Stepping Back to See the Big Picture: When Obstacles Elicit Global Processing

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Can obstacles prompt people to look at the "big picture" and open up their minds? Do the cognitive effects of obstacles extend beyond the tasks with which they interfere? These questions were addressed in 6 studies involving both physical and nonphysical obstacles and different measures of global versus local processing styles. *Perceptual scope* increased after participants solved anagrams in the presence, rather than the absence, of an auditory obstacle (random words played in the background; Study 1), particularly among individuals low in volatility (i.e., those who are inclined to stay engaged and finish what they do; Study 4). It also increased immediately after participants encountered a physical obstacle while navigating a maze (Study 3A) and when compared with doing nothing (Study 3B). *Conceptual scope* increased after participants solved anagrams while hearing random numbers framed as an "obstacle to overcome" rather than a "distraction to ignore" (Study 2) and after participants navigated a maze with a physical obstacle, compared with a maze without a physical obstacle, but only when trait (Study 5) or state (Study 6) volatility was low. Results suggest that obstacles trigger an "if obstacle, then start global processing" response, primarily when people are inclined to stay engaged and finish ongoing activities. Implications for dealing with life's obstacles and related research are discussed.

Keywords: obstacles, construal level, goal pursuit, processing styles, task engagement

Daily life is full of obstacles: A construction site blocking the usual road to work, a colleague's background chatter interfering with one's ability to concentrate, a newborn child hindering parents in completing their daily routines, or a lack of resources standing in the way of realizing an ambitious plan. How do people cognitively respond to such obstacles? How do the ways in which they perceive and process information from their environment change when an obstacle interferes with what they want to accomplish? Might the cognitive effects of obstacles reach beyond the very goal or task at hand? In the present research, we aim to shed light on these questions by investigating the impact of obstacles on global versus local processing. We propose that unless people are inclined to disengage prematurely from ongoing activities, obstacles will prompt them to step back and adopt a more global, Gestalt-like processing style that allows them to look at the "big picture" and conceptually integrate seemingly unrelated pieces of information.

Conceptualizing Obstacles and Their Effects

Obstacles can come in many shapes. They can be physical, social, situational, or merely mental in nature. They can appear in a variety of settings, including organizational, clinical, or private ones. We define obstacles in terms of what they all have in common: They act as *interfering forces* (Higgins, 2006) that prevent people from reaching their goals along the most direct or initially intended path and, thus, require them to find out how to accomplish what they want to do despite the obstacle. Based on this definition, some kinds of interference are obstacles by their very nature. For example, a broken wheel would naturally represent an obstacle to a bicycle courier because biking is an essential part of the job. To be able to work, the courier would have to find a way to deal with the problem, such as borrowing a bike from a colleague, repairing the bike, buying a new one, and so forth. Perhaps less obviously, distractions or nuisances can constitute an obstacle if they directly interfere with the task at hand and require people to figure out how to continue despite the interference. For example, hearing someone else's conversation on the phone may directly interfere with a poet's attempts to find the right words for the next piece. To succeed nevertheless, he or she might try to ignore the noise, use the snippets of speech as inspiration, or go to another room. Notably, not all factors that potentially hinder task performance would per se qualify as an obstacle according to our definition. Rather, they might *act as an obstacle* if they are perceived as such. For example, traffic noise as such is irrelevant

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to the task of searching for words and is thus unlikely to directly interfere with it. However, if a poet considered the noise as an obstacle to overcome, he or she would need to find a way to deal with it, and the situation would be similar to the one described above. Analogously, competing goals, temptations, or other interfering factors that do not per se prevent people from reaching a goal as they originally intended to might acquire the characteristics of an obstacle if the interfering factors are considered to be something that needs to be overcome and if the solution to the problem is not all that clear.

Affective and Motivational Effects

Previous research on obstacles and related concepts primarily focused on their affective and motivational consequences. To give some examples, factors rendering a goal completely unattainable (e.g., goal blockage, frustration) have been associated with increased negative arousal (e.g., Berkowitz, 1989; Lewis & Ramsay, 2005), aggressive tendencies (e.g., Berkowitz, 1989; Dollard, Doob, Miller, Mowrer, & Sears, 1939), and depression (Klinger, 1975). Regarding motivation, research has shown that pleasant activities (e.g., watching an entertaining movie) become even more attractive after an interruption, when they cannot be resumed (Mischel & Masters, 1966), that feelings of romantic love intensify among couples when parents interfere with their relationship (Driscoll, Davis, & Lipetz, 1972), or that the subjective value of a prize increases with perceived task difficulty after one solves anagrams with an aversive background noise that constitutes an interference to oppose (e.g., random words) rather than a mere nuisance to cope with (e.g., dentist drills; Higgins, Marguc, & Scholer, 2011; see also Higgins & Scholer, 2009).

More generally, research by Brehm and colleagues (Brehm & Self, 1989; for more recent reviews, see Wright, 1996, 2008) suggested that difficulty increases motivational arousal in terms of cardiovascular reactivity up to a point at which either the amount of effort one is willing to invest is too low or difficulty is too high. Recent studies further revealed that anticipated obstacles and temptations can trigger various counteractive self-control strategies, including greater optimism, increased effort, or higher valuation of the threatened goal (e.g., Fishbach, 2009; Fishbach & Trope, 2005; Zhang & Fishbach, 2010). In a similar vein, construing negative aspects of present reality as *standing in the way* of a desired future, a strategy called mental contrasting, was found to lead to more effective striving than merely dwelling on the present or indulging in the future without relating one to the other (e.g., Oettingen, 2000; Oettingen, Hönig, & Gollwitzer, 2000; Oettingen, Pak, & Schnetter, 2001; Oettingen & Stephens, 2009). Altogether, these findings indicate that obstacles can create value, intensify motivation, promote striving, and, when their impact cannot be overcome, elicit negative affective responses.

Cognitive Effects

Surprisingly, the cognitive effects of obstacles and related concepts addressed to date were usually tied to the specific goal or task at hand. For example, research on the Zeigarnik effect (Zeigarnik, 1927; for a review, see Butterfield, 1964) has shown that interrupted activities are cognitively more accessible and recalled better than completed ones (Marsh, Hicks, & Bink, 1998). Some researchers also proposed that blockage of highly valued personal goals can lead to excessive thinking about the blocked goal (e.g., Martin & Tesser, 1989, 1996). Others suggested that obstacles or difficulties encountered during goal pursuit might lead people to momentarily disrupt goal-directed behavior and evaluate the likelihood of reaching their goal despite the interference (Carver & Scheier, 1990). Finally, research by Vallacher and Wegner (Vallacher & Wegner, 1987, 1989; Wegner & Vallacher, 1986) addressed the question of how people think about routine actions that are made unusually difficult. This research showed, for example, that asking participants to eat Cheetos snacks with chopsticks rather than with their hands (Wegner, Connally, Shearer, & Vallacher, 1983) or to drink coffee from an unwieldy, heavy mug rather than from a regular one (Wegner, Vallacher, Macomber, Wood, & Arps, 1984) led them to describe those actions (i.e., eating, drinking) in more concrete, rather than abstract, terms (e.g., "moving food to my mouth" as opposed to "stilling my appetite"). One may thus conclude that blocked goals and interrupted activities tend to stay on people's minds and that people describe routine actions in more concrete terms when those actions are rendered extraordinarily difficult and when the solution to the problem is very clear (e.g., one can simply use more strength to lift a heavy cup) or the specific means with which to perform the action are determined a priori (e.g., use chopsticks).

Notwithstanding the importance of such findings, some questions remain: For example, how do obstacles that can be overcome and for which people themselves need to find solutions influence more basic cognition? Might the cognitive effects of obstacles reach beyond the current task or goal? In the present research, we aim to address these questions by drawing on Lewin's (1935) field theory, construal level theory (CLT; Liberman & Trope, 1998; for reviews see Liberman & Trope, 2008; Liberman, Trope, & Stephan, 2007; Trope & Liberman, 2003, 2010), novelty categorization theory (NCT; Förster, Liberman, & Shapira, 2009; Förster, Marguc, & Gillebaart, 2010), and research showing that *processing styles*, or the more general ways in which people perceive and process information from their environment, are content-free and can carry over from the task in which they were elicited to contentwise completely unrelated tasks (Schooler, 2002; Schooler, Fiore, & Brandimonte, 1997; Schooler, Ohlsson, & Brooks, 1993; see also Förster, Liberman, & Friedman, 2007; Förster, 2009). More specifically, we develop the argument below that obstacles can elicit a more global, integrative processing style that may extend beyond the goal, the activity, and the task at hand—and we specify when this should be more (or less) likely to happen.

Obstacles and Global Processing

In Lewin's (1935) field theory, "barriers"—which can be considered the prototype of obstacles because they literally stand in the way of the most direct path from A to B—are conceptualized as "detour problems" (p. 82) that require an initial movement *away* from the direct path in order to attain a goal. In this view, a person confronted with an obstacle has two options: She can leave the field, that is, disengage from the goal or task at hand, or stay on track and try to overcome the obstacle. In the latter case, Lewin reasoned, the solution would occur by means of "restructuring of the field" (which is necessary when a novel event changes the meaning of the field) and perceiving the total situation such that "the path to the goal becomes a unitary whole" (p. 83). In other words, a more global, encompassing view of the situation—including the obstacle, the goal, and the relation between the two—may help to reconfigure elements of the problem situation and integrate the obstacle into goal pursuit. Lewin (1935) further assumed that adopting such a holistic view should be easier to the extent that people can psychologically distance themselves from the situation at hand and detach from the directional pull of the goal *without* actually disengaging.

The notion that increasing psychological distance should facilitate a more encompassing perspective is consistent with recent research by Liberman and colleagues (for a review, see Liberman & Trope, 2008). These authors suggest that construing events as remote from direct experience is associated with global processing, that is, a greater focus on the overall *perceptual* structure of objects (Förster & Dannenberg, 2010; Liberman & Förster, 2009a), and on a *conceptual* level, access to representations with lower a priori accessibility, leading to the construction of broader and more abstract mental categories (see Förster, Friedman, & Liberman, 2004; see Friedman & Förster, 2008, 2010).

To illustrate, a recent series of studies by Liberman and Förster (2009a) revealed that imagining temporally, spatially, or socially distal rather than proximal events enhances global perception in an unrelated task. In one study, participants who imagined themselves sitting on a chair 10 m away responded faster to global stimulus features than to local stimulus features (i.e., the overall shape versus the details) in a variant of Navon's (1977) letters task (hereafter referred to as Navon-letters task; see Derryberry & Reed, 1998; Förster, Friedman, Özelsel, & Denzler, 2006) than did participants who imagined themselves sitting only 5 m or 5 cm away. In another study with the same task, global perception was more pronounced among participants who had written about their life 1 year from now (distant future) rather than about their life tomorrow (near future) or nothing (control). In a different set of studies, participants who were asked to attend to global, as opposed to local, stimulus features subsequently estimated unrelated future events as more distant in time, other places as being further away from their own location, other people to be less close to themselves, and events to be less likely to happen to themselves (Liberman & Förster, 2009b). This suggests that the link between global perception and psychological distance is bidirectional.

Given that global perception has been shown to broaden people's conceptual scope, such that asking participants to focus on the entire gestalt of objects (e.g., an entire state depicted on a map) rather than the details (e.g., a single city on the same map) promotes the generation of unusual category exemplars (Friedman, Fishbach, Förster, & Werth, 2003) and increases category breadth (Förster & Denzler, in press), it may be less surprising that greater psychological distance not only facilitates global perception but also enhances the use of more inclusive mental categories. For instance, in a study by Liberman, Sagristano, and Trope (2002), participants classified objects (e.g., cutlery, skis, infant clothes) that were part of future activities (e.g., a yard sale) into fewer (i.e., broader) categories when they imagined those activities to take place in the distant rather than the near future. Accordingly, one may assume that when people step back or mentally distance themselves from the present situation, both their perceptual and their conceptual scope (as, for example, reflected in changes of category width) become broader.

Notably, the above studies not only show that psychological distance and global processing are related. They also reflect the notion of *processing shifts* or *procedural priming* effects, in that a certain way to perceive or process information is primed in one task and subsequently carries over to a contentwise completely unrelated task (Schooler, 2002; see also Förster, et al., 2007). Such processing shifts are generally underexamined (see Förster & Dannenberg, 2010). However, they have been found in other domains. For example, local processing elicited in one phase of an experiment was shown to undermine face recognition (which benefits from global processing) in an unrelated phase (Macrae & Lewis, 2002).

Our research combines Lewin's (1935) theorizing with recent findings on global versus local processing styles, proposing that obstacles themselves might elicit more global processing on both perceptual and conceptual levels. In addition, we examine the notion of processing shifts (Förster & Dannenberg, 2010; Schooler, 2002) in relation to obstacles, testing the hypothesis that obstacles can lead people to broaden their perception, open up mental categories, and perform better at contentwise completely unrelated tasks that either measure or benefit from global processing. In other words, a person might be more likely to consider an unusual product (e.g., algae) as an ingredient for dinner after having encountered a roadblock on the way home than after having taken the usual route, or he or she might more easily solve problems requiring active integration of information after having studied Spanish while his or her flatmate was watching TV than after having studied in silence.

Global Processing as a Routinelike Response

The tendency to construe distal objects in more abstract terms may have evolved as a generalized heuristic (Bar-Anan, Liberman, & Trope, 2006), such that greater psychological distance automatically activates higher levels of construal. We propose that a similar link exists between obstacles and processing styles in that obstacles might routinely activate more global processing. Why might this be the case?

By preventing people from accomplishing tasks in the most straightforward manner or reaching their goals along the most direct path, obstacles may naturally prompt a problem-solving mindset in which people try to better understand the situation, to integrate the obstacle into goal pursuit, or to find alternative means or strategies. Global processing in turn broadens perception, promotes the use of more inclusive, abstract categories, and facilitates access to remote concepts. Thereby, it may help to obtain an overall perspective (see Lewin, 1935), promote understanding (see Fiske & Neuberg, 1990; Förster, Marguc, & Gillebaart, 2010; Förster & Dannenberg, 2010), and facilitate thinking of nonobvious solutions (see Friedman et al., 2003). By contrast, local processing narrows perception, promotes the use of more exclusive, concrete categories, and impairs access to remote concepts. Thereby, it may interfere with obtaining an overall perspective, undermine a global understanding of the situation, and render thinking of nonobvious solutions more difficult. In other words, global processing may promote ways of thinking that are potentially beneficial for dealing with obstacles, whereas local processing may undermine such processes. This reasoning is in line with NCT (Förster et al., 2010; see also Förster et al., 2009), which assumes that people start processing more globally whenever they expect a novel event because global processing facilitates understanding and promotes integration of novelty into existing knowledge structures (Piaget, 1952, 1980). Obstacles are comparable with novelty in that they change the usual or expected circumstances of a goal pursuit and require people to adapt to the circumstances created.

On the basis of the above assumptions, we suggest that as people deal with obstacles throughout their lives, they may implicitly learn that processing more globally is a promising response to obstacles and thus gradually develop an "if obstacle, then start global processing" routine that is represented in procedural memory (Tulving & Schacter, 1990) and becomes activated whenever they are dealing with an obstacle. Such a routine is comparable with other generalized routines (e.g., the heuristic that expensive wine is better than inexpensive wine) in that it is triggered automatically in certain situations (e.g., trying to decide which wine to buy). Because processing styles are content-free, global processing elicited by obstacles might further carry over to tasks or situations that have nothing to do with the obstacle, the task, or the goal at hand (Förster et al., 2007; Schooler, 2002). Studies 1–3 were designed to provide initial evidence for the hypothesis that an "if obstacle, then start global processing" routine exists and that the effects of obstacles can carry over to completely unrelated tasks.

Study 1

In this study, we examined whether completing a task with an obstacle, compared with a task without an obstacle, enhances global perception in an unrelated task. Capitalizing on one of the most frequent obstacles people complain about in their working environment—background noise and, especially, other people talking (e.g., Boyce, 1974; Nemecek & Grandjean, 1973)—participants first solved verbal anagrams in the presence or absence of an auditory obstacle. Subsequently, they completed a variant of the Navon-letters task as used by Förster et al. (2006) to measure reaction times to global versus local stimuli. We predicted that participants who encountered an obstacle in the first task would subsequently show a relatively more global perceptual scope than would participants who did not encounter an obstacle.

Method

Participants. Twenty-five students (14 female, 11 male) aged between 19 years and 30 years (M = 23.44, SD = 3.20) participated in a 2-hr battery of unrelated studies. Participants were randomly assigned to conditions and received €20 (U.S.$28.80) as compensation.

Materials and procedure. After several unrelated tasks, the present study was introduced as a study on "verbal skills and divergent thinking." Participants were told that to simulate real-world conditions in which ambient noises can be part of one's working environment, they would sometimes hear a background noise while working on tasks and sometimes not. They received instructions for a verbal anagram task and completed five practice anagrams. After the practice anagrams, the experimenter asked participants in the obstacle condition to put on headphones and switched on an interfering background noise (a series of words that were neutral in valence and unrelated to the anagrams) that was played while participants were working on the anagram task. Participants in the no-obstacle condition proceeded directly with the anagram task and could work in silence. We reasoned that hearing words in the background should interfere with solving anagrams because the words heard may compete with self-generated words and prime a dominant (but incorrect) response that has to be overcome (see also Marsh, Bink, & Hicks, 1999; Ward, 1994).

When finished with all 20 anagrams or after 8 min had passed, participants were asked, "How do you feel right now?" (1 = *very bad*, 9 = *very good*; a measure of general mood) and continued with an allegedly unrelated task, the aforementioned variant of the Navon-letters task. In this measure, a series of composite stimuli is presented, each consisting of a single large letter that is composed of numerous small letters. Specifically, each vertical and horizontal line of a large letter was made up of five closely spaced small letters (e.g., an *H* made up of *F*s). Participants were asked to indicate as quickly as possible, by pressing a blue (left) or red (right) key, whether the picture contained a letter *L* or an *H*. Global targets were those where a large *L* or *H* was made up of small *F*s or *T*s. Local targets were those where a large *F* or *T* was made up of small *L*s or *H*s. Overall faster responses to global targets reflect a predominantly global perceptual scope, and faster responses to local targets reflect a more local perceptual scope. There were 48 trials in which 24 global and 24 local targets were randomly presented. Participants were probed for suspicions, paid, thanked, and debriefed. No suspicions regarding the connection between the anagram task and the letters task were expressed.

Results and Discussion

Perceptual scope. Response times (RTs) to global, K–S(25) = .18, p = .03; S–W(25) = .81, $p < .0001$, and local targets, K–S(25) = .25, $p < .0001$; S–W(25) = .83, p = .001, were positively skewed. Following the guidelines of Fazio (1990), we therefore log-transformed (natural logarithm) all RTs prior to analyses and excluded trials with incorrect responses as well as trials on which the RT was more than 3 SD from the mean of the respective target type. A 2 (obstacle: yes vs. no) × 2 (target: global vs. local) repeated-measures analysis of variance (ANOVA) revealed that overall, participants responded marginally faster to global (M = 6.62, SD = 0.26) than to local (M = 6.69, SD = 0.19) targets, $F(1, 23) = 3.95$, p = .06, η_p^2 = .15. This is in line with what is often found on this task. Importantly, as predicted, the main effect of target was qualified by a significant Obstacle × Target interaction, $F(1, 23) = 5.24$, p = .03, η_p^2 = .19.

Because we were interested in the relative advantage of global RT over local RT in each condition and to illustrate the nature of this interaction, we computed difference scores by subtracting RT to local targets from those to global targets. Hence, lower scores indicate a greater processing advantage (i.e., faster RT) for global targets than for local targets. In line with predictions, these scores revealed that participants in the obstacle condition (M = −.15, SD = 0.12) responded relatively faster to global targets than to local targets, compared with participants in the no-obstacle condition (M = .01, SD = .22).

Control variables. A one-way ANOVA revealed no difference between the obstacle condition (M = 5.50, SD = 1.94) and the no-obstacle condition (M = 5.75, SD = 1.36) with respect to participants' self-reported mood after the anagram task ($F < 1$). Therefore, including mood as a covariate in the main analysis did not alter the effect of obstacle on perceptual scope. Likewise, though participants in the obstacle condition solved somewhat fewer anagrams correctly (M = 78.08%, SD = 21.75) than participants in the control condition ($M = 81.67\%$, $SD = 12.85$), this difference was not significant ($F < 1$), and entering anagram performance as a covariate in the main analysis did not affect the Obstacle × Target interaction. While the lack of performance differences may seem surprising at first, it could have several reasons. For example, participants might have successfully compensated for the impact of the noise because they frequently deal with background noise while working on tasks. More important, whether a background noise was present significantly influenced perceptual scope in a wholly unrelated task.

These results provide initial evidence for the assumption that obstacles can elicit global processing on the level of perception. Moreover, because the dependent measure (i.e., perceiving global or local letters) was unrelated to both the obstacle (i.e., random words) and the task with which it interfered (i.e., solving anagrams), results from this study reflect the underexamined notion of processing shifts (Förster & Dannenberg, 2010; Schooler, 2002), suggesting that the cognitive effects of obstacles can carry over to contentwise completely unrelated tasks.

Because global perception was shown to enhance conceptual integration (Förster, 2009), our main aim in Study 2 was to replicate effects on a more conceptual level, substituting the Navon-letters task from Study 1 with a task that measures conceptual scope in terms of the extent to which people include fringe exemplars in given categories (Friedman & Förster, 2000; see also Isen & Daubman, 1984; Rosch, 1975). One might also wonder whether effects in Study 1 were merely due to differences in cognitive load, as only some participants heard a background noise, whereas others could work in silence. Moreover, one might wonder whether any kind of noise might produce such effects if people consider it as an obstacle to overcome rather than, for example, as a mere nuisance or distraction they need to ignore. To address such questions, we made certain that all participants in Study 2 heard the same background noise, that is, a series of random numbers that were presented either as an obstacle they had to overcome or as a distraction they had to ignore, thus suggesting different ways of construing the same, potentially aversive, but otherwise task-irrelevant stimulus. We predicted that framing the background noise as an "obstacle to overcome" would lead to greater acceptance of unusual exemplars in given categories than would framing it as a "distraction to ignore."

Study 2

Method

Participants. Thirty-two undergraduates (25 female, 7 male) aged between 18 years and 38 years ($M = 21.65$, $SD = 5.06$; age and gender from one participant are missing) participated in a 1-hr battery of unrelated studies. Participants were randomly assigned to conditions and received €7 (U.S.$10.08) or course credit as compensation.

Materials and procedure. The obstacle manipulation was similar to that in Study 1, except that everyone heard the same background noise (a random list of numbers from 0 to 9 read aloud), and participants received different instructions after the practice anagrams. Specifically, participants in the obstacle-framing condition were told that the background noise they would hear could hinder performance and interfere with the task of solving as many anagrams as possible. To still perform well, they had to overcome this obstacle. Participants in the distraction-framing condition were told that the background noise they would hear could distract their attention from the task of solving as many anagrams as possible and lead them to be more preoccupied with the noise than with the task itself. To still perform well, they had to blank out or ignore the distraction. When finished with the anagrams or after 8 min had passed, participants were asked how they felt (1 = *very bad*, 9 = *very good*) and proceeded with a seemingly unrelated task, the breadth of categorization task used by Friedman and Förster (2000). Participants were asked to rate the typicality of nine items for each of four different categories (0 = *not typical*, 9 = *typical*). In each category, three items represented good exemplars, three items represented moderately good exemplars, and three items represented poor exemplars. Atypical exemplars (e.g., telephone for the category "furniture") were determined based on the means from a control group of another study. Higher ratings for these items reflect a broader conceptual scope. The remaining, more typical exemplars were used to control for overall shifts in response bias (Friedman & Förster, 2000; Isen & Daubman, 1984). Finally, participants indicated how difficult it was for them to solve the anagrams given the circumstances (1 = *not difficult at all*, 9 = *very difficult*). They were probed for suspicions, paid, thanked, and debriefed. No suspicions regarding the connection between the anagram task and the categorization task were expressed.

Results and Discussion

Conceptual scope. We computed separate goodness-of-fit ratings for the 12 atypical (i.e., poor) and the 24 typical (i.e., good and moderately good) exemplars. The effect of conceptual scope is typically reflected in higher or lower acceptance of *fringe* exemplars, whereas acceptance of moderate or typical exemplars should remain unaffected because they are considered typical in any event. Accordingly, we conducted a one-way ANOVA with framing-condition as independent variable and atypical exemplar ratings as a dependent variable. As predicted, participants in the obstacle-framing condition ($M = 3.39$, $SD = 0.85$) gave higher ratings to the atypical exemplars than did participants in the distraction-framing condition ($M = 2.57$, $SD = 0.94$), $F(1, 30) = 6.64$, $p = .02$, $\eta_p^2 = .18$. No such difference occurred for the typical exemplars ($F < 1$) suggesting that results do not reflect simple shifts in response bias.

Control variables. Overall, participants perceived the anagram task as rather difficult ($M = 8.28$, $SD = 1.22$). A one-way ANOVA revealed no differences between the obstacle-framing condition ($M = 8.00$, $SD = 1.54$) and the distraction-framing condition ($M = 8.60$, $SD = 0.63$) in perceived difficulty, $F(1, 30) = 1.97$, $p = .17$, $\eta_p^2 = .06$, or mood ($M_{obstacle} = 6.65$, $SD = 1.50$; $M_{distraction} = 6.60$, $SD = 0.63$, $F < 1$). This is not surprising because both conditions were exposed to the same background noise. Including difficulty or mood as covariates in the main analysis did not alter the effect of sound framing on breadth of categorization. Given that this task was generally more difficult than the one used in Study 1, participants on average solved only 9.87% of all anagrams correctly. The two conditions did not differ in anagram performance ($F < 1$) and anagram performance as a covariate did not influence the main effect of framing condition on conceptual scope. As with difficulty, the lack of performance differences is not surprising in this study because all participants heard the same background noise, and one would not expect performance differences based on the noise.

In sum, Study 2 replicates the finding of Study 1 on a more conceptual level. Specifically, this study shows that presenting the same, potentially aversive stimulus as an obstacle that has to be overcome rather than as a distraction that has to be ignored leads people to broaden their conceptual scope and include unusual exemplars more in existing categories. This effect was independent from mood, perceived difficulty, or anagram performance.[1]

The next two studies were conducted to examine whether obstacles elicit global processing in the same task in which they were encountered (Study 3A) and whether people adopt a more global processing style after encountering an obstacle, compared with doing nothing (Study 3B). These are important questions because to make the claim that a processing style elicited in one task carries over to an unrelated task, one needs to know whether the processing style in question was at all elicited in the first task. In other words, Study 3A was designed to rule out the possibility that obstacles elicit local processing in Task A, and people only switch to global processing when starting Task B (e.g., to better understand the new task). The second question relates to the notion of global precedence (Navon, 1977), suggesting that people may naturally process global information faster than local information. Although there is some controversy on this issue,[2] one may wonder whether obstacles elicit more global processing not only compared with a state in which people are performing a task without an obstacle, as was the case in Study 1, but also compared with a state in which they are not doing anything. In Study 3B, we addressed this question by comparing conditions in which participants engaged in a goal-directed activity with or without an obstacle or did nothing.

Though the manipulations we used so far (i.e., stimuli that interfere with, or are framed as an obstacle to the task at hand) fit our definition of obstacles as interfering forces that prevent people from accomplishing tasks in the most straightforward manner, in Studies 3A and 3B, we substituted this manipulation for one that speaks to the more literal view of obstacles as something standing in the way of the most direct path to a goal. In Study 3A, participants navigated a maze with or without an obstacle suddenly blocking the most direct path to the goal. During this task, participants' eye movements were recorded to measure changes in perceptual scope immediately after the appearance of an obstacle. In Study 3B, participants navigated the same maze with or without an obstacle or merely looked at a white screen before completing the Navon-letters task from Study 1.

Study 3A

Method

Participants. Thirty-six undergraduates (22 female, 14 male) aged between 18 years and 50 years ($M = 22.14$, $SD = 1.63$) participated in a 1-hr battery of unrelated studies. Participants were randomly assigned to conditions and received €7 (U.S.$10.08) or course credit as compensation.

Apparatus. We used a faceLAB 5 eye tracker (Seeing Machines, Inc., Tucson, AZ) that is completely nonintrusive (i.e., placed underneath the computer screen rather than on the participant's head) and is accurate to within approximately 1 millimeter of translational error and 1 degree of rotational error. Eye movements were sampled at 60 Hz (i.e., 60 samples per s).

Materials and procedure. Upon arrival, participants were seated individually in front of a computer screen. They were told that the session consisted of several studies from different researchers and that their eye movements would be recorded in some of the tasks. Therefore, a calibration procedure of approximately 5 min preceded the experimental tasks.

After the calibration, participants worked on unrelated tasks for approximately 20 min. They were then introduced to an alleged pretest for games to be used in future studies and were told that they were randomly assigned to the "maze game," which involved moving a figure from the upper left corner to a designated goal on the right side of the screen. Participants were asked to perform as well as possible, ostensibly because we were interested in the average difficulty of the game. They first completed a simple practice maze. Afterward, a short recalibration followed in which participants were asked to fixate a cross that appeared at the center of the screen and subsequently moved randomly across the screen. The experimenter stopped this procedure manually once eye-tracking quality was satisfactory (i.e., after approximately 10–15 s). Next, a more complex maze followed that contained our obstacle manipulation. The layout

[1] An anonymous reviewer suggested that the results of Study 2 could also be explained by differences in promotion versus prevention focus (Higgins et al., 2001). Although we do not disagree that the obstacle versus distraction framing conditions might be reminiscent of a promotion versus prevention focus, there are several reasons why we think this explanation is unlikely. First, we took measures to ensure that neither a clear prevention focus nor a clear promotion focus was triggered by our manipulations. More specifically, instructions in both conditions contained statements suggesting that participants needed to prevent the noise from influencing their performance (prevention) *and* statements suggesting that their task was to perform well and to solve as many anagrams as possible (promotion). Second, all participants were exposed to an aversive background noise that threatened their performance on the anagram task. Therefore, if anything, everybody was in a prevention focus to begin with. If the obstacle versus distraction framing added anything to this, it would have caused *relative* differences within a prevention focus rather than differences between a clear prevention focus and a clear promotion focus. We are not aware of any literature on the effects of relative differences within one of the two foci on global versus local processing. Third, an alternative explanation in terms of regulatory focus could only potentially explain the results of one out of six studies reported in this article, whereas our interpretation can account for the results of all six studies. In sum, for theoretical reasons and for reasons of parsimony, we favor our current interpretation.

[2] Many researchers have refuted Navon's original claim that global processing precedes local processing. For example, Kinchla and Wolfe (1979) showed that one factor that determines whether a global or local advantage occurs in identification is the overall size of stimuli. Similarly, Kimchi and Palmer (1982) demonstrated that the size ratio of global to local shapes can change a global processing advantage into a local one, and Lamb and Robertson (1988) found local precedence effects with central presentation and global precedence effects with peripheral presentation. More recently, Förster (in press) showed that priming a local processing style enhances local processing on the next trial. This implies that processing styles can be easily primed and again questions the general global dominance hypothesis (see also Robertson, 1996; Ward, 1982). Altogether, more than a decade of research on global precedence suggests that various parameters determine the efficiency of responding to global and local forms defined by levels in a spatial hierarchy.

of the maze was the same for all participants. However, in the obstacle condition, a large obstacle (see Figure 1) would suddenly appear and block the most direct path to the goal. In this condition, the obstacle was triggered by the figure passing one of several trigger points that were arranged (invisibly to the participant) on a vertical line located approximately one third of the way from the left side of the screen. The obstacle appeared only once and remained on the screen until the finish flag was reached. In the no-obstacle condition, the figure passed the same trigger points, but this did not cause the obstacle to appear. During the entire task, participants' eye movements were recorded.

After the maze, which all participants navigated successfully, participants were asked how they felt (1 = *very bad*, 9 = *very good*) and how difficult the task was for them (1 = *not difficult at all*, 9 = *very difficult*). At the end of the session, they were probed for suspicions, paid, thanked, and debriefed. Although participants knew that their eye movements were recorded, none of them was able to guess the hypothesis we were testing.

Results and Discussion

Perceptual scope. To measure perceptual scope, we first divided the screen into 12 equal squares. We then counted how many of these squares participants looked into before and after the figure passed one of the abovementioned trigger points (i.e., before and after the obstacle appeared in the obstacle condition). Given that no obstacle appeared in the no-obstacle condition, using those points as a reference allowed us to determine what "before" and "after" meant in both conditions. Perceptual scope was operationalized in terms of the number of squares looked into, that is, the proportion of the screen used while searching for a path to the goal. To ensure that effects were not due to participants in the obstacle condition spending more time ($M = 41.87$ s, $SD = 11.36$) on the task than participants in the control condition ($M = 16.74$ s, $SD = 6.16$), we included time as a covariate in each of the analyses.

A 2 (obstacle: yes vs. no) × 2 (trigger: before vs. after) repeated-measures ANOVA with obstacle as between-subjects factor and trigger as within-subjects factor revealed no main effect of trigger ($F < 1$). However, a significant main effect of obstacle, $F(1, 33) = 24.02$, $p < .0001$, $\eta_p^2 = .42$, suggests that overall, participants in the obstacle condition ($M = 8.55$, $SD = 1.49$) used 71.25% of the screen to find a path to the goal, whereas participants in the no-obstacle condition used only 46.33% of the screen ($M = 5.56$, $SD = 1.49$; see Figure 2). A significant Obstacle × Trigger interaction, $F(1, 33) = 5.34$, $p = .03$, $\eta_p^2 = .14$ (see Figure 3), further revealed that participants in the control condition looked into approximately the same number of squares before ($M = 5.50$, $SD = 2.50$) and after ($M = 5.62$, $SD = 1.57$) passing the obstacle trigger, whereas participants in the obstacle condition looked into more squares after passing the obstacle trigger ($M = 9.99$, $SD = 1.57$) than before passing the obstacle trigger ($M = 7.11$, $SD = 2.50$).

Simple main effects lend additional support to the hypothesis that participants in the obstacle condition indeed broadened their perception immediately after the obstacle appeared: They used a significantly larger part of the screen after passing the obstacle trigger than before passing the obstacle trigger, $F(1, 33) = 17.50$, $p < .0001$. No such difference occurred among participants in the no-obstacle condition ($F < 1$). After passing the obstacle trigger, participants in the obstacle condition also used a significantly larger part of the screen than did participants in the no-obstacle condition, $F(1, 33) = 46.57$, $p < .0001$. There was no such difference between conditions before participants passed the obstacle trigger, $F(1, 33) = 2.50$, $p = .12$.

Control variables. Participants perceived the maze task as rather easy ($M = 2.71$, $SD = 1.61$). There were no effects of obstacles on perceived difficulty ($F < 2$), or mood ($F < 1$). Accordingly, including perceived difficulty or mood as a covariate did not influence the effect of obstacle on perceptual scope.

In sum, this study shows that people broaden their perceptual scope immediately after encountering a physical obstacle standing in the way of the most direct path to a goal. We now move on to the next study, examining whether engaging in a goal-directed activity with an obstacle leads to more global processing in an unrelated task than does engaging in the same activity without an obstacle or, more critically, doing nothing.

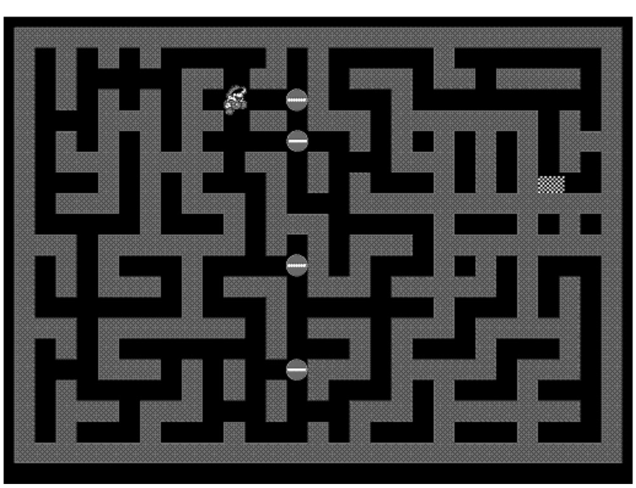

Figure 1. Maze manipulation used in Studies 3A and 3B, as well as in Studies 5 and 6 (obstacle condition). In the obstacle condition, an obstacle appeared while navigating the maze. In the no-obstacle condition, participants navigated the maze without an obstacle.

Study 3B

Method

Participants. Sixty-two 1st year students (48 female, 14 male) aged between 17 years and 44 years ($M = 20.19$, $SD = 4.34$) participated in a 1-hr battery of unrelated studies. They were randomly assigned to conditions and were compensated with course credit. Three participants were excluded because they did not follow instructions. One additional participant was excluded because too little data remained after eliminating outliers (reaction times that differed more than 3 *SD* from the group mean) in the Navon-letters task.

Materials and procedure. As in Study 3A, participants worked on several unrelated tasks before they were introduced to the current study. In the obstacle and the no-obstacle condition, the manipulation was the same as in Study 3A. In the additional white-screen condition, participants were merely told that the next time they pressed the "continue" button, a white screen would appear for approximately 1 min, and the only thing they should do would be to look at the white screen. In reality, this screen was

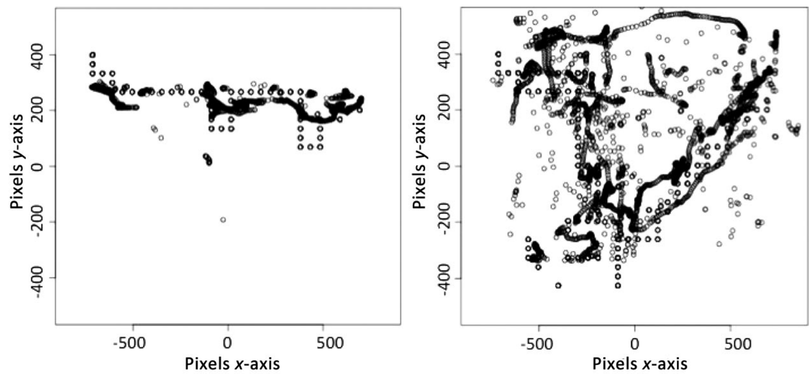

Figure 2. Sample eye movements from participants navigating a maze without (left) or with (right) an obstacle (Study 3A).

shown for 50 s, which corresponds to the average total time participants in other studies spent on the practice and manipulation mazes. Afterwards, all participants were asked how they felt (1 = *very bad*, 9 = *very good*) and how difficult it was for them to navigate the maze or look at the white screen, respectively (1 = *not difficult at all*; 9 = *very difficult*). Next, they completed the Navon-letters task from Study 1, measuring perceptual scope. At the end of the session, participants were probed for suspicions, compensated, thanked, and debriefed. No suspicions regarding the connection between the maze and the letters task were expressed.

Results and Discussion

Perceptual scope. As in Study 1, response times (RT) to global, *K–S* (58) = .14, $p = .01$; *S–W* (58) = .88, $p < .0001$, and local targets, *K–S* (58) = .14, $p = .006$; *S–W* (58) = .83, $p = .002$, were positively skewed. Accordingly, we log-transformed RT (natural logarithm) prior to analyses and excluded both trials with incorrect responses and trials on which the RT was more than 3 *SD* from the mean of the respective target type. A 3 (task: obstacle vs. no-obstacle vs. white-screen) × 2 (target: global vs. local) repeated-measures ANOVA revealed that overall, participants responded faster to global ($M = 6.30$, $SD = 0.14$) than to local ($M = 6.41$, $SD = 0.17$) targets, $F(1, 55) = 104.43$, $p < .0001$, $\eta_p^2 = .66$, replicating the "global precedence" effect (Navon, 1977). There was also a main effect of task, $F(2, 55) = 3.24$, $p < .05$, $\eta_p^2 = .11$, suggesting that participants in the no-obstacle condition generally responded faster ($M = 6.29$, $SD = 0.15$) than did participants in the obstacle condition ($M = 6.40$, $SD = 0.15$) or the white-screen condition ($M = 6.41$, $SD = 0.15$). More critically, these effects were qualified by a significant Task × Target interaction, $F(2, 55) = 3.43$, $p = .04$, $\eta_p^2 = .11$.

Because we were interested in differences between conditions in the relative advantage of global RT over local RT and to illustrate the nature of this interaction, we computed difference scores (global RT minus local RT), such that lower scores reflect a faster RT to global targets than to local targets. As predicted, these scores were lower among participants in the obstacle condition ($M = -.16$, $SD = .09$) than among participants in the no-obstacle ($M = -.11$, $SD = .08$) or white-screen ($M = -.09$, $SD = .09$) conditions. Supplementary planned contrasts revealed a significant difference in relative RT between the obstacle and the white-screen condition, $t(55) = 2.47$, $p = .02$, $d = 0.78$, a marginally significant difference between the obstacle and the no-obstacle condition, $t(55) = 1.95$, $p = .06$, $d = 0.59$, and no difference between the no-obstacle and the white-screen condition, $t(55) = .63$, $p = .53$, $d = 0.23$. In other words, participants who encountered an obstacle during a goal-directed activity showed a faster relative RT to global targets, compared with local targets, than did participants who did not encounter an obstacle during the same activity and participants who did nothing.

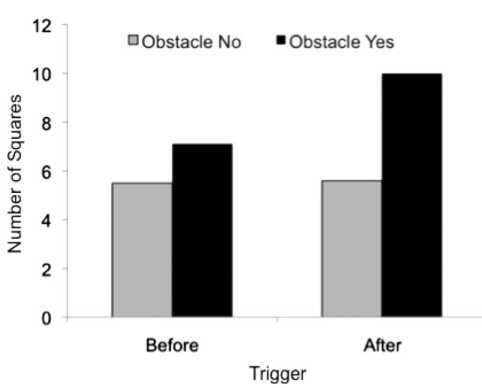

Figure 3. Number of squares looked into before and after passing the obstacle trigger as a function of obstacle condition (Study 3A).

Control variables. A one-way ANOVA revealed that perceived difficulty was higher among participants in the obstacle condition ($M = 2.35$, $SD = 1.46$) and participants in the white-screen condition ($M = 3.88$, $SD = 2.55$) than among participants in the no-obstacle condition ($M = 1.81$, $SD = 0.81$), $F(2, 55) = 7.39$, $p = .001$, $\eta_p^2 = .21$. Importantly, entering perceived difficulty as a covariate in the main analysis neither influenced perceptual scope directly nor changed the main effect of task on perceptual scope. There was also no effect of task on mood ($F < 1$). Accordingly, mood as a covariate did not influence the main effect of task on perceptual scope.

To conclude, Studies 3A and 3B provide initial answers to the questions of whether obstacles elicit global processing in the same task in which they were experienced and whether obstacles elicit more global processing, compared with doing nothing. Having shown that a direct link between obstacles and global processing exists in the first three studies, we now turn to the question of when obstacles should be more, or less, likely to increase global processing.

Task Engagement as a Moderator

Based on Lewin's (1935) field theory, an "if obstacle, then start global processing" response appears most relevant when people remain engaged in the ongoing activity or task and try to deal with the obstacle (e.g., try to integrate it, find ways around it), but not when they would rather disengage. The concept of *volatility*, which was introduced as part of Kuhl's (1994a, 1994b) theory of action control, refers precisely to this distinction: When volatility is low, individuals are inclined to remain engaged in ongoing activities and follow through with what they do. When volatility is high, individuals are less engaged in ongoing activities and are inclined to switch to alternative activities prematurely, even if they are successful or the current activity is pleasant. Volatility differs from commitment in that one can be very committed to a goal but fail to stay fully engaged in a goal-relevant activity (e.g., think about other attractive activities, disrupt the current activity to do something else for a while), or as Latham and Locke (1991, p. 217) wrote, "the feeling of commitment does not automatically lead one to act in accordance with it." In a recent validation study (for more information, see the Appendix), volatility was related to quickly changing interests (see Duckworth & Quinn, 2009) and attentional impulsiveness (see Patton, Stanford, & Barratt, 1995). Hence, it contains both a motivational and an attentional component (see also Kuhl, 1983) but constitutes a distinct factor of its own, reflecting peoples' degree of engagement in ongoing activities.

Because staying engaged (either mentally or physically) is critical with regard to overcoming obstacles, we suggest that volatility may moderate people's cognitive response to obstacles, such that global processing should be more likely when volatility is low rather than high. Moreover, we propose that volatility might vary not only as a chronic trait, as originally assumed, but also with context. For example, high volatility might be activated when having the ability to multitask or having many different interests and goals appears desirable, whereas low volatility might be activated when becoming immersed in activities and being able to follow through with one's intentions are valued.

Qualifying the general prediction that obstacles should lead to a more global processing style, Studies 4–6 therefore examined the moderating role of volatility. In these studies, we predicted that individuals low in trait or state volatility should try to adopt a more global processing style upon facing an obstacle in order to better understand the situation, integrate the obstacle, or find alternative means. By contrast, individuals high in trait or state volatility should *not* adopt a more global processing style because they are likely to disengage prematurely, and dealing with an obstacle may not be their main concern. In Study 4, the same paradigm was used as in Study 1, except that differences in trait volatility were assessed at the beginning of the session, and the Navon-letters task was replaced with another measure of perceptual scope in order to establish generalizability of the effect to different tasks.

Study 4

Method

Participants. Thirty-two students (14 female, 18 male) aged between 17 years and 31 years ($M = 22.52$, $SD = 3.00$; age and gender from two participants are missing) were recruited to participate in a 2-hr battery of unrelated studies. Participants received €20 (U.S.$28.80) as compensation. One participant was excluded because he failed to complete all questionnaires.

Materials and procedure. Upon arrival, participants completed a number of questionnaires, including Kuhl's (1994b) Action Control Scale (ACS–90). Typical items from the volatility subscale are "When I'm working on something that's important to me (a) I still like to do other things in between working on it; (b) I get into it so much that I can work on it for a long time," or "When I read something that I find interesting (a) I sometimes still want to put the article down and do something else; (b) I will sit and read the article for a long time."[3] In these examples, choosing *a* reflects high volatility and choosing *b* reflects low volatility. Typically, volatility is used as a dichotomy (e.g., Beckman & Kazén, 1994; Boekaerts, 1994), distinguishing between individuals who are more inclined to stay engaged and follow through with ongoing activities and individuals who are more inclined to disengage prematurely, even when they are successful or the current task is pleasant.[4]

After several unrelated tasks, the present study was introduced. As in Study 1, participants completed the anagram task while hearing interfering random words (i.e., obstacle) or no sound (i.e., no obstacle). Subsequently, they continued with an allegedly unrelated task on "visual matching." This was Kimchi and Palmer's (1982; see Gasper & Clore, 2002) geometrical figures task, our measure of perceptual scope. This task is similar to Navon's letter task, but replaces letters by figures and reaction times as the

[3] The quoted items are from "Action Versus State Orientation: Psychometric Properties of the Action-Control Scale (ACS-90)," by J. Kuhl, 1994, in J. Kuhl and J. Beckmann (Eds.), *Volition and Personality: Action Versus State Orientation,* pp. 47–59. Copyright 1994 by Hogrefe & Huber, Publishers. Reprinted with permission.

[4] We dichotomized volatility scores for three reasons: First, the ACS-90 was not originally developed to measure continuous dimensions ranging from low to high, but to distinguish between person types who predominantly use one of two qualitatively different processing modes associated with each of the two response options on scale-items (self-control vs. self-regulation; Kuhl, 1994a; see also Kazén, Baumann, & Kuhl, 2005). Second, the original norm data ($N = 554$; Kuhl, 1994b) and data from a recent study conducted by us ($N = 496$; see Appendix) suggests that the distribution of the volatility scale is negatively skewed and, as a likely result, that the assumption of normality of error distributions underlying linear regression was violated in the present studies. Common transformations did not change this distribution in a meaningful way. The third, and for us most important, reason was that we were specifically interested in comparing individuals who almost never interrupt activities prematurely (i.e., are *very* sure about finishing ongoing activities/are unlikely to have doubts) with individuals who might start pondering about whether they would rather do something else. To illustrate, even if a person is still working on a task, one may consider her thinking about doing something else as disengaging in the present context because the person's attention is no longer fully dedicated to the task at hand.

dependent variable by decisions based on global or local stimulus features. More specifically, it consisted of 48 trials in which a target figure was presented at the center of the screen. In half the trials, the target figure was a large square made up of small triangles or squares. In the other half, the target figure was a large triangle made up of small triangles or squares. In each trial, the shape of one bottom figure resembled the target in its global attributes (i.e., the shape of the composite large figure), whereas the shape of the other bottom figure resembled the target in its local attributes (i.e., the shapes of the constituent small figures). Participants were asked to indicate for each target figure which of the two other figures resembled the target more. The overall number of global choices was our measure of per scope. At the end, participants were asked how difficult it was for them to solve the anagrams (1 = *not difficult at all*, 9 = *very difficult*), were probed for suspicions, and were paid, thanked, and debriefed. No suspicions regarding the connection between the anagram task and the dependent measure were expressed.

Results and Discussion

Perceptual scope. Applying the norms (Kuhl, 1994b, n.d.), participants were classified as either high or low in trait volatility. Specifically, respondents were considered to be high in trait volatility if they picked between zero and nine low volatility answers, and low in trait volatility if they picked between 10 and 12 low volatility answers (see Kuhl, 1994b; see footnote 3). A 2 (obstacle: yes vs. no) $\times$ 2 (volatility: high vs. low) ANOVA revealed no main effects of obstacle or volatility (Fs < 1). Importantly, as predicted, a significant Obstacle $\times$ Volatility interaction emerged, $F(1, 27) = 6.03$, $p = .02$, $\eta_p^2 = .18$ (see Figure 4). Simple main effects further revealed that participants low in volatility ($n = 15$) made significantly more global choices in the obstacle condition ($M = 41.27$, $SD = 10.20$) than in the no-obstacle condition ($M = 26.50$, $SD = 15.07$), $F(1, 27) = 4.73$, $p = .04$, $\eta_p^2 = .15$, whereas for participants high in volatility ($n = 16$), the difference between the two obstacle conditions was not significant (obstacle: $M = 32.00$, $SD = 7.01$; no-obstacle: $M = 39.50$, $SD = 13.69$), $F(1, 27) = 1.56$, $p = .22$, $\eta_p^2 = .06$. Thus, being confronted with an obstacle increased perceptual scope among individuals low in trait volatility, but not among those high in trait volatility.

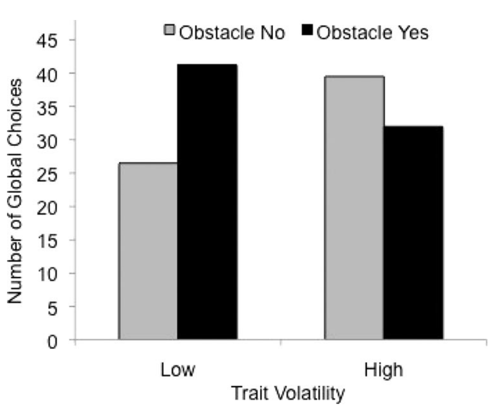

Figure 4. Mean number of global choices as a function of obstacle condition and trait volatility (Study 4).

Control variables. Overall, participants perceived the anagram task as moderately difficult ($M = 5.81$, $SD = 1.89$). There were no effects of obstacle, volatility, or their interaction on perceived difficulty (Fs < 1). Accordingly, including perceived difficulty as a covariate in the main analysis did not alter the Obstacle $\times$ Volatility interaction. Complementing this result, participants solved 73.81% ($SD = 12.81$) of all anagrams correctly overall. There were no main effects of obstacle or volatility on anagram performance ($F < 1$), and there was no significant interaction ($F < 3$). Consequently, including anagram performance as a covariate in the main analysis did not change the impact of obstacle and volatility on perceptual scope.

Building on and further qualifying effects from Studies 1–3, which demonstrated cognitive effects of obstacles in terms of automatic shifts in attention to global versus local stimulus features and changes in conceptual category breadth, this study identified trait volatility as a variable that moderates the impact of obstacles on processing styles. Specifically, it revealed that individuals low in trait volatility, but not those high in trait volatility, respond to obstacles by broadening their perceptual scope. In Studies 5 and 6, we sought to replicate this finding with a conceptual scope task that not only involves typicality ratings, as does the task that we used in Study 2, but also requires actively finding structural relations (Förster, 2009) and integrating different pieces of information—a process that is often relevant for efficiently dealing with obstacles (see Förster et al., 2010; Lewin, 1935; Marguc, Van Kleef & Förster, 2010; Oettingen & Stephens, 2009). We chose to use variants of Mednick's (1962) remote-associates task (RAT) as indicators of conceptual scope because global processing has been shown to promote a search for similarity (Förster, 2009) and has been posited to enhance RAT performance by increasing the similarity search and the likelihood that remote concepts are activated (Friedman et al., 2003; see also Bowden & Jung-Beeman, 2003; Martindale, 1995; Schooler & Melcher, 1995). In other words, to find a common word that connects *barrel*, *white*, and *belly*, people have to go beyond the hyperaccessible solutions for each of the single concepts (e.g., *oil*, *snow*, or *fat*, respectively), find the similarities between them, and activate the less accessible overarching associations that are shared by all of them (e.g., "beer"). Consequently, in Study 5, we expected participants low in trait volatility to perform better on the RAT after navigating a maze with an obstacle, compared with a maze without an obstacle, whereas for participants high in trait volatility, we did not expect such an improvement.

Study 5

Method

Participants. Sixty-eight students (47 female, 21 male) aged between 18 years and 47 years ($M = 21.38$, $SD = 4.23$) participated in a 1-hr battery of unrelated studies. One participant was excluded because he did not complete all measures. Participants received €7 (U.S.$10.08) or course credit as compensation.

Materials and procedure. Participants completed several questionnaires, including Kuhl's (1994b) ACS–90, before they continued with the maze task from Study 3. Again, all participants navigated the same maze, the only difference being whether an obstacle appeared and blocked the direct path to the goal. Afterwards, participants were asked how they felt (1 = *very bad*, 9 = *very good*) and how difficult the maze task was for them (1 = *not difficult at all*, 9 = *very difficult*). They then received instructions for an ostensibly unrelated task, an adapted version of the 10-trial RAT used by Kray, Galinsky, and Wong (2006). On each trial, participants saw three words on the screen (e.g., *envy*, *golf*, and *beans*) and were asked to find a fourth word that connects them all (e.g., *green*). The RAT was self-paced, so participants could spend as much time as needed on each trial. However, once they continued with the next trial, they could not go back to earlier ones. Participants had 2 min for this task. They were probed for suspicions, paid, thanked, and debriefed. No suspicions regarding the connection between the maze and the RAT were expressed.

Results and Discussion

Conceptual scope. A 2 (obstacle: yes vs. no) × 2 (volatility: high vs. low) ANOVA revealed no main effects (Fs < 1.40, ps > .24). Replicating the pattern from Study 4, a significant Obstacle × Volatility interaction emerged, $F(1, 63) = 4.88$, $p = .03$, $\eta_p^2 = .07$. Simple main effects further revealed that participants low in volatility ($n = 20$) found more correct RAT solutions in the obstacle condition ($M = 4.75$, $SD = 3.20$) than in the no-obstacle condition ($M = 2.83$, $SD = 1.80$), $F(1, 63) = 4.05$, $p = .05$, $\eta_p^2 = .06$, whereas for participants high in volatility ($n = 48$), the difference between the two obstacle conditions was not significant (obstacle: $M = 3.33$, $SD = 1.93$; no-obstacle: $M = 3.91$, $SD = 1.93$; $F < 1$; see Figure 5). Thus, as predicted, after encountering a physical obstacle in one task, the ability to integrate information in an unrelated task improved for individuals low in trait volatility, but not for those high in trait volatility.

Control variables. Although the maze was generally perceived as rather easy ($M = 2.00$, $SD = 1.19$), participants in the obstacle condition ($M = 2.56$, $SD = 1.39$) evaluated it as more difficult than did those in the no-obstacle condition ($M = 1.49$, $SD = 0.66$), $F(1, 63) = 16.08$, $p < .0001$, $\eta_p^2 = .20$. There were no effects of volatility or the Obstacle × Volatility interaction on perceived difficulty (Fs < 1). Including perceived difficulty as a covariate in the main analysis did not alter the combined effect of obstacle and volatility on RAT performance. Furthermore, there were no effects of obstacle, volatility, or their interaction on mood (Fs < 2.10, ps > .15), and entering mood as a covariate in the main analysis did not alter the Obstacle × Volatility interaction. Thus, neither perceived difficulty nor mood could account for the effects of obstacles and volatility on RAT performance.

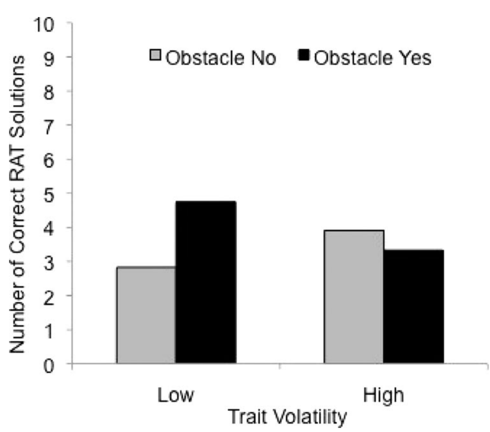

Figure 5. Mean number of correct solutions on the remote-associates task as a function of obstacle condition and trait volatility (Study 5).

As predicted, results from Study 5 show that physical obstacles are more likely to broaden conceptual scope among individuals low in trait volatility than among individuals high in trait volatility. Importantly, this study goes beyond our previous studies in demonstrating that global processing triggered by an obstacle not only transfers to completely unrelated contexts or tasks but also improves performance on tasks that require a search for similarity and more active integration of seemingly unrelated concepts.

To further strengthen our findings and test whether experimentally manipulating volatility would influence RAT performance in the same way as measuring it as a chronic trait, we conducted Study 6. To the best of our knowledge, the concept of volatility has hitherto never been experimentally induced, even though it appears reasonable to assume that in some situations, people might be more inclined to follow through with an activity, whereas in other situations, they might be more inclined, or tempted, to disengage quickly. Thus, expanding the concept of volatility, in Study 6, we pioneered the examination of the effects of state volatility. We expected participants primed with low volatility to perform better on the RAT after navigating a maze with an obstacle, compared with a maze without an obstacle, whereas for participants primed with high volatility, we did not expect such a difference.

Study 6

Method

Participants. One hundred twenty five students (72 female, 47 male, 6 unknown) aged between 17 years and 30 years ($M = 21.43$, $SD = 2.76$) participated in a 1-hr battery of unrelated studies. Participants received €7 (U.S.$10.08) or course credit for compensation.

Materials and procedure. After several unrelated tasks, the volatility manipulation was introduced as an alleged test of social competence. Participants were told that the task was "designed to test whether making correct inferences about people based on minimal information is a skill that some people have and others do not." They then received a sheet with a number of statements and photographs of young men and women. One half of the female and male faces had a neutral facial expression, whereas the other half was smiling. Participants were instructed to read the statements carefully and look at all the photographs until they felt they knew which statement belonged to which photograph. In case they were not sure, they should choose the one that seemed the most likely candidate. In other words, participants were asked to intuitively decide which statement belonged to which photograph. Depending on condition, half of the statements represented high volatility (e.g., "Even the most enthralling movie doesn't stop me from getting up and doing something else for a while.") or low volatility (e.g., "When I'm watching an enthralling movie, I wouldn't even think of doing something else."), whereas the other half consisted of neutral fillers (e.g., "I like the color white, even if it's technically not a color. I just like it."). After this task, participants proceeded with the ostensibly unrelated maze task from Study 5, indicated how they felt (1 = *very bad*, 9 = *very good*) and how difficult the maze was for them (1 = *not difficult at all*, 9 = *very difficult*), and proceeded with a 20-item version of the RAT (see Bongers, Dijksterhuis, & Spears, 2008), which was also introduced as an unrelated task. Participants completed five practice trials before they continued with the real trials, of which 10 were difficult and 10 were moderately difficult. There was no time limit. As in Study 5, the RAT was self-paced; however, once participants continued with the next trial, they could not go back to earlier trials. Finally, participants were probed for suspicions, paid, thanked, and debriefed. No suspicions regarding the connection between the volatility manipulation, the maze, and the RAT were expressed.

Results and Discussion

Conceptual scope. A 2 (obstacle: yes vs. no) × 2 (volatility: high vs. low) ANOVA on the number of correct solutions revealed no main effects (Fs < 1.53, ps $> .22$, $\eta_p^2 = .01$). However, in line with predictions and replicating Study 5, a significant Obstacle × Volatility interaction emerged, $F(1, 121) = 5.01$, $p = .03$, $\eta_p^2 = .04$, such that participants primed with low volatility performed better on the RAT when they were in the obstacle condition ($M = 3.71$, $SD = 2.94$) than when they were in the no-obstacle condition ($M = 2.44$, $SD = 2.27$), $F(1, 121) = 4.22$, $p = .04$, $\eta_p^2 = .03$. By contrast, for participants primed with high volatility, there was no difference between obstacle conditions with regard to RAT performance (obstacle: $M = 2.20$, $SD = 2.16$; no-obstacle: $M = 2.88$, $SD = 2.34$), $F(1, 121) = 1.23$, $p = .27$, $\eta_p^2 = .01$.

Control variables. Although participants generally perceived the maze as rather easy ($M = 2.17$, $SD = 1.57$), those in the obstacle condition ($M = 2.45$, $SD = 1.72$) perceived it as somewhat more difficult than did those in the no-obstacle condition ($M = 1.93$, $SD = 1.40$), $F(1, 121) = 3.58$, $p = .06$, $\eta_p^2 = .03$. There were no effects of volatility or the Obstacle × Volatility interaction on perceived difficulty (Fs < 1). Including perceived difficulty as a covariate in the main analysis did not change the interactive effect of obstacle and volatility on RAT performance. Furthermore, participants primed with high volatility ($M = 7.03$, $SD = 1.45$) felt somewhat better than those primed with low volatility ($M = 6.53$, $SD = 1.22$), $F(1, 121) = 3.84$, $p = .05$, $\eta_p^2 = .03$. There were no effects of volatility or the Obstacle × Volatility interaction on mood (Fs < 1.86, ps $> .18$). Although mood as a covariate had a marginally significant effect on RAT performance, $F(1, 120) = 3.69$, $p = .06$, $\eta_p^2 = .03$, the Obstacle × Volatility interaction remained unchanged.

To follow up the effect of mood, correlation analyses within each condition were performed, revealing that mood was only associated with RAT performance among participants who were primed with low volatility and did not encounter an obstacle. This correlation was negative and marginally significant ($r = -.29$, $p = .10$); thus, if mood had an effect, it did not help to improve RAT performance.

Last but not least, because there was no time limit in this study, we also assessed the role of time spent on the RAT. Results revealed that overall participants worked 104.48 s ($SD = 13.60$) on the RAT. Unsurprisingly, participants primed with low volatility worked a little longer ($M = 106.69$, $SD = 10.53$) than did participants primed with high volatility ($M = 102.30$, $SD = 15.85$), $F(1, 121) = 3.83$, $p = .05$, $\eta_p^2 = .03$. A marginally significant Obstacle × Volatility interaction, $F(1, 121) = 2.91$, $p = .09$, $\eta_p^2 = .02$, further suggests that this difference appeared mainly in the obstacle condition (low volatility: $M = 109.58$, $SD = 7.82$; high volatility: $M = 100.76$, $SD = 17.13$), but not in the no-obstacle condition (low volatility: $M = 104.31$, $SD = 11.92$; high volatility: $M = 103.71$, $SD = 14.71$). Hence, it seems that participants primed with low volatility were more persistent on the RAT after encountering an obstacle than were participants primed with high volatility, which is in line with the notion that the former are less likely to disengage prematurely from ongoing activities than the latter. Nevertheless, as expected, time spent on the RAT did not influence performance when included as a covariate ($F < 1$), and the Obstacle × Volatility interaction remained significant. One may therefore conclude that encountering an obstacle in one task improved performance on an unrelated task that requires seeing the connection between seemingly unrelated concepts among participants primed with low rather than high volatility and that this effect was independent of perceived difficulty, mood, or time spent on the second task.

General Discussion

Six studies support the idea that obstacles influence global versus local processing styles, that is, the more general ways in which people perceive and conceptually process information from their environment. Consistently, these studies show that encountering an obstacle in one task can elicit a more global, Gestalt-like processing style that automatically carries over to unrelated tasks, leading people to broaden their perception, open up mental categories, and improve at integrating seemingly unrelated concepts. In line with the assumption that a global processing response to obstacles should be most relevant when people are inclined to stay engaged and follow through with what they do but not when they would rather disengage, this response was more likely among participants with a chronic or situationally activated tendency to become immersed and follow through with ongoing activities (low volatility) than among participants with a chronic or situationally activated tendency to disengage prematurely (high volatility). Notably, these effects were independent of and thus could not be explained by self-reported mood, perceived task difficulty, or time spent on the second task.

Because obstacles were primed in different ways, our studies suggest that similar cognitive effects may occur regardless of whether an obstacle is physical, auditory, or merely mental in nature. Specifically, hearing interfering random words (compared with no sound) while solving verbal anagrams broadened perceptual scope in an unrelated task (Study 1), especially when trait volatility was low rather than high (Study 4). Hearing unrelated random numbers presented as an obstacle that has to be overcome rather than a distraction that has to be ignored increased conceptual scope (Study 2), such that participants were comparatively more willing to accept fringe exemplars (e.g., camel) in given categories (e.g., vehicles). Finally, navigating a maze in which an obstacle suddenly appeared and blocked the most direct path to a goal immediately broadened perceptual scope as measured by participants' eye movements (Study 3A) and accelerated response times to global targets relative to local targets in an unrelated task, both compared with navigating the same maze without an obstacle and compared with doing nothing (Study 3B). After navigating a maze with an obstacle rather than a maze without an obstacle, participants also performed better on an unrelated task measuring the ability to find similarities and to integrate seemingly unrelated concepts. However, this was only true when trait (Study 5) or state (Study 6) volatility was low rather than high.

Next to our main findings, in Study 6, we demonstrated that volatility could be experimentally induced. To the best of our knowledge, this is the first study priming the tendency to stay engaged in ongoing activities or tasks, as opposed to switching, showing that the concept not only reflects a chronic personality difference but also two basic strategies to pursue goals that may be activated in different settings and that people might employ rather flexibly. This opens the door for new research questions, such as what kind of situations might naturally trigger volatile or engaged strategies, as well as when, how, and why those strategies could be functional, respectively.

Obstacles and Global Processing: Theoretical Perspectives

Several theoretical perspectives, including construal level theory (CLT; for reviews see Liberman & Trope, 2008; Liberman, Trope, & Stephan, 2007; Trope & Liberman, 2003, 2010), novelty categorization theory (NCT; Förster et al., 2009; Förster et al., 2010), and action identification theory (AIT; Vallacher & Wegner, 1987, 1989; Wegner & Vallacher, 1986) are relevant in the present context. We discuss how our research relates to each of them in turn.

Construal level theory. Undoubtedly, our model was inspired by CLT (Liberman & Trope, 1998, 2008), as we think that not only is "stepping back to see the big picture" a metaphor but also that "stepping back" or mentally distancing oneself from that which is directly experienced may be part of what allows people to "see the big picture" upon facing an obstacle (see also Lewin, 1935). Therefore, an important next step will be to investigate the impact of obstacles on psychological distance. For example, because global processing has been shown to increase estimates of spatial distance (Liberman & Förster, 2009a), one might expect that whenever (nonvolatile) individuals encounter an obstacle in one task, they would, in a different task, estimate unrelated places (e.g., cities, historic sites) to be further away from their own location than do (nonvolatile) individuals who did not encounter an obstacle. Initial evidence from our lab suggests that this is indeed the case. Beyond psychological distance, it would be fascinating to examine whether people would also *physically* move back upon encountering (nonphysical) obstacles. This would further clarify the processes involved in dealing with obstacles and would link the present model to recent theories on embodied cognition (for a review, see Barsalou, 2008).

Our findings might also qualify CLT by making assumptions about obstacles and introducing the notion of staying engaged versus disengaging, which dates back to Lewin (1935). For example, one might wonder whether these variables would change the usual link between temporal distance (proximity) and global (local) processing: Would nonvolatile individuals construe a hiking trip 1 year from now even more globally than is usually the case if they envision overcoming an obstacle (e.g., a hernia) in order to join the trip? Would they construe the same trip taking place tomorrow more globally rather than locally if it involves overcoming an obstacle?

As the above speculations illustrate, our findings point toward potentially interesting interrelations between obstacles, task engagement, and psychological (or physical) distance. However, more research will be needed to fully understand these relations.

Novelty categorization theory. The present model was also inspired by NCT (Förster, et al., 2009; Förster et al., 2010). NCT defines novelty in terms of unexpectedness or lack of experience and assumes that categorization processes are involved both in determining whether an event is appraised as novel or old (see Scherer, 2001) and in the processing styles people use when they anticipate a novel event, compared with a familiar event. Specifically, NCT suggests that people adopt a more global processing style when they prepare for novelty because they want to understand novel events and because global processing facilitates integration of novel stimuli into existing knowledge structures. Thus, similar to the present account, NCT predicts that novelty enhances the perception of the overall Gestalt of stimuli and the use of broad, inclusive categories, whereas it impedes the perception of details and the use of narrow, exclusive categories.

Interestingly, although novelty *per se* elicits global processing, research by Förster and colleagues (2009) has shown that threatening novelty elicits local processing via negative arousal, possibly so that people can focus on the threat and cope with it (see Förster & Higgins, 2005; Schwarz & Bless, 1991). This finding is in line with earlier research showing that negative arousal signaling threat may lead to more local processing (e.g., Cacioppo, Berntson, & Crites, 1996; Easterbrook, 1959; Fredrickson, 2001; Fredrickson & Branigan, 2005; Gasper, 2004; Gasper & Clore, 2002; Isen & Daubman, 1984; see also Förster & Higgins, 2005; Friedman & Förster, 2010).

In the present studies, we used rather mild forms of obstacles to preclude effects of potential confounds and show that obstacles *per se* can increase global processing. Such obstacles can occur in real life, for example, when a construction site is blocking the road, when one is working on intellectual tasks, or when one is playing a computer game. However, to the extent that the effects of obstacles resemble those of novelty, one might expect that when obstacles seem insurmountable or when not finding a solution has severe consequences for one's life, well-being, or important goals, obstacles might well produce a strong negative affect and thereby narrow people's perceptual and conceptual scope. It would be interesting for future research to examine whether strong negative arousal is also necessary for obstacles to trigger local processing and whether, for example, reducing the affective impact of grave obstacles (e.g., by mindfulness techniques) might in turn give way to global processing.

Are obstacles and novelty then not the same? Indeed, obstacles could be considered novel events when they are unexpected (e.g., the road that was still free in the morning is blocked by a construction site in the evening) or when people lack experience with a particular kind of obstacle (e.g., a newborn child hindering parents in completing their daily routines). However, obstacles are defined not by unexpectedness or lack of experience but by the fact that they obstruct progress: People may encounter the same kind of obstacle over and over again (e.g., colleagues talking down the hallway), and they can frequently anticipate the obstacles they are likely to encounter (e.g., expecting financial hurdles in the realization of an ambitious plan). Even in our studies, obstacles were sometimes expected (Studies 1, 2, and 4) and sometimes not (Studies 3, 5, and 6). Accordingly, the present findings may be related to effects of novelty, but they are not the same: Obstacles can be novel or old, and novel things can be obstacles or not. Because both NCT and the current account are relatively new, in the future, researchers will need to examine the extent to which our model overlaps with NCT and whether NCT might have to be expanded to encompass the case of obstacles.

Action identification theory. Last but not least, because obstacles may render progress on a task or goal more difficult, one might wonder how our findings relate to AIT (Vallacher & Wegner, 1987, 1989; Wegner & Vallacher, 1986), which suggests that difficulty should elicit a more local, detailed way of thinking rather than a more global, encompassing way of thinking. How might the two be reconciled?

First, obstacles in daily life sometimes add difficulty to what one is trying to accomplish and sometimes not. For example, finding an alternative route to work when a moving truck is blocking the street might be very easy for someone who has lived in a city for years, whereas it might be rather difficult for someone who has just moved. In both situations, the obstacle still needs to be overcome and a new route needs to be found. Also in our studies, obstacles sometimes increased perceived task difficulty (Studies 3B, 5, and 6) and sometimes did not (Studies 2, 3A, and 4). When there were no differences in perceived task difficulty, this might have been due to the fact that the participants were dealing with the same aversive stimulus in both conditions (Study 2) or that the obstacles were not terribly hard to deal with (Studies 3A and 4). More important, when there was a difference in perceived task difficulty, it did not influence processing styles. This suggests that the effects in our studies are not driven by perceived difficulty but by attempts to overcome the obstacle.

Second, in studies on AIT (e.g., Wegner et al., 1983, 1984), researchers investigated how people identify the specific actions that they were performing, whereas in our studies, we investigated the more general processing styles that are activated while performing a problematic task and investigated whether these processing styles carry over to contentwise completely unrelated tasks (i.e., a procedural priming effect, see Förster, Liberman, & Friedman, 2007).

The third, and perhaps most important, difference between the two lines of research can be derived from our definition of obstacles, which includes the notion that people need to find out how they can accomplish what they want to do despite the obstacle. In prototypical studies on AIT, however, figuring out how to solve a problem might not have been much of an issue. For example, to lift heavy and unwieldy mug one can simply increase effort in the same action one was performing anyway. Similarly, participants who were prevented from eating Cheetos with their hands were explicitly instructed on what to do instead (e.g., use chopsticks). In other words, it was probably clear to participants what they should do in those studies, whereas in our studies, the participants had to figure that out themselves. As a result, there was no need for participants to expand their horizons to find alternative ways of approaching the task, and therefore, no global processing was triggered.

More generally, recent findings leads one to question the notion that AIT's central variable of difficulty should invariably lead to local processing. For example, in a study by Alter and Oppenheimer (2008), participants who read the instruction to describe New York City in a difficult-to-read (i.e., disfluent) font subsequently provided more abstract descriptions of the city than did participants who read the same instructions in an easy-to-read (i.e., fluent) font. Likewise, participants in an online study provided more abstract definitions for words that were difficult to pronounce than for words that were easy to pronounce. This suggests that difficulty can lead to more abstract (or global) *and* more concrete (or local) ways of thinking, or as in our studies, in which we measured perceived difficulty, not influence processing styles at all. An interesting puzzle for future research will therefore be to resolve the question of when difficulty leads to more global, abstract processing or to more local, concrete processing.

Toward a Self-Regulatory Perspective of Global Versus Local Processing

On the basis of Lewin's field theory (1935) and the more recent NCT (Förster et al., 2010), we proposed that people should start processing more globally when trying to overcome an obstacle because it can be useful. That is, global processing affords a birds-eye perspective on the situation and promotes the use of more inclusive categories, which in turn facilitates understanding and integration of information into existing knowledge structures. Thereby, it may constitute the basis for restructuring the problem field and integrating obstacles into goal pursuit. Additionally, global processing might facilitate discovering alternative means. For example, Kruglanski and colleagues (Kruglanski & Jaffe, 1988; Kruglanski et al., 2002; see also Gollwitzer & Kirchhof, 1998; Wicklund & Gollwitzer, 1982) suggested that when one means to a goal is blocked or fails, coping may entail a "means shift," which involves selecting another means from a preexisting set (Martin & Tesser, 1989) or generating new means. Assuming that goal systems are cognitively represented as networks of associated goals and means (Kruglanski et al., 2002), the first step toward accomplishing such a shift might be to broaden one's perspective and look beyond the means that is currently being obstructed.

Supporting such a functional view, in Studies 4, 5, and 6, only nonvolatile participants, who are inclined to stay engaged and finish what they are doing, started processing more globally upon facing an obstacle, whereas volatile participants, who are inclined to disengage prematurely, did not use different processing styles depending on the presence or the absence of obstacles. In other words, global processing was only triggered in these studies when it was relevant.

Our findings thus add to previous research suggesting that global versus local processing styles are not merely byproducts of positive versus negative affect or approach versus avoidance motivation but may have specific functions in relation to goals and underlying motives (see also Förster & Dannenberg, 2010). For example, the tendency to process open-mindedly was found to characterize early action phases (e.g., when people deliberate which goal to pursue), whereas more narrow-minded processing was found to characterize later action phases (e.g., after people have decided which goal to pursue). Presumably, this is because the former prevents people from missing out on information that might inform a good choice, whereas the latter allows them to filter out goal-irrelevant information (Fujita, Gollwitzer, & Oettingen, 2007; Gollwitzer, 1990; Heckhausen & Gollwitzer, 1987). In a similar vein, recent studies by Gable and Harmon-Jones (2008, 2010a; for a review, see Gable & Harmon-Jones, 2010b) suggested that both positive *and* negative emotions can increase local processing when they are high in motivational intensity (i.e., approach or avoidance) and that both positive *and* negative emotions can increase global processing when they are low in motivational intensity. Again, narrowing may facilitate focusing on a goal and excluding irrelevant information (e.g., Fujita et al., 2007; Gable & Harmon-Jones, 2010b), whereas broadening may promote understanding (Förster et al., 2010) or opening up to unforeseen possibilities (e.g., Fredrickson, 2001; Klinger, 1975; Oatley, Johnson-Laird, 1987; von Hecker & Meiser, 2005).

More generally, research has shown that abstract construal levels, which are related to global processing, promote self-control (Fujita, 2008; Fujita & Han, 2009; Fujita, Trope, Liberman, & Levin-Sagi, 2006) and that literally stepping backward, compared with stepping forward or sideways (Koch, Holland, Hengstler, & Van Knippenberg, 2009), enhances cognitive control measured in a Stroop task (Stroop, 1935). However, abstract construal levels were also found to increase procrastination (Liberman, Trope, McCrea, & Sherman, 2007; McCrea, Liberman, Trope, & Sherman, 2008), so one would be mistaken to conclude that abstract or global processing is invariably superior to more concrete or local processing in the context of obstacles.

On the contrary, we think that global processing alone may not suffice for successfully overcoming obstacles. It may rather denote a reflective moment during which people temporarily suspend goal-directed movement (without disengaging) and broaden their perspective in order to reorient themselves, to understand the situation (Förster & Dannenberg, 2010; Förster et al., 2010), to find alternative means (Gollwitzer, 1990; Kruglanski & Jaffe, 1988; Kruglanski et al., 2002; Martin & Tesser, 1989), or to evaluate whether further persistence is still warranted (e.g., Carver, 1996; Carver & Scheier, 1990; Jostmann & Koole, 2009; Wrosch, Scheier, Carver, & Schulz, 2003; Wrosch, Scheier, Miller, Schultz, & Carver, 2003). Once the situation is understood and potential solutions are identified, people need to choose the most promising solution and act on their goal, at which point it might be more functional to process locally again (see also Förster et al., 2010). Local processing might thus naturally follow global processing in the context of obstacles. Unfortunately, the scope of this article did not allow for testing the dynamics of cognitive responses to obstacles over time. However, we hope that our findings will inspire future research to investigate the temporal dynamics of processing styles elicited by obstacles—or by other circumstances encountered during goal pursuit.

To summarize, the present findings add to previous research suggesting that global versus local processing styles may be activated in the service of goals and underlying motives to ensure effective striving in a dynamically changing environment. However, this may also have unintended side effects, as we found that global processing elicited by obstacles can transfer to and influence performance on completely unrelated tasks (see Förster et al., 2007; Schooler, 2002). Because global processing is related to such variables as better face recognition (Macrae & Lewis, 2002), right hemisphere activation (see Beeman, 1998; Burgess & Simpson, 1988), generating similarities (Förster, 2009), and enhanced creativity (Friedman et al., 2003), our findings imply that dealing with obstacles might also influence these variables. Finally, recent research by Förster (in press) has shown that global versus local processing not only relates to perceptual or conceptual scope but that people may also touch, taste, listen to, or smell things globally or locally. Would obstacles (such as an unexpected dissonance played during a symphony) lead to more auditory attention to the entire piece? Would food that is hard to chew on lead to a more global tasting experience? In the future, researchers might examine whether obstacles might also affect other sensory modalities.

Global Processing and Obstacles in Daily Life: Can Obstacles Have Positive Effects?

Because variants of the RAT have previously also been used as a measure of creative performance (e.g., Isen, Daubman, & Nowicki, 1987; Kray et al., 2006; Mednick, 1962), Studies 5 and 6 could be regarded as a first step toward showing that obstacles may promote creative thinking, particularly when people want to stay engaged and finish what they are doing. For example, a researcher who wants to finish an article despite an ambitious graduate student knocking at her door not only might find creative ways to deal with the problem (e.g., involve the student in the project) but also might write a more innovative article, or think of a more extravagant menu for the dinner guests she has invited. Similarly, one might speculate that dealing with criticism in the development of a new product (which can be conceived of as an obstacle) might not only result in extra work: By broadening one's perspective in order to understand and address such criticism, the quality of the product might increase because additional perspectives are integrated. However, as mentioned earlier, local processing might be necessary in subsequent steps for choosing the most appropriate means and finishing the work. Finally, people might personally benefit from "looking at the big picture" in response to obstacles because by taking a more distanced view on what they are doing they might better understand why they are striving for specific goals or might integrate obstacles into their broader goal systems. Although such notions are but bold suggestions at this point, testing them might further enlighten the consequences of global processing in relation to obstacles in more applied settings.

Conclusion

The present studies shed light on the basic cognitive effects of obstacles. Specifically, our findings indicate that obstacles may prompt people to broaden their perception and think in a more integrative, open-minded way that influences how they solve completely unrelated tasks. This was found to be the case especially when people are inclined to stay engaged in ongoing activities, but not when they tend to disengage prematurely. This work thus constitutes a first step toward understanding the cognitive impact of obstacles, even beyond the task with which they interfere.

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Appendix

Results From the Validation Study on Trait Volatility

To increase understanding of the somewhat underexamined concept of volatility, we conducted a validation study ($N = 496$) and analyzed convergent and discriminant validity with each of the following constructs: sensitivity of the behavioral approach (BAS) and behavioral inhibition (BIS) systems (BIS/BAS-scales; Carver & White, 1994), regulatory focus (Regulatory Focus Questionnaire [RFQ]; Higgins et al., 2001), regulatory mode (Kruglanski et al., 2000), need for closure (Need for Closure Scale [NFCS]; Webster & Kruglanski, 1994), impulsiveness (Barratt Impulsiveness Scale [BIS-11]; Patton, Stanford, & Barratt, 1995), general self-efficacy (GSE; Schwarzer & Jerusalem, 1995), grit (Short Grit Scale [Grit-S]; Duckworth & Quinn, 2009); and curiosity (Curiosity and Exploration Inventories I and II [CEI–I and CEI–II]; Kashdan, Rose, & Fincham, 2004; Kashdan et al., 2009).

Results revealed that two scales were moderately correlated with volatility. These were consistency of interests ($r = .31$, $p < .0001$), measured by a subscale of the Grit-S, and attentional impulsiveness ($r = -.32$, $p < .0001$), measured by a subscale of the BIS-11. Other scales were weakly correlated with volatility. These were decision-related action control ($r = .13$, $p = .004$), measured by the hesitation subscale of the ACS–90; behavioral approach (drive: $r = .21$, $p < .0001$; fun seeking: $r = .12$, $p = .008$; reward responsiveness: $r = .14$, $p = .003$), measured by respective subscales of the BIS/BAS; stretching ($r = .13$, $p = .004$) and absorption ($r = .23$, $p < .0001$), measured by subscales of the CEI–II and CEI–I, respectively; perseverance, measured by a subscale of the Grit-S; promotion focus ($r = .22$, $p < .0001$) and prevention focus ($r = .10$, $p = .03$), measured by the RFQ; locomotion ($r = .20$, $p < .0001$; $n = 492$), measured by the regulatory mode questionnaire; nonplanning ($r = -.16$, $p < .0001$), measured by a subscale of the BIS-11; and general self-efficacy ($r = .13$, $p = .003$), measured by the GSE. The remaining (sub)scales were not correlated with volatility.

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