing related to conceptual tasks? According to prominent views in cognitive psychology, high-level cognition is connected to and derives from perception (Barsalou, 1999; Finke, 1985; Gilbert, 1991; Masson, 1995). Prominently, Tucker and his colleagues (Tucker & Williamson, 1984; see also, Derryberry & Reed, 1998; Derryberry & Tucker, 1994; Luu, Tucker, & Derryberry, 1998) suggested that *perceptual scope* is closely related to

conceptual scope. More specifically, they suggested that the attentional selection of stored mental representations in long-term memory (conceptual scope) is related to the selection of sensory-based percepts (perceptual scope, see Anderson & Neely, 1996; Derryberry & Reed, 1998; Derryberry & Tucker, 1994; Luu et al., 1998).

Borrowing this notion, Friedman et al. (2003) reasoned that procedurally priming a perception on the gestalt of objects (e.g., city maps) would translate into activation of abstract concepts in memory and thus enhance the generation of unusual objects in an allegedly unrelated test phase. In an experiment, they showed that participants who underwent a global processing manipulation (i.e., being instructed to look at the entire gestalt of a city map) outperformed those who underwent a local processing manipulation (i.e., being instructed to look at the details of the same city map) when asked to generate the most unusual exemplar they could think of for a number of categories (e.g., birds, colors, fruits, and so on; see also Förster, Friedman, Özelsel, & Denzler, 2006). Presumably, local perception narrowed participants' conceptual attention, which in turn impaired their creative thinking (Ward, 1995). Notably, the priming phase and the test phase did not overlap in content, so that the effect of the priming on the performance in the creativity task has to be attributed to a process influence rather than a content influence.

Such processing style should also trigger inclusion. To include an exemplar into a category requires one to broaden the conceptual scope (by activating more abstract representations; Isen & Daubman, 1984). For example, consider the question, "Is a camel a vehicle?" One may think of a camel as a means to move from one place to another, which is similar to what a car or a bus does. On the contrary, exclusion involves focusing on concrete details that make the exemplar sufficiently distinct from typical members of the particular category. Deciding that a camel is not a vehicle involves noticing distinct features that do not fit the category, for instance, that a camel does not have wheels (see Friedman & Förster, 2002). It involves the construction of a narrow category (i.e., that vehicles have wheels). The results of Friedman et al.'s (2003) experiment in which participants after global priming generated more unusual exemplars could thus be based on an inclusion process of more remote information.

Global versus local processing may be related not only to inclusion versus exclusion but also to closely related processes, such as searching for similarities versus dissimilarities. For example, Förster (2007a) asked participants to look at a series of Navon letters (Navon, 1977) and then asked some participants to name the big letters (global priming condition) and some to name the small letters (local priming condition; see Förster & Higgins, 2005; Macrae & Lewis, 2002). Then, in an ostensibly unrelated task, participants searched for similarities or differences between pictures of flower bunches (Markman & Gentner, 1996). As predicted, after global priming, participants found more similarities than dissimilarities, whereas after local priming, the reverse was true. To sum up, global versus local processing could trigger further processes highly relevant for the development of assimilation or contrast effects, such as inclusion or exclusion and similarity search.

We will come back to the discussion of how GLOMO is different from other models of assimilation versus contrast in the General Discussion section, after we have presented the results of our experiments. For now, we would like to point out that looking at global versus local processing as a potential moderator of assimilation versus contrast offers a possible way to integrate processes of assimilation and contrast to novel psychological phenomena. On the empirical side, it allows the prediction that perceptual scope of attention, as activated by the Navon (1977) task or the map task (Friedman et al., 2003), affects assimilation versus contrast. On the theoretical side, it allows the connection to known antecedents and mediators of scope of processing. Of these, in the present article, we chose to examine psychological distance (which was related to more global processing in construal level theory, Liberman, Trope, & Stephan, 2007) and asymmetry in hemispheric activation (which Derryberry & Tucker, 1994, and Tucker & Williamson, 1984, related to global versus local processing).

Overview of the Experiments

In our experiments, we induced global versus local processing by the aforementioned map task (in Experiment 1; Friedman et al., 2003), the Navon task (in Experiments 2, 4, and 5; Macrae & Lewis, 2002), or introduction of varying temporal distances (Experiment 4; Liberman & Trope, 1998). For all paradigms, we expected the elicited processing styles to be shifted to the subsequent judgment phase (see Dodson, Johnson, & Schooler, 1997; Schooler, 2002).

In Experiment 1, we replicated the classic experiment by Srull and Wyer (1979) on impression formation, in which participants were primed with aggression-related or control words and then were asked to rate the aggressiveness of an ambiguously aggressive target person. Before the semantic priming, we induced either global or local processing. We expected higher aggressiveness ratings (i.e., more assimilation) after global processing than after local processing. Because most of the moderators of assimilation versus contrast were tested within this context of social comparison, in all subsequent experiments, we tested our hypotheses within this context. Thus, in Experiments 2–5, participants were asked to compare themselves either to high or to low standards. In addition to inducing global versus local processing, we also manipulated extremity of standards in Experiment 4 and introduced a lexical decision task to examine whether global versus local processing selectively activated standard-consistent versus standard-inconsistent information. In Experiment 5, we attempted to find initial evidence for hemispheric activation mediating assimilation or contrast effects.

Experiment 1: Global Versus Local Processing and Assimilation Versus Contrast in a Classic Impression Formation Paradigm

Method

Participants

Participants were 88 undergraduate students (60 women, 28 men) from 52 different nations majoring in different disciplines at the Jacobs University Bremen (formerly known as International University Bremen) in Germany. The study was conducted in English during their "Introduction to Social Psychology" class. Participants were randomly assigned to experimental conditions.

Six students chose to not take part in the experiment. There were no gender differences in any of the results reported.

Materials

Induction of processing style. We induced global versus local processing in a way similar to the procedure used by Friedman et al. (2003). Specifically, a map of the inner city of Oldenburg, Germany, was projected on the screen of the lecture hall, and participants were asked to examine it for 3 min. In the global processing condition, participants were asked to look at the map as a whole so that they could answer later questions about the overall shape of the map. In the local processing condition, participants were asked to look at the details of the map so that they could answer later questions about them. In the control condition, participants were asked to focus on both details and shape.

Semantic priming. The priming manipulation consisted of a word-search puzzle similar to the one used by Bargh and Gollwitzer (1994) and Mussweiler and Förster (2000). In particular, we used two word-search puzzles, 19 letters × 17 letters, each with 12 words that were arranged horizontally and vertically. All 12 words were listed on the right-hand side of the letter matrix. Both puzzles included 6 words that were neutral with respect to aggression (*board*, *radio*, *roof*, *clock*, *newspaper*, *bread*). The neutral puzzle included another 6 neutral words (*teapot*, *colorful*, *calendar*, *barge*, *chair*, *cup*) and the aggression puzzle included 6 aggression-related words (*violence*, *hatred*, *brutal*, *murder*, *attack*, *malicious*) that were successfully used in other studies (e.g., Mussweiler & Förster, 2000).

For our main dependent variable, we made use of Srull & Wyer's (1979) person perception task. In this task, participants read a paragraph about John, who is described as performing a number of ambiguously aggressive behaviors (e.g., denying a salesman entry into the apartment, refusing to pay rent until the landlord repainted the apartment). Previous research has shown that this paragraph is ambiguous with respect to its evaluative implications, as the target person may be perceived as either aggressive or assertive (e.g., Srull & Wyer, 1979; 1980). Participants then rated the target person on 10 bipolar scales, which ranged from 1 to 9, with endpoints labeled with antagonistic traits. The endpoints of the 2 critical scales, which appeared in the fifth and the eighth positions on the list, were labeled *assertive–hostile* and *determined–belligerent*. These 2 scales appeared along with 8 irrelevant scales (e.g., with endpoints labeled *self-confident–arrogant*, *cowardly–cautious*). The order of the traits was constant.

Procedure

Participants of an "Introduction to Social Psychology" class were asked to participate in an experimental session. The instructor announced a class demonstration of three different experiments on different psychological questions. He said that students were welcome to participate but could also choose not to participate. Participants were given four different folders. The first folder contained the general instructions. Here, participants were informed that they were about to take part in three separate studies, one on geographic abilities, one on cognitive performance, and one on person perception. It was pointed out that the three studies were unrelated and were administered together solely for efficiency reasons. The materials were printed in different fonts and on different types of paper.

The second folder contained the alleged geographic abilities task to induce a global versus local processing style. Participants were asked to focus on a map of the city of Oldenburg that was projected on the screen of the lecture hall. One third of the participants were instructed to attend to the global shape, one third to attend to the local details, and one third was asked to attend to both the details and shape of the map. After 3 min of observing the map, the participants were asked to answer a questionnaire concerning the map that was intended to render credibility to the cover story but was not analyzed

The third folder contained the semantic priming task, which was introduced as a pretest of materials that would later be used to examine cognitive performance. About half of the participants received the puzzle containing aggression-related words, whereas the other half received a puzzle containing no aggression-related words. Participants had 2 min to do the task, which none of the participants completed. We did this because a former study showed that priming effects are more likely to be effective if the priming task is interrupted (Förster, Liberman, & Higgins, 2005; Liberman, Förster, & Higgins, 2007; Martin, 1986).

The fourth folder contained the third impression formation task. Participants were informed that the purpose of the third study was to pretest materials for a study on social perception. They were asked to read the description of John and to rate him on the 10 bipolar scales.

A final set of questions examined participants' awareness of the actual purpose of the study, which was discovered by none of them. After completing the tasks in the folders, participants were thanked and debriefed. A class discussion revealed that no one felt that one task influenced the next and that participants enjoyed taking part in the study. In sum, Experiment 1 was based on a 3 (processing: global vs. local vs. control) × 2 (semantic priming: aggression vs. no aggression) between-participants factorial design.

Results

We averaged the two aggressiveness items ($r = .63$) to arrive at an aggressiveness score and submitted it to a 3 (processing: global vs. local vs. control) × 2 (semantic priming: aggression vs. no aggression) between-participants analysis of variance (ANOVA). The analysis revealed that, as can be seen in Table 1, participants primed with aggression judged the target person to be more aggressive ($M = 5.06$, $SD = 1.96$) than those not primed with aggression ($M = 4.35$, $SD = 1.20$), $F(1, 76) = 5.96$, $p = .017$. Moreover, participants in the global processing condition gave higher aggressiveness ratings ($M = 5.43$, $SD = 1.71$) than those in the control ($M = 5.04$, $SD = 1.40$) or the local ($M = 3.70$, $SD = 1.44$) processing condition, $F(2, 76) = 13.13$, $p < .0001$. Most important, these two main effects were qualified by the predicted interaction, $F(2, 76) = 21.57$, $p < .0001$, showing that processing style affected the impact of the prime. Results reflected an assimilation effect in the control processing condition; that is, participants judged the target person to be more aggressive after aggression priming ($M = 5.63$, $SD = 1.25$) than after nonaggression priming ($M = 4.29$, $SD = 1.23$), $t(25) = 2.79$, $p = .01$. This

Table 1
Experiment I: Mean Ratings (and Standard Deviations) of Aggressiveness and Traits Unrelated to Aggressiveness as a Function of Induced Processing Style and Semantic Priming

	Induced processing style					
	Local		Control		Global	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Rating of aggression						
Semantic priming of aggression	2.86	1.15	5.63	1.25	6.53	1.21
Semantic priming of neutral words	4.62	1.16	4.29	1.23	4.15	1.25
Rating of unrelated traits						
Semantic priming of aggression	4.72	0.43	4.43	0.44	4.58	0.67
Semantic priming of neutral words	4.41	0.40	4.53	0.45	4.64	0.49

assimilative effect was somewhat more pronounced in the global processing condition compared with the control processing condition ($M_{\text{aggression}} = 6.53$, $SD = 1.21$; $M_{\text{no aggression}} = 4.15$, $SD = 1.25$), $t(26) = 5.10$, $p < .0001$. Yet, in the local processing condition, as predicted, a contrast effect occurred: Participants judged the target person to be less aggressive after aggression priming ($M = 2.86$, $SD = 1.15$) than after nonaggression priming ($M = 4.62$; $SD = 1.16$), $t(25) = 3.96$, $p < .001$. There were no effects of the experimental manipulation on any of the other judgment scales, Fs < 1.4, *ns.*

We further examined whether aggressiveness ratings differed between the processing groups with two separate one-way ANOVAs for the aggression and the nonaggression priming groups. In the nonprimed groups, processing did not yield any significant effects, Fs < 1. In the primed groups, the analysis was significant, $F(2, 41) = 36$, $p < .0001$, as were all contrasts between processing conditions. Both the local processing condition, $t(41) = 6.19$; $p < .0001$, and the global processing condition, $t(41) = 2.04$; $p = .05$, differed significantly from the control condition.

To sum up, the experiment showed a significant moderation of processing style on the effects of semantic priming on person perception. Whereas global processing relative to control processing (i.e., participants focused on both details and shape of the map) intensified assimilation to the prime, local processing produced a significant contrast.

In the following experiments, we further examined the impact of processing styles on assimilation and contrast but turned to social comparison paradigms. Recently, research on social comparison has uncovered a multitude of moderators of assimilation versus contrast effects, including extremity of the comparison standard and use of objective versus subjective scales. We examined the effect of processing styles on assimilation versus contrast in the context of both of these variables.

Experiment 2: Global Versus Local Processing, Moderate Standards, and Subjective Versus Objective Scales

In this experiment, we induced global versus local processing by making participants attend to either large or small letters, respectively. In an allegedly unrelated task, they were asked to compare their own alcohol consumption with one of two celebrities who constituted either a moderately high standard (the British pop singer Robbie Williams) or a moderately low comparison standard (the former tennis star Steffi Graf). Without prior activation of processing styles, we expected participants to assimilate self-evaluations toward the moderate standards on the objective scale and contrast away from the standards on the subjective scale, as found by Mussweiler and Strack (2000). We expected global processing to tilt the balance toward assimilation and local processing to tilt the balance toward contrast. We also wanted to examine whether global versus local processing would override the effect of subjective versus objective scales, so that after local processing there would be a contrast effect on both scales, whereas after global processing there would be an assimilation effect on both scales.

Mussweiler and Strack's (2000) SAM explains the effect of scale type by suggesting that with objective scales, accessible knowledge affects judgment, whereas subjective scales are used as a reference point to anchor the judgment of comparison. Biernat and Manis's (2007) model on stereotypes also predicts assimilation on objective scales and contrast on subjective scales. According to the authors, this occurs because objective scales evoke comparison to the entire population, and information about the group is used to interpret the target (e.g., "She is a woman; therefore, she probably has high verbal skills"). Contrary to that, subjective scales evoke more local comparisons within the group (e.g., "For a woman, her verbal skills are not that high").

As mentioned before, we hypothesized, in line with IEM, that subjective scales would enhance contrast because the target and the standard are used to define the range of the scale on which they obviously occupy opposite ends. We believed, however, that if one took enough of a global perspective, then a value range wider than that defined by the target and the standard might be considered, thus allowing for inclusion and assimilation. We also thought that it might be possible that a local perspective would narrow the range of values around the target and the standard, and would thus produce exclusion and contrast, even with objective scales. Thus, we thought that both types of scales might produce both assimilation, if processed globally, and contrast, if processed locally. The next study examined these predictions.

Method

Participants

Participants were 124 undergraduate students (62 women, 62 men) at the University of Bremen majoring in disciplines other than psychology who were recruited for an experimental session described as consisting of diverse psychological tests. Participants were randomly assigned to conditions, tested in groups of up to 3 in sessions lasting approximately 2 hr, and paid 16 euros for participation.

Materials

We conducted a pretest to examine common attitudes about drug consumption among a number of rock, pop, and hip hop singers, and selected the British pop singer Robbie Williams, a well known celebrity in Germany, as our moderately high standard of drug consumption.[3] We conducted yet another pretest in which a different group of 20 participants estimated how often they and a number of celebrities engaged in a variety of behaviors. The critical questions pertained to the number of times the targets consumed drugs and alcohol within 1 month. On average, participants reported consuming drugs and alcohol about 10 times a month. Participants estimated that Robbie Williams (the high standard) consumes drugs and alcohol about 20 times a month, whereas Steffi Graf (the low standard) consumes drugs and alcohol about once to twice a month.

There were three questions about drug and alcohol consumption, gauging comparative, objective, and subjective estimates. One third of the participants were first asked whether they consumed drugs, including alcohol, more or less often than Robbie Williams (i.e., the high standard). The other third were asked whether they consumed drugs and alcohol more or less often than Steffi Graf (i.e., the low standard). One third of the participants did not answer a comparative question. In the subsequent objective judgment, all the participants were asked to estimate the number of times they consumed drugs and alcohol per month. Finally, using a rating scale that ranged from 1 (*not at all extensive*) to 9 (*very extensive*), all the participants indicated how extensive their drug and alcohol consumption was.

Procedure

Upon arrival of the participants, the experimenter handed out the materials of the two studies and pointed out that they were unrelated to each other and were administered together for efficiency reasons. Participants first completed the global–local processing task (Navon, 1977), which was administered on a computer and which presented a series of global letters (2.5 cm × 2.5 cm) that were formed with local letters (0.5 cm × 0.5 cm; i.e., each horizontal or vertical line making up a global letter was formed with five closely spaced local letters). On each trial, participants were first presented with a fixation cross (+) in the center of the screen for 500 ms. Then, one of eight global composite letters was randomly presented, and participants were instructed to press a blue response key if the stimulus contained the letter *L* and to press a red response key if the stimulus contained the letter *H*. They were asked to respond as quickly as possible. The task was set up so that by random assignment, one third of the participants always had to detect a global letter (global processing condition), one third of the participants always had to detect a local letter (local processing condition), and one third of the participants had to detect global and local letters equally often (control processing condition). More specifically, in the global processing condition, each set of composite letters included eight global targets (an *H* made of *F*s, an *H* made of *T*s, an *L* made of *T*s, and an *L* made of *F*s) and no local targets, whereas in the local processing condition, each set included eight local targets (an *F* made of *H*s, an *F* made of *L*s, a *T* made of *H*s, and a *T* made of *L*s) and no global targets. In the control processing condition, four of the composite letters included global targets (an *H* made of *F*s, an *H* made of *T*s, an *L* made of *T*s, and an *L* made of *F*s) and four local targets (an *F* made of *H*s, an *F* made of *L*s, a *T* made of *H*s, and a *T* made of *L*s). Participants worked on a total of eight sets of composite letters: 48 global, 48 local, or 24 global and local trials each.

Participants then received a folder with instructions on the social comparison task, modeled after the task used by Mussweiler (2001) and Mussweiler and Strack (2000). Participants were first informed that the purpose of this study was to pretest materials for future studies on self-evaluation. They were told that in order to obtain normative data for these studies, the experimenter would ask them a number of questions about drug consumption. Participants were told that before evaluating themselves, they would compare themselves to a celebrity: They were asked to bring this person to mind and to compare themselves with this person with respect to drug and alcohol consumption. Participants were encouraged to take some time to make this comparison. To ensure that participants did indeed engage in the respective comparisons, the experimenter asked them to indicate how difficult it was for them to make the comparison, using a scale ranging from 1 (*very easy*) to 9 (*very difficult*). There were no differences in experienced difficulty across conditions. Then, participants answered the two critical questions, one subjective and one objective question assessing self-evaluations of drug and alcohol consumption. The order of the two questions was counterbalanced and had no effects. This procedure was similar to that of Mussweiler and Strack (2000). After completion of the two tasks, participants were asked to perform other unrelated tasks, fully debriefed after the entire session, paid, and thanked for their participation. In sum, Experiment 2 was based on a 3 (processing: global vs. local vs. control) × 2 (standard: high vs. low) × 2 (scale: subjective vs. objective) factorial design, with only the last factor manipulated within participants.

Results

We expected to replicate Mussweiler and Strack's (2000) findings in the control processing condition, in that participants would assimilate evaluations of their alcohol and drug consumption toward the standards on the objective scale but would contrast it away from the standard on the subjective scale. We also predicted for both scales more assimilative effects and less contrastive

[3] We aimed to replicate a study by Mussweiler and Strack (2000), who used the musician Frank Zappa and tennis player Steffi Graf as comparison standards. However, we learned in a different pretest that only 30% of the tested sample knew who Frank Zappa was and 82% of them associated him with an anti-drugs campaign.

effects after induction of global processing than after induction of local processing. We wanted to examine whether global versus local processing would override the effects of the type of scale, so that no difference between objective and subjective scales would be detected after activation of global versus local processing style.

To allow comparisons of subjective and objective scales, we *z*-transformed all ratings (for means, see Table 2). We conducted a 3 (processing: global vs. local vs. control) × 2 (standard: moderately high vs. moderately low) × 2 (scale: objective vs. subjective) ANOVA for mixed designs, which yielded two-way interactions between scale and standard, $F(1, 118) = 5.69$, $p < .02$, and between processing and standard, $F(2, 118) = 10.31$, $p < .0001$. More important, the three-way interaction qualified these interactions, $F(2, 118) = 5.51$, $p = .005$. There were no other effects, Fs < 1.

The three-way interaction indicated that processing style affected the impact of standards differently for objective and subjective scales. More specifically, in the control processing condition, there was a tendency of a contrast effect on the subjective scale ($M_{high} = -0.28$, $SD = 0.34$, vs. $M_{low} = 0.12$, $SD = 1.49$), $t(40) = 1.25$, $p = .12$, and a marginal assimilation on the objective scale ($M_{high} = 0.07$, $SD = 0.79$, vs. $M_{low} = -0.45$, $SD = 0.98$), $t(40) = -1.87$, $p < .07$. Assimilation effects were found after global processing for both the objective scale ($M_{high} = 0.66$, $SD = 1.13$, vs. $M_{low} = -0.47$, $SD = 0.57$), $t(39) = 4.07$, $p < .0001$, and the subjective scale ($M_{high} = 0.30$, $SD = 0.89$, vs. $M_{low} = -0.20$, $SD = 0.66$), $t(39) = 2.06$, $p < .05$). Contrary to this finding, in the local processing condition, contrast effects were found for both the objective scale ($M_{high} = -0.41$, $SD = 0.83$, vs. $M_{low} = 0.60$, $SD = 0.99$), $t(39) = 3.53$, $p < 001$, and the subjective scale ($M_{high} = -0.29$, $SD = 1.10$, vs. $M_{low} = 0.36$, $SD = 1.07$), $t(39) = 1.92$, $p = .06$.

To sum up, in the control processing condition, we replicated Mussweiler and Strack's (2000) results, showing the expected pattern, with assimilation on the objective scale and contrast on the subjective scale; however, admittedly, assimilation versus contrast was not statistically significant if two-tailed *t* tests were used.[4] After global processing, however, assimilation occurred on both scales, whereas after local processing, a contrast effect occurred on both scales. It is possible that in the control conditions, global versus local processing style affected ratings unsystematically. In the experimental conditions, though, we bound variance by priming manipulations, and results confirmed our predictions.

Table 2
Experiment 2: Mean Z-Transformed Judgments (and Standard Deviations) as a Function of Induced Processing Style, Scale, and Standard

	Induced processing style					
	Local		Control		Global	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Subjective scale						
High standard	−0.29	1.10	−0.28	0.34	0.30	0.89
Low standard	0.36	1.07	0.12	1.49	−0.20	0.66
Objective scale						
High standard	−0.41	0.83	0.07	0.79	0.66	1.13
Low standard	0.60	0.99	−0.45	0.98	−0.47	0.57

We think that this was the case because global processing widened the scope of conceptual processing, allowing the inclusion of both the target and the standard of comparison in the same category, whereas local processing narrowed conceptual scope, fostering perception of the prime and the target as belonging to different categories. In the next experiment, we aimed to replicate the results with another induction of global versus local processing style—temporal distance.

Experiment 3: Time Perspective, Moderate Standards, and Subjective Versus Objective Scales

Construal level theory (Liberman, Trope, & Stephan, 2007; Trope & Liberman, 2003) suggests that increasing a perceiver's psychological distance from a stimulus causes him or her to construe that stimulus in a more abstract manner. Several lines of research are consistent with this analysis. For example, Liberman, Sagristano and Trope (2002, Study 1) found that temporal distance influenced the way in which participants classified objects that were part of future activities (e.g., a camping trip). The same set of items (e.g., potato chips, boots, hot dogs, blanket) was classified into fewer, broader categories when the items pertained to more distant future activities. Related to this finding, Förster, Friedman, and Liberman (2004) showed that temporal distance increased performance in the Snowy Picture Test and in the Gestalt Completion Test, both of which require abstracting a global visual image and ignoring local details that constitute noise. Conceptually similar effects on abstraction and global processing have also been found with other dimensions of psychological distance: spatial distance (Fujita, Henderson, Trope, Eng, & Liberman, 2006; Henderson, Fujita, Trope, & Liberman, 2006), hypotheticality (Wakslak, Trope, & Liberman, 2006), and social distance (Stephan, Liberman & Trope, 2007; see also Idson & Mischel, 2001). Recently, distancing has been shown to also affect performance on the Navon task, increasing the efficiency of global perception and decreasing local perception (Liberman & Förster, 2007). If our reasoning is correct, we would expect temporal distance to increase the tendency for assimilation and inclusion and decrease the tendency toward contrast and exclusion.

Participants in our experiment compared their athletic skills to either a moderately high standard (race car driver Michael Schumacher) or a moderately low standard (former U.S. president Bill Clinton) and then rated (on both an objective scale and a subjective scale) their expected athletic performance in an athletic competition the day after or 1 year from the time of the experiment. In the control condition, time was not specified. As in Experiment 2, we expected that relative to the control condition, global processing (induced by the distant time perspective) would enhance assimilation (and reduce contrast) and local processing (induced by the

[4] Note that in the Mussweiler & Strack (2000) studies (Experiments 3 and 4), although the interactions between high versus low standard and objective versus subjective scales were significant, contrasts were either not reported (Study 4) or were tested with less conservative one-tailed *t* tests (Study 3), which showed a significant assimilation effect for objective scales, $t(18) = 2.53$, $p < .01$, but only a marginal contrast effect for subjective scales, $t(18) = 2.53$, $p < .07$ (both one tailed). Thus, even though results seem to replicate across studies, the effects are potentially weak.

proximal time perspective) would enhance contrast (and reduce assimilation) on both scales.

Method

Participants

Participants were 132 undergraduate students (72 women, 60 men) at the University of Bremen majoring in disciplines other than psychology who were recruited for an experiment consisting of diverse psychological tests. The experiment was conducted in German at Jacobs University Bremen. Participants were randomly assigned to conditions and were tested in groups of up to 3 in sessions that lasted approximately 2 hr. Participants were paid 16 euros for their participation. Three participants had to be excluded because they did not respond to all questions. Two other participants were excluded because of experimenter errors.

Procedure

After working on several unrelated tasks for approximately 60 min, participants received a folder with instructions on the social comparison task, which was modeled after the task used by Mussweiler and Strack (2000) and Stapel and Suls (2004). Participants were first informed that the study was a pretest of materials for future studies on self-evaluation. They were further told that to obtain normative data for these studies, the experimenter would ask them a number of questions about their athletic abilities; however, before evaluating themselves, they would be asked to compare themselves with a celebrity: They were asked to bring this person to mind and to compare themselves with this person with respect to athletic abilities. Participants were encouraged to take some time to make this comparison. They were either asked to compare themselves to a moderate athletic standard (Michael Schumacher)[5] or to a moderately unathletic standard (Bill Clinton). To ensure that participants did indeed engage in the comparisons, we asked them to indicate how difficult it was for them to make the comparisons on a scale ranging from 1 (*very easy*) to 9 (*very difficult*). There were no differences in experienced difficulty across conditions.

Then, participants were instructed to imagine that they would participate in an athletics competition the day after or 1 year from the experiment; thus we manipulated proximal versus distal time perspective, respectively. A control group was asked to imagine an athletics competition without a time indicator. Participants then answered questions on their athletic performance on that competition. Two questions introduced an objective scale: Participants were asked to estimate the maximum number of knee bends and push-ups they could do. The third question—"How athletic do you think you are?"—introduced the subjective scale, which ranged from 1 (*not that athletic*) to 9 (*very athletic*). Whether the objective or subjective measure came first was counterbalanced and had no effect on any of the results. In this experiment, we also controlled for participants' mood, since mood has been shown to affect global versus local processing styles (see Gasper & Clore, 2002; for a detailed discussion, see General Discussion). Temporal distance may change moods. Specifically, it is possible that because people tend to have a more positive view of the more distant future (e.g., Peterson, 2000; Weinstein, 1980), a distant time perspective would enhance mood.

In order to control for possible mood effects, we asked participants to indicate how they felt at the moment on a scale ranging from 1 (*very bad*) to 9 (*very good*). After some unrelated tasks, participants were fully debriefed, paid, and thanked for their participation. In sum, Experiment 3 was based on a 3 (temporal distance: distant future vs. near future vs. control) × 2 (standard: high vs. low) × 2 (scale: objective vs. subjective) factorial design, with only the last factor manipulated within participants.

Results

Similar to Experiment 2, answers on both objective and subjective scales were *z*-transformed. We conducted a 3 (temporal distance: distant future vs. near future vs. control) × 2 (standard: moderately high vs. moderately low) × 2 (scale: objective vs. subjective) ANOVA for mixed designs, which yielded two-way interactions between scale and standard, $F(1, 120) = 9.28$, $p = .003$, and between time distance and standard, $F(2, 120) = 29.55$, $p < .0001$. More important, the predicted three-way interaction was also obtained, $F(2, 120) = 4.51$, $p = .013$. There were no other effects, Fs < 1. To better understand the three-way interaction, we now turn to examine the assimilation and contrast effects in each of the temporal distance conditions.

As can be seen in Table 3, the control condition revealed the typical pattern of assimilation on objective scales ($M_{high} = 0.36$, $SD = 1.08$, vs. $M_{low} = -0.36$, $SD = 0.77$), $t(38) = 2.44$; $p < .02$, and contrast on subjective scales ($M_{high} = -0.25$, $SD = 0.85$, vs. $M_{low} = 0.25$, $SD = 1.01$), $t(38) = 1.60$, $p = .12$. As we found in Experiment 2, it seems that the general pattern of results described in Mussweiler & Strack (2000) can be obtained; however, it was difficult to obtain significant results with two-tailed *t* tests (see also Footnote 4). Consistent with our predictions, in the distant future condition, assimilation occurred on both the objective scale ($M_{high} = 0.56$, $SD = 1.04$, vs. $M_{low} = -0.58$, $SD = .51$), $t(41) = 4.5$, $p < .0001$, and the subjective scale ($M_{high} = 0.64$, $SD = 0.75$, vs. $M_{low} = -0.67$, $SD = 0.78$), $t(41) = 5.64$, $p < .0001$. Also consistent with our predictions, in the near future condition, contrast occurred on both the objective scale ($M_{high} = -0.35$, $SD = 0.33$, vs. $M_{low} = 0.36$, $SD = 1.29$), $t(41) = 2.53$; $p < .02$, and the subjective scale ($M_{high} = -0.71$, $SD = 0.72$,vs. $M_{low} = 0.68$, $SD = 0.72$), $t(41) = 6.30$, $p < .0001$. Thus, as in Experiment 2, we replicated Mussweiler and Strack's (2000) results in the control condition, with assimilation on the objective scale and contrast on the subjective scale. In the distant future condition, however, assimilation occurred on both scales, whereas in the near future condition, a contrast effect occurred on both scales.

We examined whether mood mediated any of the obtained results but found no differences between conditions in reported mood, Fs < 1.5, ps $> .23$. In addition, when entered as a covariate, mood had no effect and did not change the significance of the

[5] We attempted to replicate the studies with race driver Niki Lauda, who was used as a moderately high standard in Mussweiler and Strack's (2000) research, but only a few of our participants knew who he was. Thus, we conducted pretests and identified race driver Michael Schumacher as a moderately high standard with respect to athletic abilities.

Table 3
Experiment 3: Mean Z-Transformed Judgments (and Standard Deviations) as a Function of Time Perspective Scale, and Standard

	Time perspective					
	Near future (tomorrow)		Control condition		Distant future (1 year)	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Subjective scale						
High standard	−0.71	0.72	−0.25	0.85	0.64	0.75
Low standard	0.68	0.72	0.25	1.01	−0.67	0.78
Objective scale						
High standard	−0.35	0.33	0.36	1.08	0.56	1.04
Low standard	0.36	1.29	−0.36	0.77	−0.58	0.51

results. Thus, it seems that mood did not mediate the obtained results.

The effect of temporal distance on assimilation and contrast would suggest that similar effects would be found if we manipulated other distance dimensions, as well as level of construal. For example, familiar others should be assimilated to a standard more than unfamiliar others (see Mussweiler & Bodenhausen, 2002), and thinking about a standard's actions in high-level *why* terms (e.g., "Why is Bill Clinton out of shape?") should enhance assimilation, whereas thinking of the same person in low-level *how* terms (e.g., "In what way is Bill Clinton out of shape?") should enhance contrast. Our notion would also suggest similar effects for the dimension of hypotheticality, which is another form of psychological distance, whereby likely, high-probability effects are proximal and unlikely, improbable events are distant (as is suggested by expressions like "remote possibility"; see Wakslak et al., 2006). We could predict that the different alternative outcomes of an unlikely event (e.g., an earthquake) would seem more similar to each other (i.e., would be assimilated to each other) than the outcomes of a more likely event (e.g., accepting a job at another university). More generally, we thought that connecting the question of assimilation versus contrast to psychological distance opened the door to many interesting and important social psychological questions.

Note that the present experiment is different from the former experiments with respect to the stage at which global versus local processing was introduced. Whereas in Experiments 1 and 2, participants "opened up" or "narrowed down" perception before being exposed to the comparison standard, in this experiment, they were exposed to the standard before being induced with local versus global perception (i.e., before the temporal distance manipulation). We may assume that selective activation took place before global versus local processing was introduced. It seems, therefore, that global versus local processing affected not only the information that was being activated but also how the activated information was used. In that way, global versus local processing afforded inclusion versus exclusion of already processed stimuli.

Of course, these results do not mean that GLOMO is irrelevant for information search and selective activation, a process that we examined more thoroughly in the next experiment. We think that because GLOMO, as a relative of IEM, addresses both information activation and use of activated information, it goes beyond the former models, which suggested processes that operate at either the perception phase (like SAM) or the judgment phase (see ICM).

Study 4 examines local versus global processing in combination with another moderator of assimilation versus contrast: extremity of standard. The literature reports that extreme standards produce contrast rather than assimilation more than do moderate standards (Herr, 1986; Herr et al., 1983; Mussweiler et al., 2004; Stapel & Blanton, 2004). We predicted that a global processing style would lead to assimilative effects with both extreme and moderate standards and that a local processing style would lead to contrast effects with both extreme and moderate standards. This is because even extreme exemplars can be included into a category if it is sufficiently broad. Similarly, if the category is narrow, even moderate exemplars may be excluded from it (see Isen & Daubman, 1984). We also investigated the accessibility of standard-consistent and standard-inconsistent knowledge to test whether the induction of a global processing style leads to a similarity search in memory; the induction of a local processing style should instead lead to a dissimilarity search in memory.

Experiment 4: Global Versus Local Processing, Moderate Versus Extreme Standards, and Accessibility of Standard-Related Knowledge

In order to manipulate extremity of the comparison standard and accessibility of the self, we modeled Experiment 4 after that of Dijksterhuis and colleagues (1998), which showed contrast effects with extreme exemplars (see also Herr, 1986; Herr et al., 1983; Manis, Nelson, & Shedler, 1988). On the basis of classic research by Herr (1986) and Sherif and Hovland (1961) among others, those authors argued that extreme standards produce contrast because they trigger comparison rather than interpretation mindsets (see also Stapel, Koomen, & Van der Pligt, 1996; 1997). A similar prediction follows from IEM because extreme standards are by definition close to or even outside of category boundaries and may thus represent lateral (i.e., mutually exclusive) categories, which would be excluded from the target and thus lead to contrast (Schwarz & Bless, 2007).

For example, upon seeing a picture of Albert Einstein, one might think, "I am not Einstein. I am not smart. I am dumb." (Dijksterhuis et al., 1998, p. 864). One study by Dijksterhuis et al. (1998) showed the importance of self-comparison processes for contrast effects. Participants imagined either a social category associated with high intelligence (professor) or an intelligent exemplar (Albert Einstein). Dijksterhuis et al. reasoned that if the extreme exemplar (but not the category) led to a comparative conclusion (e.g., "I am stupid"), then this process should be facilitated by priming a self-concept. After being exposed to the comparison standards, participants made lexical decisions on words related to intelligence, words related to stupidity, unrelated words, and nonwords. Each of the words or nonwords was preceded by a subliminal prime that was either related to the self (e.g., *I*, *me*, *my*) or unrelated to the self (e.g., *the*, *and*). It was found that participants who were presented with the standard *Albert Einstein* responded faster to stupidity words than to intelligence words and

unrelated words compared with those participants who were presented with the category *professor*. This, however, was only the case if the target words were preceded by self-primes, not when they were preceded by control primes. Presumably, the self prime enhances the saliency of the self category, thereby triggering a comparison process with an exemplar (but not with a category).

We predicted that after global processing, as compared with a control condition, the typical contrast to an extreme standard would be eliminated, giving rise to assimilation because even extreme exemplars could be included in a broadened category. We also predicted that after local processing, the typical assimilation to a moderate standard would be eliminated, giving rise to a contrast effect. This is because even a moderate standard can be excluded from a narrow category.

In the present experiment, we asked participants to compare themselves with either a moderate or an extreme standard that was either high or low in athletic performance. We then assessed the accessibility of standard-consistent versus standard-inconsistent words via a lexical decision task, after presenting a prime that was either related to the self (e.g., the word *me*) or not related to the self (e.g., the word *and*) before each target word. Finally, we gauged participants' self-rating of athletic performance on the same objective scale used in Experiment 3. SAM (Mussweiler, 2003) predicts that participants would base their self-ratings on accessible knowledge and that therefore the measures of accessibility and self-ratings would show a similar pattern. Specifically, global processing should enhance the accessibility of standard-consistent information and lead to assimilation. Moreover, local processing should enhance the accessibility of standard-inconsistent information and lead to a contrast effect. Furthermore, effects on accessibility should be stronger when self-related primes were presented before the words in the lexical decision task, as found by Dijksterhuis et al. (1998) and Mussweiler and Strack (2000). Generally, GLOMO shares the assumption that selective accessibility drives assimilation and contrast effects in judgments. However, GLOMO includes the possibility that assimilation and contrast can be produced by other mechanisms such as simulation of nonfactual knowledge (see Markman & McMullen, 2003) or use of a different scale.

Method

Participants

Participants were 120 undergraduate students (64 women, 56 men) at the University of Bremen majoring in disciplines other than psychology who were recruited for an experimental session consisting of diverse psychological tests and lasting approximately 2 hr. They were paid 16 euros for their participation. Four participants refused to answer some of the questions and were excluded from the analysis.

Materials and Procedure

After arrival, participants were asked to perform diverse, allegedly unrelated tasks. The first task they worked on was the global–local processing task used in Experiment 2. To reduce the experimental design, we used no control priming group in the present experiment. Afterwards, participants performed a comparison task that was modeled after that used by Dijksterhuis et al. (1998). Participants were led to separate booths and seated at a predetermined distance from a 75-Hz computer monitor. Instructions on the computer screen explained that the study would examine the extent to which cognitive performance was influenced by comparisons with others. Participants were told that they would first compare themselves to a famous person and then engage in a cognitive task. Afterwards, they were instructed about the upcoming lexical decision task—they were told that letter strings would appear on the computer screen and that they would have to decide whether they were German words or not. Half of the participants were told to press the *X* key to indicate that the presented letter string was a word and the *period* key to indicate that it was not a word. For the other half, the key assignment was reversed. To reduce variance in response latencies, the experimenter told the participants to concentrate on the fixation point that appeared in the center of the screen, where the letter strings would then appear, to position their forefingers on the two keys, and to keep this position throughout the lexical decision task. Participants were instructed to solve this task as quickly and as accurately as possible.

After they had read the instructions on the lexical decision task, participants were asked to compare their athletic ability to a target person. Participants were randomly assigned to one of four targets: race driver Michael Schumacher (the moderately high standard), bicycle racer Jan Ulrich (the extremely high standard), former U.S. president Bill Clinton (the moderately low standard), and former German chancellor Helmut Kohl (the extremely low standard).[6] A pretest with a similar sample showed that these standards produced assimilation for the moderate standards and contrast for the extreme standards.

The lexical decision task immediately followed the comparison task. We used four different sets of stimuli words: standard-consistent, standard-inconsistent, neutral, and nonwords. Of all 27 presented words, 4 words were associated with being athletic (*fit* [fit], *athletisch* [athletic], *dynamisch* [dynamic], *trainiert* [in good shape]), 4 were associated with being unathletic (*steif* [stiff], *schwach* [weak], *schwerfällig* [heavy], *plump* [plump]), 10 words were neutral (e.g., *läutern* [purify], *Kuh* [cow]), and nine were nonwords (e.g., *molen, schonzem*). These stimuli were identical to Mussweiler and Strack's (2000) stimuli. Nevertheless, we pretested the words of the first two sets with a sample similar to the one in the present experiment and found that the words were indeed related to being athletic and being unathletic, respectively. We combined half of the stimuli words with self-primes, which were words closely associated with the self (*Ich* [I], *mein* [my], *mir* [me]), and the other half with control primes which were not associated with

[6] Michael Schumacher was at that time a famous Formula One race driver. Jan Ulrich was a professional road bicycle racer, the first German to win the Tour de France. The experiment took place before he was part of a doping scandal. Helmut Kohl was a chancellor of Germany and was known for his lack of interest in sports.

the self (*und* [and], *oder* [or], *aber* [but]).[7] Altogether, we constructed two lists of 27 prime–target combinations for the lexical decision task. In the first list, half of each target category was preceded by a suboptimally presented self-prime, whereas the other half was preceded by a suboptimally presented neutral prime. For the second list, this assignment was reversed, so that across the two lists each word was preceded once by a self-prime and once by a neutral prime. Within the two prime categories, the individual primes were randomly assigned to the specific targets. The order of the prime–target combinations was randomly determined for both lists. Thus, for each list, 2 of the words that were associated with being athletic were preceded by a self-prime, and 2 were preceded by a neutral prime. Similarly, 2 of the words that were associated with being unathletic were preceded by a self-prime, and 2 were preceded by a neutral prime. In addition, 5 of the neutral words and 4 of the nonwords were preceded by a self-prime, and the remaining 5 neutral words and 5 nonwords were preceded by a neutral prime. All primes were presented suboptimally (60-ms presentation with a 60-ms mask).

In sum, after the global–local processing task participants compared themselves with moderately high, extremely high, moderately low, or extremely low standards of athletic performance and then made lexical decisions about words associated with being athletic and words associated with being unathletic. Half of these lexical decisions were preceded by a suboptimal self-prime, and the other half were preceded by a suboptimal control, non-self-related prime. Finally, participants estimated the maximum number of knee bends and push-ups they could perform (i.e., estimated their athletic performance on an objective scale). We did not include a subjective scale to reduce the experimental design.

Thus, our experiment comprised two dependent measures: Lexical decision times served as our first dependent measure; responses on the objective scale were the second measure. For the lexical decision, the experimental design was a 2 (processing: global vs. local) × 2 (standard: high vs. low) × 2 (extremity of standard: extreme vs. moderate) × 2 (word type: related to athletic vs. related to unathletic) × 2 (self-priming: self vs. control prime) factorial design. In this design, the first three factors were manipulated between participants, whereas the last two factors were manipulated within participants. For the scale ratings, the experimental design was the same except for the two last factors, which were excluded.

Results

In presenting the results, we start with participants' self evaluations. We then move to examine reaction times of lexical decisions and finally to examine mediation of objective ratings by accessibility of standard-related knowledge as measured by the length of time taken to make lexical decision.

Self-evaluations. We calculated the mean number of knee bends and push-ups and conducted a 2 (processing: global vs. local) × 2 (direction of standard: high vs. low) × 2 (extremity of standard: extreme vs. moderate) between-subjects ANOVA. This analysis yielded the predicted two-way interaction between direction of standard and processing, $F(1, 108) = 10.14$, $p < .002$. There were no other significant effects, all Fs < 1. The obtained interaction indicated that, as predicted, both extreme and moderate standards produced assimilation after global processing ($M_{high} = 40.88$, $SD = 4.20$; $M_{low} = 23.64$, $SD = 4.50$), $t(56) = 2.65$, $p < .01$, and a contrast effect after local processing ($M_{high} = 27.58$, $SD = 4.34$; $M_{low} = 38.04$; $SD = 4.34$), $t(56) = -1.90$, $p = .06$. The results are summarized in Table 4. It seems that after activation of a local versus global processing style, the typical effect of standard extremity was not replicated. Instead of assimilating to a moderate standard and contrasting away from an extreme standard, participants with global processing assimilated their self-evaluations to both moderate and extreme standards, whereas participants with local processing contrasted their judgments away from both moderate and extreme standards.

Lexical decision times. We omitted reaction times that were more than 3 standard deviations higher or lower than the mean reaction time for each target word (1.2 % of the responses). An assimilationlike effect would be expressed by an enhanced accessibility of athletic words and a reduced accessibility of nonathletic words with an athletic standard (i.e., when direction of standard was high) compared with an unathletic standard (i.e., when direction of standard was low). A contrastlike effect would produce an opposite pattern: a reduced accessibility of athletic words and an enhanced accessibility of nonathletic words with an athletic standard (i.e., when direction of standard was high) compared with an unathletic standard (i.e., when direction of standard was low). We conducted a 2 (processing) × 2 (direction of standard) × 2 (extremity of standard) × 2 (word type) × 2 (self-priming) ANOVA for mixed designs. The results are summarized in Table 5.

On the basis of SAM (Mussweiler & Strack, 2000) and GLOMO, we predicted an assimilationlike effect would occur after global processing, and a contrastlike effect would occur after local processing, but only with words that had been primed with self-related concepts. Thus, we expected a four-way interaction among processing, direction of standard, self-prime, and word type. The analysis revealed no significant main effects, all Fs < 1, but a significant two-way interaction between word type and direction of standard, $F(1, 108) = 14.39$, $p < .0001$, and a significant three-way interaction among direction of standard, word type, and processing style, $F(1, 108) = 27.82$, $p < .0001$. There were no other significant lower order interactions. These interaction effects were further qualified by the predicted four-way interaction among processing, direction of standard, self-priming, and word type that proved to be significant, $F(1, 108) = 26.17$, $p < .0001$. This interaction was not further qualified by a five-way interaction with

[7] A reviewer suggested that the distinction between the primes does not necessarily reflect a manipulation of self-relevance but rather could reflect a difference on the dimension "person" versus "no person." This is possible. We wanted to replicate former studies that produced assimilation versus contrast effects only under the condition that self-primes preceded the judgments (see Dijksterhuis et al. 1998; Mussweiler & Strack, 2000). Future research should examine whether similar results could be obtained with "person not me" primes (e.g., *she* or *her*). For our purposes, however, what is important is that accessibility was affected by global versus local processing and that it mediated the effect of global versus local processing on judgment. From this perspective, the interpretation of the results would not change even if a similar effect may be obtained by "person not me" primes.

Table 4
Experiment 4: Mean Judgments (and Standard Deviations) of Athletic Ability as a Function of Induced Processing Style, Extremity of Standard, and Direction of Standard

Extremity of standard	Induced processing style: Local *M*	Local *SD*	Global *M*	Global *SD*
Moderate				
High direction	27.30	11.28	36.80	31.71
Low direction	34.75	23.21	24.75	12.78
Extreme				
High direction	27.86	15.68	44.97	33.53
Low direction	41.33	30.46	22.54	9.11

extremity of standard, $F < 1$. To better understand this effect, we now examine more specific predictions.

As noted before, we predicted an effect of processing, direction of standard, and word type on lexical decision times for words preceded by a self-prime but not for those preceded by a self-irrelevant prime. Thus, we conducted separate analyses for words preceded by a self-prime and words preceded by a control prime. When the prime was unrelated to the self, a 2 (processing: global vs. local) × 2 (standard: high vs. low) × 2 (extremity of standard: extreme vs. moderate) × 2 (word type: related to athletic vs. related to unathletic) yielded no significant three-way interaction, $F < 1.1$. However, when the primes were related to the self, the same analysis yielded a three-way interaction among processing, standard, and word type, $F(1, 108) = 39.65$, $p < .0001$. This interaction was not qualified by extremity of standard.

In the following, we present simple comparison analyses to examine differences in accessibility of athletic and unathletic words between the high and low standard conditions. We examined only the self-priming condition (as no effects on accessibility were obtained in the non-self-priming condition) and collapsed data across extreme and moderate standards (as extremity did not affect accessibility).

We conducted two separate 2 (word type) × 2 (standard) analyses for global and local priming conditions, respectively. These analyses revealed a significant two-way interaction in the local priming condition, $F(1, 56) = 42.09$, $p < .0001$, and a (somewhat weaker) two-way interaction for the global priming condition, $F(1, 56) = 4.47$, $p < .04$. Further contrast analyses showed a significant contrast for the local priming condition for athletic words ($M_{high} = 689$, $SD = 201$, and $M_{low} = 557$, $SD = 81$), $t(56) = 3.26$, $p < .002$, as well as for unathletic words ($M_{high} = 550$, $SD = 133$, and $M_{low} = 693$, $SD = 74$), $t(56) = 5.07$, $p < .001$). For the global priming condition, means were in the predicted direction of assimilation effects, but the contrasts were not significant ($M_{high} = 589$, $SD = 82$, and $M_{low} = 648$, $SD = 184$), $t(56) = 1.61$, $p = .11$, for the athletic words, and ($M_{high} = 631$, $SD = 121$, and $M_{low} = 613$, $SD = 73$), $t < 1$, for the unathletic words).

We find it interesting that even though we found significant assimilation and contrast effects on the self-evaluation measures in both the global and the local priming conditions, the accessibility measures only partly supported our hypotheses. For the local priming condition, we found significant contrast effects; for the global priming condition, means were in the predicted direction of assimilation effects, but the contrasts did not reach significance (although the interaction was significant). This might suggest that accessibility only partly mediates effects on evaluation, a possibility we examine in the next section.

Mediation analyses. We now examine whether accessibility as measured in the lexical decision task mediated the effect of direction of standard on self-judgments. According to Baron and Kenny (1986), two necessary preconditions for establishing mediation are (a) that the independent variable must predict both the dependent variable and the mediator (an effect we already reported earlier) and (b) that the mediator must predict the dependent variable. Once these preconditions are fulfilled, the dependent variable regresses onto the independent variable and the mediator in a final regression analysis. Support for mediation is obtained by showing that the effect of the independent variable (i.e., high vs. low standard) on the dependent variable (i.e., the judgment) is significantly reduced when one has accounted for the effect of the hypothesized mediator (i.e., accessibility of athletic vs. unathletic words).

Table 5
Experiment 4: Mean Reaction Times (and Standard Deviations) as a Function of Induced Processing Style Priming, Word Type, Standard, and Extremity of Standard

Extremity of standard	Local processing style: Self-priming: Athletic words *M*	*SD*	Unathletic words *M*	*SD*	Control priming: Athletic words *M*	*SD*	Unathletic words *M*	*SD*	Global processing style: Self-priming: Athletic words *M*	*SD*	Unathletic words *M*	*SD*	Control priming: Athletic words *M*	*SD*	Unathletic words *M*	*SD*
Moderate																
High	695	163	538	137	635	88	601	55	589	77	633	101	646	75	599	65
Low	516	61	698	59	579	92	628	83	643	172	625	81	626	71	624	185
Extreme																
High	682	242	563	132	632	100	618	110	589	88	629	140	611	82	604	84
Low	596	80	689	88	659	94	650	98	653	203	600	65	641	58	640	66

We conducted two mediation analyses, one for the local condition and one for the global condition. In both analyses, low standard was coded as –1 and high standard was coded as 1. In order to test for mediation, we used a difference score of accessibility of athletic and unathletic words (athletic–unathletic). Because extremity of standard did not affect either accessibility or ratings, we cumulated data over this factor, and because effects on lexical decisions were predicted and were only found for words preceded by a self-prime, we included these words only in the mediation analyses.

Self-ratings of athletic ability were related to accessibility in both the local priming condition, $\beta = -.36$, $t(56) = -2.86$, $p < .01$, and the global priming condition, $\beta = -.43$, $t(56) = -3.53$, $p < .001$. Higher accessibility of athletic concepts (i.e., faster lexical decisions for those concepts) relative to the accessibility of unathletic concepts enhanced self-ratings of athletic ability. Direction of standard (high vs. low) predicted the difference in accessibility of athletic versus unathletic words in both the local priming condition, $\beta = .66$, $t(56) = 6.49$, $p < .001$, and the global priming condition, $\beta = -.27$, $t(56) = -2.09$, $p < .04$.

We turn now to the regression analyses. Self-ratings were significantly predicted by direction of standard in the local priming condition, $\beta = -.25$, $t(56) = -1.90$, $p = .06$, and in the global priming condition, $\beta = .33$, $t(56) = 2.65$, $p < .01$ (of course, as noted before, the direction of this effect was opposite, representing contrast after local priming and assimilation after global priming). In the local priming condition, when both direction of standard and the relative accessibility of athletic versus unathletic words were entered into the regression, the effect of direction of standard was rendered insignificant, $\beta = -.02$, $t(56) = -0.12$, $p = .90$, whereas in the global priming condition, the effect of direction of standard remained significant even after we controlled for accessibility of athletic versus unathletic words, $\beta = .24$, $t(56) = 1.93$, $p = .06$.

We conducted two Sobel tests for local and global conditions. The mediation was significant in the local priming condition, $Z = 1.96$, $p = .05$, but not in the global priming condition, $Z = 1.71$, $p = .09$. Thus, accessibility of athletic versus unathletic words significantly mediated the effect of comparison standard on self-rating in a local processing condition but not in the global processing condition, in which the mediation was not significant and the direct effect of standard on self-ratings remained significant even after the mediator was controlled. In other words, if a local processing style was induced, knowledge about sportsmanship was activated when participants compared themselves with a low, unathletic standard, and knowledge about lack of sportsmanship was activated when participants compared themselves with a high, athletic standard. Participants then used this knowledge to judge their own athletic ability, producing a contrast effect. A similar effect, however, was not obtained if a global processing style was induced. Although knowledge about sportsmanship was activated when participants compared themselves with a high, athletic standard and knowledge about lack of sportsmanship was activated when people compared themselves with a low, unathletic standard and although this knowledge was then used for the judgment; it seems that the assimilation effect was not fully accounted for by this enhanced accessibility.

These mediation results provide some support for SAM (Mussweiler & Strack, 2000), according to which selective activated knowledge mediates some of the assimilation versus contrast effects. At the same time, it suggests the existence of mechanisms unrelated to selective activation that may produce assimilation.

Experiment 5: Global Versus Local Processing, Moderate Standards, Subjective Versus Objective Scales, and Relative Hemisphere Activation

An intriguing finding is that global versus local processing seems to be related to right versus left hemisphere activation: Right hemisphere activation has been characterized as involving an expanded scope of both perceptual and conceptual attention, whereas the left hemisphere is said to involve a narrow scope of attention (e.g., Beeman, 1998; Burgess & Simpson, 1988; Friedman & Förster, 2005). For example, extensive empirical evidence has shown that trait anxiety is associated with greater left hemispheric activity (Tucker, Antes, Stenslie, & Barnhardt, 1978; Tyler & Tucker, 1982; see also, e.g., Baxter et. al., 1987; Buchsbaum et al., 1985) and that this enhanced left hemispheric activation is associated with a narrowed focus of perceptual attention (Derryberry & Reed, 1998). More important, in the aforementioned model by Tucker and colleagues (Derryberry & Tucker, 1994; Tucker & Williamson, 1984), the relation between perceptual scope and conceptual scope is assumed to be hardwired. Whereas the right hemisphere is associated with both global perception and broad conceptual scope, the left hemisphere is thought to be associated with both local perception and narrow conceptual scope. Providing preliminary evidence for such a biological explanation could potentially open the field of research on assimilation and contrast to research on other psychological phenomena that are related to hemisphere asymmetries.

We will postpone the discussion of such consequences until the General Discussion and for now discuss whether global processing, inclusion, and assimilation are associated with right hemisphere activation and local processing, whereas exclusion and contrast are associated with left hemisphere activation.

Experiment 5 replicated Experiment 2 with one major difference: After the processing style induction and before the judgment task, we introduced an assessment of hemisphere activation in order to examine whether it would mediate the effect of induced processing style on assimilation versus contrast. Our expectation was that stronger right hemisphere activation would be related to assimilation, whereas stronger left hemisphere activation would be related to contrast.

Method

Participants

Participants were 128 undergraduate students (67 women, 61 men) at the University of Bremen majoring in disciplines other than psychology who were recruited for an experiment consisting of diverse psychological tests and lasting approximately 2 hr. They were paid 16 euros for participation. Five participants did not answer all the questions and were excluded from the analysis.

Materials

Relative hemispheric activation was gauged using a line bisection task (Milner, Brechmann, & Pagliarini, 1992; see also Bisiach, Geminiani, Berti, & Rusconi, 1990; Bowers & Heilman, 1980;

Bradshaw, Nathan, Nettleton, Wilson, & Pierson, 1987). There are multiple versions of this task. In the one that we used in the present experiment, participants are provided with a series of lines and are asked to mark the center of each line. Typically, participants commit a leftward error, signifying an attentional bias toward the left visual field (LVF), which manifests itself in an attentional neglect of the rightward extension of the line (Milner et al., 1992). Presumably, this nomothetic LVF bias reflects increased relative right hemispheric activation and is engendered by the perceptual–motor demands of the task. However, there is also demonstrable ideographic variation in the extent of this bias; therefore, the line bisection task can serve as a behavioral index of transient and chronic individual differences in relative hemispheric activation (e.g., Friedman & Förster, 2005; Martin, Shrira, & Startup, in press; Morton, 2003).

Table 6
Experiment 5: Mean Z-Transformed Judgments (and Standard Deviations) as a Function of Induced Processing Style, scale, and standard

	Induced processing style					
	Local		Control		Global	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Subjective scale						
High standard	−0.53	0.74	−0.25	0.85	0.32	1.07
Low standard	0.52	1.37	0.30	0.75	−0.35	0.68
Objective scale						
High standard	−0.51	0.51	0.25	0.78	0.62	1.38
Low standard	0.50	1.38	−0.35	0.48	−0.42	0.35

Procedure

Participants first worked on several unrelated tasks for about 30 min. They then completed the Navon letter task as in Experiment 2, after which they were asked to perform an evaluation task. They were asked to compare themselves with the standards, but before rating themselves, they were asked to perform an ostensibly unrelated task, supposedly intended to provide mental rest and enable them to make better judgments. This was the line bisection task, as used by Friedman and Förster (2005). Participants marked the center of each in a series of lines printed on two sheets of paper, using writing implements held in their dominant hand (right or left was not specified by the experimenter). Right- versus left-handedness was subsequently assessed by self-report and did not differ across conditions, nor did it affect the results. Participants bisected altogether 22 lines of different lengths (11.5, 9.0, 11.5, 11.5, 14.3, 10.8, 13.4, 10.5, 11.5, 13.5, 10.3, 14.3, 9.4, 12.8, 12.3, 12.3, 12.3, 11.9, 10.4, 11.9, 13.4, and 13.8 cm). After the line bisection task, participants completed self-ratings on objective and subjective scales, as described in Experiment 2.

In sum then, like Experiment 2, Experiment 5 was based on a 3 (processing: global vs. local vs. control) × 2 (standard: high vs. low) × 2 (scale: objective vs. subjective) factorial design, with only the last factor manipulated within participants. The predictions were the same as in Experiment 2: We predicted that relative to the control condition, the global processing condition would produce more assimilation on both the subjective and the objective scale, and the local processing condition would produce more contrast on both scales. Hemisphere activation as assessed by the line bisections was expected to mediate the effects of induced processing style on self-ratings.

Results

Self-evaluation. As in our previous experiments, we *z*-transformed the ratings on the objective and subjective scales (for means, see Table 6) and conducted a 3 (processing: global vs. local vs. control) × 2 (standard: high vs. low) × 2 (scale: objective vs. subjective) ANOVA for mixed designs, which yielded two-way interactions between scale and standard, $F(1, 117) = 11.23$, $p < .001$, and between processing and standard, $F(2, 117) = 13.79$, $p < .0001$. More important, the predicted three-way interaction was significant, $F(2, 117) = 4.58$, $p < .02$. There were no other effects, Fs < 1. The three-way interaction shows that the findings of Mussweiler and Strack (2000) were successfully replicated in the control processing condition, indicating contrast on the subjective scale ($M_{high} = -0.25$, $SD = 0.85$, vs. $M_{low} = 0.30$, $SD = 0.75$), $t(39) = 2.20$, $p < .04$, and assimilation on the objective scale ($M_{high} = .25$, $SD = .78$, vs. $M_{low} = -0.35$, $SD = 0.48$), $t(39) = 3.00$, $p < .01$. However, as predicted and as shown in Experiment 2, in the global processing condition, assimilation was found for both the objective scale ($M_{high} = 0.62$, $SD = 1.38$, vs. $M_{low} = -0.42$, $SD = 0.35$), $t(38) = 3.24$, $p < .01$, and the subjective scale ($M_{high} = 0.32$, $SD = 1.07$, vs. $M_{low} = -0.35$, $SD = 0.68$), $t(38) = 2.37$, $p < .03$. Contrary to this, in the local processing condition, the predicted contrast effect was found for both the objective scale ($M_{high} = -0.51$, $SD = 0.51$, vs. $M_{low} = 0.50$, $SD = 1.38$), $t(40) = 3.22$, $p < .01$, and the subjective scale ($M_{high} = -0.53$, $SD = 0.74$, vs. $M_{low} = 0.52$, $SD = 1.37$), $t(40) = 3.14$, $p < .01$. These results fully replicate the results of Experiments 2 and 3.

Perceptual asymmetry. To reiterate, we predicted that participants induced with global processing would exhibit more pronounced leftward bisection errors, demonstrating greater relative right hemispheric activation (RHA) and smaller relative left hemispheric activation (LHA) than those in the control group, who would exhibit more pronounced leftward errors than participants with induced local processing. To assess these predictions, we measured the deviations of participants' bisection marks from the lines' true midpoints in centimeters. The obtained values were averaged across the 22 lines to create an overall bisection error index with negative values indicating a leftward bias (i.e., a mean leftward deviation from center; greater leftward deviations signify greater relative RHA). We multiplied these values by –1 so that positive values signify relative greater RHA.

As shown in Table 7, the pattern of bisection errors was in accord with our predictions, as revealed by the results of a Processing × Standard ANOVA, which indicated a significant main effect of processing, $F(2, 117) = 10.09$, $p < .0001$, and no other effects, Fs < 1. More specifically, participants in the global processing condition demonstrated greater RHA ($M = 0.97$, $SD = 1.86$) than participants in the control condition ($M = 0.26$, $SD = 1.54$), $t(120) = 1.95$, $p = .05$, who, in turn, demonstrated a greater RHA than participants in the local processing condition ($M = -.67$, $SD = 1.47$), $t(120) = 2.60$, $p = .01$.

Table 7
Experiment 5: Mean Right Hemispheric Activation (and Standard Deviations) as Measured by the Line Bisection Task as a Function of Induced Processing Style and Standard

	Induced processing style					
	Local		Control		Global	
Standard	*M*	*SD*	*M*	*SD*	*M*	*SD*
High	−0.70	1.68	0.30	1.05	0.97	1.85
Low	−0.63	1.25	0.23	1.89	0.97	1.92

Note. Measured in centimeters. Higher values indicate higher right hemispheric activation.

Mediation by hemisphere activation. To determine whether the judgment was mediated by hemisphere activation, we examined whether the effect of processing styles on self-judgment was significantly reduced when hemispheric activation was entered as another predictor in a regression analysis. To test our predictions, we conducted two separate mediation analyses for the high and low standard conditions with an index that combined subjective and objective scales because in the local and global processing conditions (but not in the control condition), they were highly correlated ($r = .84$; $p < .0001$ for the low standards, and $r = .74$; $p < .0001$ for the high standards) and were similarly affected by global versus local processing. Local processing was coded as –1, and global processing was coded as 1.

For both high and low standards, hemisphere activation was a significant predictor of judgment: $\beta = -.57$, $t(40) = -4.25$, $p < .0001$, for the low standard, and $\beta = .67$, $t(38) = 5.70$, $p < .0001$, for the high standard. The higher the relative RHA was, the higher the judgment after high standards (indicating an assimilation effect with high standards) and the lower the judgment after low standards (indicating an assimilation effect with low standards).

In the final stage of the mediation analysis, processing styles and hemisphere activation were entered jointly to predict judgments. For high standards, the effect of RHA remained significant, $\beta = .56$, $t(39) = 4.45$, $p < .001$, and the effect of global versus local processing was reduced, $\beta = .25$, $t(39) = 2.02$, $p < .05$. A Sobel test of the significance of the mediation, $Z = 2.52$, $p < .01$, confirmed that the effect of processing style on judgment was partially mediated by RHA.

For the low standards, a similar pattern emerged. When entered jointly into the regression, the effect of RHA remained significant, $\beta = -.47$, $t(37) = -3.21$, $p < .01$, and the effect of processing style was reduced, $\beta = -.21$, $t(37) = -1.40$, $p = .17$. A Sobel test of the significance of mediation, $Z = -2.24$, $p = .03$, indicated that the effect of processing style on judgment was partially mediated by hemisphere activation.

General Discussion

Five experiments showed that inducing a global processing style enhanced assimilation of a target to a prime or a comparison standard, whereas inducing a local processing style enhanced the contrasting of a target away from a prime or a comparison standard. Global versus local processing styles were induced by making participants attend to global letters or to local letters in a Navon task (Experiments 2, 4, and 5; Navon, 1977), by making them look at the global shape of a map or at its details (Experiment 1; Friedman et al., 2003), or by making them think of the distant future or the near future (Experiment 3; Liberman & Trope, 1998; Liberman et al., 2002). In Experiment 1, we looked at a classic priming paradigm in which perception of an ambiguous target is the dependent measure, whereas in Experiments 2–5, we looked at self-ratings after comparison to a standard.

We found that global versus local processing influenced judgments both when processing was introduced after the standard and the target (Experiment 3) and when processing was introduced before the standard and the target (Experiments 1, 2, 4, and 5). This results points to an important aspect of GLOMO: Like IEM, it encompasses both processes by which a differential use of identical input information may produce assimilation versus contrast and processes by which the input itself is changed to produce assimilation versus contrast effects.

In addition to the effects of global versus local processing on assimilation and contrast, we explored possible mediators in Experiments 4 and 5. In Experiment 4, we examined accessibility of standard-consistent and standard-inconsistent concepts and found that when local processing was induced, the standard produced contrast via its effect on increasing accessibility of standard-inconsistent knowledge. However, when global processing was induced, it created accessibility not only by increasing accessibility of standard-consistent concepts. In other words, it is possible that in global processing, assimilation was not only produced by accessibility, as would be predicted by SAM. In Experiment 5, we examined relative RHA and found that global processing style, compared with local processing style, increased assimilation relative to contrast by increasing relative RHA.

In addition to processing style, two moderators of assimilation versus contrast were manipulated in Experiments 2–5: type of scale (subjective vs. objective, in Experiments 2, 3, and 5) and extremity of standard (extreme vs. moderate, in Experiment 4). In the literature, subjective scales and extreme standards have been found to produce more contrast and less assimilation than objective scales and moderate standards. We replicated the scale effect in the control condition of Experiments 2 and 3 (i.e., when neither global nor local processing was induced). In the control condition of these studies, a contrast effect emerged with subjective scales and an assimilation effect emerged with objective scales. In our experiments, the effect of global versus local processing overrode the effect of type of scale and the effect of standard extremity. This finding does not mean, however, that processing style would always override these factors. Furthermore, it is impossible to determine which of these effects is stronger because their strength obviously depends on experimental manipulations. All we wished to show is that global versus local processing is a potent manipulation that exerts an effect that is distinct from these moderators.

No less important is the fact that we think that many of the moderators of assimilation and contrast—including processing style—may be integrated into the IEM (Schwarz & Bless, 1992; 2007). They constitute different ways to make the target and the comparison-standard (or the prime) seem close, similar, and indistinct as opposed to distant, separate, and different. GLOMO, as a relative of IEM, does not obliterate the specific moderators of assimilation and contrast as suggested by other models. Each such

moderator points to an interesting and important phenomenon and to a different set of antecedents of assimilation versus contrast.

We think that the moderator we propose—global versus local processing—derives its importance from the fact that it opens the way to connect assimilation versus contrast to a vast number of potentially interesting variables that are known to affect global versus local processing. Some of them we examined in our article. Others we will now briefly review, obviously not exhausting the range of possibilities.

Additional Potential Moderators of Global Versus Local Processing

Self-Regulation

Recently, global versus local processing has been related to regulatory focus (Higgins, 2000). Förster and Higgins (2005) measured participants' chronic promotion or prevention focus and gauged their performance in the Navon task. They found that strength of promotion focus (i.e., a chronic focus on ideals and aspirations) was positively correlated with speed of processing global letters and negatively correlated with speed of processing local letters, whereas the reverse was true for strength of prevention focus (i.e., a chronic focus on security and "oughts"). On the basis of our findings in the present article, we could expect more assimilation and less contrast effects for promotion-focused participants relative to prevention-focused participants. We are currently testing this prediction and have initial confirming evidence (Förster & Friedman, 2006) showing that a promotion focus enhances assimilation effects in classic priming tasks and in self-comparison, whereas a prevention focus leads to the opposite.

Positive Mood

Mood has been shown to affect processing style (see Förster et al., 2006; Gasper & Clore, 2002). In a series of recent studies, Gasper (2004; Gasper & Clore, 2002) showed that elated mood promoted classification of global–local composite figures (e.g., squares composed of symmetrically arranged triangles) on the basis of their global form as opposed to their components. In a similar vein, Basso, Schefft, Ris, and Dember (1996) found that trait happiness was associated with a proclivity to categorize visual images on the basis of global rather than local structure. Would positive mood also enhance assimilation and reduce contrast? Further research will have to address this question.

Anxiety and Obsessive–Compulsive Styles

Mikulincer, Kedem, and Paz (1990; see also Mikulincer, Paz, & Kedem, 1990) found a correlation between rejecting an item from a category and both trait and state anxiety. Yovel et al., (2005) found that obsessive–compulsive behavior, which is assumed to be related to anxiety, was associated with local processing in the Navon task. It would be interesting to examine whether anxiety and obsessive–compulsive behavior are related to assimilation versus contrast, as is the case with positive mood.

Approach Versus Avoidance

Not only regulatory focus and mood have been found to affect processing style but also subtle external or interoceptive approach versus avoidance cues. Recently, Förster et al. (2006) asked participants to complete a maze in which a mouse was either escaping from an owl or trying to find a piece of cheese and then to perform the Navon task. The owl maze activates avoidance motivation, whereas the cheese maze activates approach motivation (Friedman & Förster, 2002). The study found enhanced global processing in the approach condition and enhanced local processing in the avoidance condition. We find it interesting that these effects were independent from self-reported mood. Would approach versus avoidance also affect assimilation versus contrast? Recently, we have obtained initial results in support of that hypothesis. Using a classic paradigm of subtly inducing approach versus avoidance motivation, we manipulated arm flexion (approach) versus arm extension (avoidance; see Cacioppo, Priester, & Berntson, 1993; Förster, 2004; Förster & Strack, 1997; 1998; Neumann & Strack, 2000; Priester, Cacioppo, & Petty, 1996). We found assimilative effects in social comparisons in the former condition, and contrast effects in the latter condition (Förster, 2007b).

Construal of the Self

Connecting recent theorizing on the self with our model could be another starting point for new research. In general, the self can be construed as a broader or a narrower category (DeSteno & Salovey, 1997; Markus & Kunda; 1986). For example, a person may think about him- or herself as a human being or as a psychology student, with the former being a broader category than the latter. Recently, Fishbach and Förster (2006) showed that participants who were induced to process globally via the global Navon task described themselves in broader categories compared with participants who were induced to process locally via the local Navon task. These findings suggest that global versus local processing of the self would produce more assimilation to the self and less contrasting away from the self in various judgments, even if global versus local judgment is not activated at the time of the judgment is made.

Brain Research

Experiment 5 provides preliminary evidence for a partial mediation by hemisphere activation for our priming effects on social comparisons. This finding has repercussions for brain research on higher cognitive processes. It is a well-supported notion that global processing is associated with RHA and local processing is associated with LHA (see Derryberry & Reed, 1998). For one thing, one could investigate whether this link is bidirectional. We would hypothesize, for example, that placing questions at the right side of the perceptual field (thereby activating LH) would lead to contrast in comparison, whereas placing questions at the left side (thereby activating RH) would lead to assimilation. Moreover, consistent with the theorizing of Derryberry and Tucker (1994), RHA has been characterized as involving an expanded scope of attention on the perceptual and conceptual levels (see, e.g., Beeman, 1998; Burgess & Simpson, 1988; Fiore & Schooler, 1998). An example of a conceptual task posited to require RHA is creative task performance, which also profits from expanded scope of attention (see Friedman & Förster, 2005). Relating assimilation versus contrast research to the same neurobiological system may lead to new research questions. One may wonder, for example, how similarity

search is related to creativity if a creativity task affords quite the opposite: finding something different from the norm. Our results may suggest that, quite counterintuitively, the process involved in creative generation is searching for similarities that formerly did not exist. Consider the following example: In a typical unusual uses paradigm (e.g., "Find as many uses for a brick as you can"), a person generates a relatively creative solution such as "I grind it up and use it as makeup." The underlying process may be a broad search for similarity (the substance of the brick is similar to makeup powder) that enhances finding new uses (see Friedman & Förster, 2005; 2007). As an alternative, a global perspective that may be related to RHA may lead to use of more abstract concepts (e.g., the substance of the brick), enhancing creative generation. Similarly, metaphor comprehension, which demands broadened conceptual attention to nonliteral (and thereby nondominant) word meanings (Beeman, 1998) is related to RHA. Further research may relate assimilation effects to metaphor understanding and creativity.

Relation of GLOMO to Other Process Models of Assimilation Versus Contrast

Our approach does not contradict recent models, such as SAM by Mussweiler and Strack (for a review, see Mussweiler, 2003), ICM by Stapel and colleagues (for a review, see Stapel, 2007), or REM by Markman and McMullen (2003), but it has the potential to integrate aspects of all models. Let us briefly summarize the theoretical and empirical points of similarity between GLOMO and these models, as well as points at which these models depart from each other.

SAM (e.g., Mussweiler, 2003) suggests that assimilation results from searching for similarity between the target and the comparison standard and an enhanced accessibility of standard-consistent information. Likewise, contrast results from searching for differences between the target and the comparison standard and an enhanced accessibility of standard-inconsistent information. Our Experiment 4 showed that accessibility of standard-consistent versus standard-inconsistent knowledge partly mediates assimilation versus contrast effects. More specifically, we showed that local processing activated standard-inconsistent information, thereby leading to contrast. However, there was no conclusive evidence that global processing led to assimilation by activating standard-consistent information. Moreover, in Study 3, global processing and local processing were induced by temporal distance that was introduced after the comparison stage and thus could not have influenced whether similarities or differences were sought out in the comparison process. The finding of assimilation versus contrast in this study thus suggests that a process other than selective activation of similarities versus differences is operating and that it operates at the comparison stage rather than at the information activation stage. In short, our results suggest that selective accessibility only partly explains the effect of global versus local processing on assimilation versus contrast.

Whereas SAM focuses on information search and the different information that produces assimilation versus contrast, ICM and REM focus on differential use of the same information as a basis for assimilation versus contrast effects. ICM (Stapel, 2007) suggests that assimilation is a result of an interpretation process (whereby a standard is used to interpret the target), whereas contrast is a result of a comparison process (whereby a target is compared with the standard). In a similar vein, REM (Markman & McMullen, 2003) suggests that assimilation is the result of applying a reflective processing style, in which the target is imagined in a standard-consistent situation (e.g., a person imagines that she is Albert Einstein), whereas contrast results from applying an evaluative mode of thinking. Both ICM and REM suggest that the same accessible information may produce both assimilation (if it is used to interpret the target) or contrast (if it is used to compare the target). GLOMO, just like IEM, incorporates both differences in accessible input and differences in processing the same input as potential causes of assimilation versus contrast.

Is it possible that an interpretative mode of thinking profits from a global processing style, whereas a comparing mode of thinking profits from local processing? Is it possible that modes of thinking mediated the effect of processing style on assimilation versus contrast? Further research is needed to examine these questions.

GLOMO can also integrate REM's suggestion that factual knowledge is not the only basis for assimilation and contrast effects. Rather, it is possible that assimilation ensues from engaging in "as if" simulations that have little factual basis. A person could imagine herself as being Steffi Graf and thus could overestimate her own athletic skills. We could speculate that it is possible that reflective modes of thinking and simulations profit from a global processing style, whereas evaluative modes profit from local processing. Further research is needed to examine such relations.

Another important difference between GLOMO and other models is that processing style may apply to the prime or standard of comparison, as well as to the target of comparison. Therefore, local versus global processing may affect the way people process the prime or the comparison standard, even before they encounter any target. Contrary to this notion, SAM, ICM, and REM refer to the target or to its relation to the comparison standard. These models cannot be applied to a situation in which a target has not yet been presented. For example, consider a situation in which participants are asked to think about Robbie Williams' drug and alcohol consumption. We believe that a global processing style (relative to a local processing style) would make it more likely that participants represent Robbie Williams in terms of a relevant general category (e.g., "He is a pop singer; pop singers often take drugs") as opposed to remembering specific incidents in his career (e.g., "I saw his show on TV last month; he must have taken drugs before it"). All aforementioned models, however, are silent with respect to processing the comparison standard that occurs before any comparison target is presented. Notably, Experiment 1 showed that processing styles affected assimilation and contrast in the absence of any comparison process. In that way, GLOMO seems to have a wider range of application than SAM, ICM, or REM.

Conclusion

The question of when primes or comparison standards produce assimilation and when they produce contrast is of central importance in social psychology. Our studies showed that global processing enhances assimilation, whereas local processing enhances contrast. For example, when participants were induced with global processing by looking at global letters, they indicated that they consumed more drugs and alcohol after being presented with a

high standard of drug and alcohol consumption (Robbie Williams) than after being presented with a low standard (Steffi Graf). However, after participants were induced with local processing by looking at the local letters, the reverse pattern emerged, giving rise to a contrast effect. These variations in self-descriptions may have vast implications for real life: For example, doctors and therapists who rely upon their clients' and patients' self-descriptions should be aware of the fact that certain narrowing and broadening of perspectives can lead to systematic biases in self-reports. In a similar vein, polling and survey research may be affected by diverse processing styles that bias reports in an unwanted way.

Changes in categorization due to global versus local processing styles may affect behavior as well. A person who includes chimpanzees into the category of human beings may demand human rights for this species, and a person that thinks of himself as a mammal rather than a human being may consider not eating members of that category and may become a vegetarian. Furthermore, from an experimental point of view, it may be interesting to examine whether behavioral assimilation effects would be more likely to occur when people are in a global processing mode. Would people in a global processing mode walk slower after being primed with the stereotype of an older person (indicating assimilation toward the stereotype), and would they walk faster (indicating contrast away from the stereotype) when in a local processing mode (Bargh, Chen, & Burrows, 1996)? We hope that the moderator we examined thus broadens the perspective of research on assimilation and contrast in social judgment to other important areas of research.

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