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Goal-Discrepant Situations Prime Goal-Directed Actions if Goals Are Temporarily or Chronically Accessible

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This research tested the hypothesis that perception of goal-discrepant situations automatically (i.e., without conscious intent) facilitates access to representations of instrumental actions if goal representations are mentally accessible. Employing a probe-recognition paradigm, Experiment 1 established that sentences describing situations that are discrepant with the goal of "looking well-groomed" (e.g., having dirty shoes) automatically increased the accessibility of representations of appropriate instrumental actions (e.g., polishing) in comparison to control situations, but only when participants frequently pursued the goal. Experiments 2a and 2b suggest that this effect was due to chronic accessibility of the goal representation and demonstrate that the same effects occur if the accessibility of the goal is temporarily enhanced (by subliminal priming) for people that nonfrequently pursue the goal.

Keywords: *nonconscious goal pursuit; goal-directed behavior; regulation; automaticity*

Human action is commonly understood in terms of serving the goals people desire to attain. People often engage in goal-directed behavior to reduce the discrepancy between their actual state and a goal state. However, in many cases, this is only half the story. Once a desired state has been established, people often have to react to arising discrepancies with that state to maintain it (Carver & Scheier, 1998; Powers, 1973). For instance, if one has the goal to come across as interested while listening to someone else's story during a conversation, a well-placed "Get outa here!" might establish that impression. However, the trick is then to maintain it, by for instance reacting to a brief moment of distraction with firm nodding and blaming a sudden yawn on chronic insomnia. Thus, to maintain desired states, people have to react to goal discrepancies that arise from changes in their actual state by employing the proper instrumental actions that will reduce the discrepancy and restore the goal state. The present article deals with the cognitive processes involved in these goal-directed reactions to goal discrepancies.

Although most theories on goal pursuit recognize and emphasize that discrepancy-reduction plays an essential role in attaining and maintaining desired states (e.g., Carver & Scheier, 1998; Lewin, 1936; Miller, Galanter, & Pribram, 1960; Powers, 1973), they rarely make reference to the issue of whether detecting and reacting to goal discrepancies can occur automatically, that is, without explicit instructions or a conscious intention to do so (see Moskowitz, Li, & Kirk, 2004). Recent research on nonconscious goal pursuit suggests that such a conscious intention may not be necessary for goal-directed behavior to occur. It has been demonstrated that people can engage in goal pursuit without a conscious intervention

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when the mental representation of a goal is rendered accessible by priming (Aarts, Gollwitzer, & Hassin, 2004; Bargh, Gollwitzer, Lee Chai, Barndollar, & Trötschel, 2001; Shah, 2003; for an overview, see Moskowitz et al., 2004). These findings show that people are able to pursue goals without being conscious of the source of their goal-directed behavior. Although in these studies discrepancies arise as a result of the introduction of a desired state (as opposed to a change in someone's actual state), they suggest that people can detect and react to goal discrepancies without a conscious intention but that such automatic discrepancy reduction relies on an accessible goal representation.

However, if automatic discrepancy reduction is dependent on an accessible goal representation, then the ability to detect and react to arising goal discrepancies may not only be influenced by temporal changes in accessibility but also differ from person to person. It is known that mental constructs can become chronically accessible due to frequent activation, that is, if someone frequently thinks of and uses the construct (Bargh, 1982; Higgins, King, & Mavin, 1982; Srull & Wyer, 1980; for an overview, see Higgins, 1996). Hence, for a person who frequently pursues the goal of being an interested listener (e.g., because he or she is a bartender), this goal may be chronically more accessible than for someone that non-frequently pursues this goal, even though the goal may be equally desirable to both (see Custers & Aarts, 2005b). This chronic accessibility may enable people to automatically react to goal-discrepant situations regardless of whether they are primed with the goal. Thus, people's ability to react to goal discrepancies may depend on the accessibility of the goal representation, which is influenced by temporal as well as chronic factors.

In the present article, we investigate whether mere perception of situations that are discrepant with a desired state can spontaneously trigger the preparation of goal-directed actions by rendering the representations of these actions accessible. First, we are interested in whether the perception of such goal-discrepant situations can automatically, that is, without being instructed or having the intention to engage in goal-directed behavior (see Uleman, 1999), increase the accessibility of mentally represented actions that are instrumental in restoring or maintaining the desired state. Second, we aim to investigate whether such preparation of instrumental actions requires the goal representation to be mentally accessible, be it temporarily as a result of priming or chronically as a function of frequent goal pursuit.

We focus on facilitated accessibility of action representations for several reasons. First, we are primarily interested in the cognitive antecedents of spontaneous detection of, and reactions to, goal discrepancies. Because activation of action representations is the starting point for all behavior (Jeannerod, 1997; Prinz, 1997), measuring increases in their accessibility is the most direct way to pick up such spontaneous responses. Second, spontaneous facilitation of action representations can be accurately measured using well-developed cognitive paradigms, such as the probe-recognition task (McKoon & Ratcliff, 1986). Furthermore, there is an abundance of research demonstrating that mere increases in the accessibility of action representations can directly produce the corresponding action itself, without any conscious interventions (e.g., Aarts & Dijksterhuis, 2003; Bargh, Chen, & Burrows, 1996; Holland, Hendriks, & Aarts, 2005; for an overview, see Dijksterhuis & Bargh, 2001). Thus, although we rely on cognitive measures because they are most suitable to test our current hypothesis, we can assume, based on the literature on automatic behavior, that the hypothesized facilitation of action representations has behavioral consequences (see the General Discussion for further discussion on this topic).

GOAL DISCREPANCIES AND GOAL-DIRECTED ACTION

Comparing one's actual state to the desired state is crucial in attaining and maintaining goal states. Many process models of goal-directed action propose that goal pursuit begins with such a comparison and is put in motion when a discrepancy between the two states is detected (Carver & Scheier, 1998; Lewin, 1936; Miller et al., 1960; Powers, 1973). Because this comparison depends on information about both the actual and the desired state, goal discrepancies may arise in two different ways: First, a desired state or goal can be set or adopted that is discrepant with the actual state, creating a tension that motivates people to attain this goal state. Second, a discrepancy can arise when the actual state of a person changes and no longer matches a desired state, which motivates people to restore this desired state. Consequently, goal-directed action may be triggered in these two fundamentally different ways.

Recent research on nonconscious goal pursuit suggests that rendering a goal representation more accessible suffices to trigger the comparison process and motivate goal-directed behavior in the same way as does consciously setting or adopting a desired state (Aarts et al., 2004; Bargh et al., 2001; see Moskowitz et al., 2004). Aarts and colleagues (2004, Experiment 1), for example, primed participants with the goal to make money by having them read a story describing another person's behavior that implied this goal. They found that compared to control participants, primed participants worked harder on a mouse-click task if this would allow them to engage in another task in which they could make money, thereby

actively reducing the discrepancy between their actual state and the goal state. Of importance, these discrepancy-reduction effects occurred without a conscious intention on the participants' behalf to react to the goal discrepancy. This demonstrates that increasing the accessibility of a goal state can create a discrepancy with that state that people are motivated to reduce.

However, as explained above, discrepancies also may be created in a different manner, that is, not by introducing a desired state but by changing people's perceived actual state so that it no longer matches the desired state. Past studies suggest that motivational behavior can result from discrepancies that are established by reminding people of, or manipulating, their perceived actual state (e.g., Fein & Spencer, 1997; Koole, Smeets, Van Knippenberg, & Dijksterhuis, 1999; Moskowitz, 2002). For instance, Moskowitz (2002) had people ponder on instances in which they had failed or been successful in maintaining a desired state (e.g., being egalitarian, Experiment 2). Results showed that participants who had contemplated failure—or in other words, a goal-discrepant state—were more motivated to restore the goal state, as was indicated by increased attention for goal-relevant words.

To conclude, there is both evidence for the idea that the process of discrepancy reduction can occur without conscious intent as well as for the idea that perceived goal-discrepant actual states motivate people to restore the goal state. However, in both lines of research, accessibility of the goal representation is not manipulated independently from the goal discrepancy, that is, in the research on nonconscious goal pursuit, a goal discrepancy is typically created by priming a desired state (e.g., earning money) that is different from the actual state of the participant (e.g., having no money or being broke). Hence, a goal discrepancy arises from, and is therefore confounded with, the priming manipulation. Likewise, in research that manipulates participants' (perceived) actual states, the desired state is necessarily explicitly given—and thus made accessible—by the instructions. To investigate whether spontaneous reactions to goal-discrepant situations are dependent on goal accessibility, we attempted to resolve these confounds by presenting people with descriptions of actual states or situations that were either discrepant or not with an accessible or not accessible desired state.

CHRONIC GOAL ACCESSIBILITY

As noted earlier, goal accessibility may not only be subject to temporal changes but also differ chronically from person to person. Indeed, evidence suggests that chronic goal accessibility may impinge on cognition and action in a direct way. In research on chronic egalitarian goals, Moskowitz, Gollwitzer, Wasel, and Schaal (1999) had participants pronounce attributes that were stereotypical of women that were preceded by pictures of men and women. They found that pictures of women facilitated pronunciation of stereotypical attributes, but only for participants without a chronic egalitarian goal. This suggests that participants with a chronic egalitarian goal processed that social group in a less stereotypical way, thus maintaining their desired state of being egalitarian.

In examining the effects of chronic goal accessibility, the current research diverges from the Moskowitz et al. (1999) studies in two important ways. First, in their studies, people were labeled as chronic or nonchronic based on their level of commitment to the goal rather than on goal accessibility per se. To make stronger claims about chronic accessibility, we measured in the current studies the primary antecedent of chronic accessibility, that is, frequency of goal pursuit (for a discussion on frequency of activation as a determinant of chronic accessibility, see Higgins, 1996), and compared the effects of this frequency measure with those of temporal accessibility (manipulated by subliminal priming). Second, whereas Moskowitz et al. focused on compensatory cognition (i.e., absence of stereotyping as reaction to women's faces), we focus on accessibility of concrete instrumental actions as a result of perceiving situations that are, or are not, discrepant with the goal.

THE PRESENT RESEARCH

To recap, the present research makes a first attempt to (a) demonstrate that mere perception of a goal-discrepant situation can automatically facilitate access to mentally represented actions that are instrumental in resolving the discrepancy and (b) investigate whether this automatic facilitation requires the goal representation to be mentally accessible, be it temporarily or chronically.

For this purpose, we selected the goal to "look well-groomed." According to Chulef, Read, and Walsh's (2001) taxonomy of goals, goals related to physical appearance are in the top five of people's goals.[1] Moreover, the chosen goal typically needs to be maintained over time because discrepancies easily arise between the actual state and the desired state (e.g., when one spills sauce on one's shirt). However, it is also a goal that some students may pursue more often than others, for instance, because they work in a restaurant or visit their parents more frequently than their peers.

To measure accessibility of instrumental actions on perception of goal-discrepant situations, we used the probe-recognition task, a paradigm that has been successfully used to assess the automatic emergence of

concept accessibility effects during text comprehension (e.g., Hassin, Aarts, & Ferguson, 2005; McKoon & Ratcliff, 1986; Uleman, Hon, Roman, & Moskowitz, 1996; Wigboldus, Dijksterhuis, & Van Knippenberg, 2003). Participants had to read short sentences on the computer screen that were directly followed by a probe word. Their task was to decide whether the word had appeared in the preceding sentence. Some of the sentences described a goal-discrepant situation and were followed by a probe word that referred to an applicable instrumental action that had not been explicitly mentioned in the sentence. If instrumental actions are indeed automatically facilitated by discrepant situations, then their accessibility should increase after reading the sentence, which would render the judgment task more difficult. Hence, facilitation of instrumental actions by goal-discrepant sentences would be evidenced by worse performance (slowing down) on sentences describing a goal-discrepant, as compared to a nondiscrepant, situation.

In Experiment 1, we aimed to demonstrate the basic effect that representations of instrumental actions become more accessible when a goal-discrepant situation—compared to a control situation—is perceived, but only for people for whom the goal is mentally accessible. Based on the assumption that accessibility of the goal representation increases as a function of frequency of goal pursuit, we hypothesized that the more frequently people pursue the goal to look well-groomed, the worse they would perform on the probe-recognition task, but only on the sentences that describe goal-discrepant situations.

In Experiments 2a and 2b, we aimed to consolidate our claim for the crucial role of goal accessibility in spontaneous reactions to goal discrepancies by experimentally manipulating this accessibility by means of priming. In Experiment 2a, we first examined whether and how the effects of priming on goal accessibility would interact with the effect of frequent goal pursuit. It was expected that, without priming, accessibility would increase as a function of frequency of goal pursuit, whereas after priming, accessibility would be high for all participants regardless of the frequency with which they pursue the goal. Subsequently, in Experiment 2b, we investigated the combined effects of priming and frequency of goal pursuit on reactions to goal-discrepant situations. In line with our hypothesis that spontaneous reactions to goal discrepancies are dependent on accessible goal representations, we predicted the same pattern for the accessibility of instrumental actions as for goal accessibility in Experiment 2a, that is, we expected that spontaneous facilitation of the representations of instrumental actions would increase as a function of frequency of goal pursuit without priming but also that spontaneous facilitation would be high for all people when the goal was primed.

EXPERIMENT 1

Method

Participant and Design

One hundred thirty-eight undergraduates from Utrecht University participated in the experiment, receiving €4,–. They were randomly assigned to either the discrepant or nondiscrepant condition. Frequency of goal pursuit was measured and treated as a quasi-experimental factor.

Procedure

Participants were seated in separate cubicles in which the experiment was presented on a 100-Hz computer screen. After receiving the instructions, they started on the probe-recognition task, which was modeled after Hassin et al. (2005). Each trial started with a row of Xs as a fixation point for 1,000 ms on the place at which the first word of the sentence would appear on the screen, followed by the sentence for 2,000 ms. After a brief delay of 1,000 ms, the probe word was presented until the participant responded. Participants received 50 trials in total. They first completed 10 warm-up trials and continued with 40 experimental trials. The intertrial time was 1,000 ms. To not influence the accessibility of the goal representation, the frequency measure was conducted only after the probe-recognition task. Moreover, to minimize the chance of the experimental manipulation affecting the measure, participants first completed an unrelated 30-min filler task before completing the frequency questions.

Materials

Sentences. Five sentences were constructed that described actual states or situations that were discrepant with the goal to look well-groomed and strongly associated with a specific instrumental action. For each sentence, a different action was instrumental in attaining the goal (e.g., "The shoes you put on look dirty"—polish). For every discrepant experimental sentence, a nondiscrepant control sentence was constructed (e.g., "The shoes you put on have laces"). These nondiscrepant sentences were always presented with the same probe word as the corresponding discrepant sentence. Depending on the condition, participants were either presented with the five discrepant or nondiscrepant experimental sentences. The correct response for these sentences was always "no," and they were embedded in 20 filler sentences that also required a "no" and 25 filler sentences that required a "yes" response. The experimental sentences were presented on trials 18, 26, 34, 42, and

50 in random order. The filler sentences were randomly assigned to the remaining positions.

Frequency of goal pursuit. To assess the frequency with which the goal was pursued over time, people were asked two questions, "How often do you think about looking well-groomed?" and "How often do you pursue the goal to look well-groomed?" Responses were measured on a 10-point scale ranging from *never* to *very often*. The correlation between the two frequency items was $r = .66$, $p < .01$. A frequency index was computed by averaging the z scores of the two responses.

The reliability of this measure was tested in an earlier study in which a different sample of students ($N = 35$) completed a battery of questions two times with a 1-month interval that included the two frequency items. The means for the frequency of goal thinking, $M_{t1} = 7.51$, $M_{t2} = 7.46$, $t(34) = 0.40$, *ns*, and goal pursuit, $M_{t1} = 7.51$, $M_{t2} = 7.49$, $t(34) = 0.21$, *ns*, proved unchanged over time. The correlation of the frequency index calculated for *t1* and *t2* showed that the frequency index was highly stable, $r = .85$, $p < .01$. The frequency index proved to be unaffected by the experimental manipulation, $F(1, 136) = 0.09$, *ns*.

Results

Reaction Time on Probe Words

The reaction times (RTs) of the correct responses on the five experimental sentences describing the discrepant or nondiscrepant situations were analyzed. RTs slower than 1,500 ms and faster than 150 ms (1.45%) were regarded as outliers and excluded from the analyses (cf. Wigboldus et al., 2003).

To test whether automatic facilitation of instrumental actions is conditional on frequent goal pursuit, we subjected the RTs to a moderated hierarchical multiple regression analysis (Baron & Kenny, 1986) in which RTs were predicted by situation (coded as nondiscrepant = 1, discrepant = 2), frequency, and the Situation × Frequency interaction term. To reduce multicollinearity bias, all variables were standardized before computing the cross-product (Dunlap & Kemery, 1987). The analyses revealed a significant effect of situation, $\beta = .18$, $t(134) = 2.20$, $p = .03$, and a marginally significant effect of frequency, $\beta = .15$, $t(134) = 1.85$, $p = .07$. However, according to our hypothesis, RTs should only increase as a function of frequency in the discrepant condition. Indeed, the main effects were qualified by the Situation × Frequency of goal pursuit interaction, $\beta = .16$, $t(134) = 1.97$, $p = .05$. RTs increased with frequency in the discrepant, $\beta = .31$, $t(67) = 2.71$, $p < .01$, but not in the nondiscrepant condition, $\beta = -.01$, $t(67) = -.09$, *ns*.

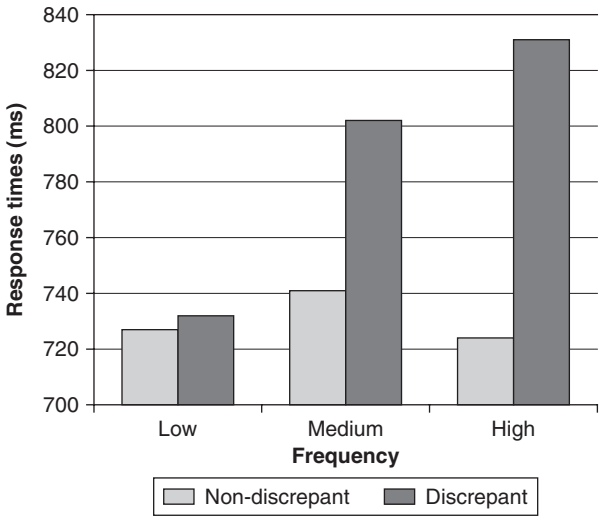

Figure 1 Mean response times (RTs) as a function of frequency and situation (Experiment 1).

To further corroborate and illustrate the pattern and to test the simple effects of situation for nonfrequent and frequent pursuers, a 2 (situation: nondiscrepant vs. discrepant) × 3 (frequency: low, medium, high) ANOVA was conducted with a trichotomised frequency index in which we tested for a linear effect of frequency. Means are presented in Figure 1. A significant effect of situation was found, $F(1, 134) = 4.92$, $p = .03$, and the effect of frequency, $F(1, 134) = 2.32$, *ns*, as well as the interaction, $F(1, 134) = 2.57$, *ns*, showed a trend in the predicted direction. However, the effects of frequency in the discrepant, $F(1, 136) = 4.77$, $p = .03$, and nondiscrepant condition, $F(1, 136) = 0.00$, *ns*, corroborated the findings of the regression analyses. More important, in the high-frequency condition, RTs were higher in the discrepant than in the nondiscrepant condition, $F(1, 136) = 5.51$, $p = .02$. This effect was absent in the medium, $F(1, 136) = 1.82$, *ns*, and the low-frequency condition, $F(1, 136) = 0.00$, *ns*.

Error Rates

In a regression analysis on the proportion of errors on the experimental trials, no effect of frequency, $\beta = 0.07$, $t(134) = .77$, *ns*; situation, $\beta = -0.02$, $t(134) = -.25$, *ns*; or of their interaction, $\beta = -0.09$, $t(134) = -1.04$, *ns*, was found.

Discussion

Together, these results demonstrate that people can react to goal discrepancies by preparing the proper instrumental actions without explicit instructions or a conscious intention to do so, but only if they frequently

pursue the goal. Because frequency of goal pursuit is the primary antecedent of chronic goal accessibility, these results suggest that spontaneous reactions to goal discrepancies are dependent on an accessible goal representation.

However, a critic could argue that these effects are not caused by differences in accessibility of the goal representation but by other variables that are associated with frequent goal pursuit. Therefore, to consolidate our claim about the crucial role of goal accessibility in spontaneous reactions to goal-discrepant situations, we conducted Experiments 2a and 2b, in which accessibility of the goal representation was experimentally manipulated by means of priming. Before investigating the combined effects of priming and frequency of goal pursuit in Experiment 2b, Experiment 2a was conducted as a first step to examine the combined effects of these two factors on goal accessibility. This experiment was conducted for two reasons. First, we wanted to test our assumption about the relation between frequency of goal pursuit and goal accessibility. Second, before manipulating goal accessibility in the probe-recognition paradigm, we wanted to investigate whether and how the effects of priming on goal accessibility would interact with those of frequency of goal pursuit; in the literature, both additive and interactive effects of chronic and temporal sources of accessibility are reported (Bargh, Bond, Lombardi, & Tota, 1986; Higgins, 1996; Levesque & Pelletier, 2003; Srull & Wyer, 1986). However, based on the findings of Experiment 1, which fit our assumption that for people who frequently pursue the goal to look well-groomed the representation of this goal would already be highly accessible, we expected priming only to increase goal accessibility for nonfrequent pursuers.

EXPERIMENT 2A

Method

Participants and Design

Ninety-one undergraduates from Utrecht University participated in the experiment, receiving €4,–. They were randomly assigned to either the prime or no-prime condition. Frequency of goal pursuit was again measured and treated as a quasi-experimental factor.

Procedure

Participants were seated in front of a 100-Hz computer screen in a dimly lit room in which the first part of the experiment took place. This part consisted of a parafoveal-priming task, which was presented as a stimulus-perception task. The task was identical to the task used by Chartrand and Bargh (1996), which effectively primed concepts outside of people's awareness. Participants learned that stimuli would appear on one of the four corners of the screen and that they had to indicate whether the stimulus appeared on the left or right side. In fact, each stimulus was a word or nonword depending on the prime condition and was presented for 60 ms, followed by a postmask (a row of Xs for 60 ms). These stimuli were presented in the parafoveal field (i.e., outside the most sensitive part of the retina), where words cannot be consciously perceived at such short presentation times (for further details, see Chartrand & Bargh, 1996). In the prime condition, the two Dutch synonyms for "well-groomed" (*netjes* and *verzorgd*) were primed in alternating order on 76 trials in total.

After the priming task, accessibility of the goal representation was measured by means of a cued-association task. Specifically, participants were asked to type in five words that described how they would like to look physically. According to Higgins et al. (1982), accessibility of a mental construct in such a task is reflected by the primacy and the frequency with which construct-related words are mentioned. Therefore, an accessibility index was constructed that reflected both primacy and frequency. When one of the two Dutch synonyms for well-groomed was mentioned, a number of points was awarded, ranging from 5 for the first position to 1 for the last. If both synonyms were mentioned, the two scores were added. Thus, the index for goal accessibility ranged from 0 (no goal-related words mentioned) to 9 (goal-related words mentioned on Position 1 and 2; see Higgins et al., 1982, for a similar accessibility measure).

When participants had completed this task, they were escorted to a cubicle in which they participated in an allegedly unrelated experiment. After a 30-min filler task, frequency of goal pursuit was measured and computed in exactly the same manner as in Experiment 1. The correlation between the two items was $r = .68$, $p < .01$. The frequency index proved to be unaffected by the experimental manipulation, $F(1, 89) = 1.45$, *ns*.

Results and Discussion

The index for goal accessibility was subjected to a moderated hierarchical multiple regression analysis in which accessibility was predicted by prime (coded as no = 1, yes = 2), frequency, and the Prime × Frequency interaction term. Again, variables were standardized before computing the cross-product. Analysis revealed no significant effect of frequency, $\beta = .14$, $t(87) = 1.25$, *ns*; a marginally significant effect of prime, $\beta = .17$, $t(87) = 1.67$, $p = .10$; and a significant Prime × Frequency interaction, $\beta = -.22$, $t(87) = -2.08$, $p = .04$. Further analyses showed that goal accessibility increased as

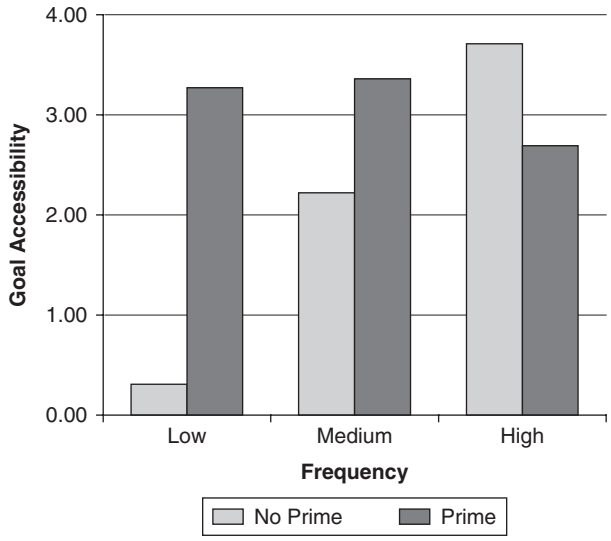

Figure 2 Mean goal accessibility as a function of frequency and prime (Experiment 2a).

a function of frequency in the no-prime, $\beta = .46$, $t(43) = 3.43$, $p < .01$, but not in the prime condition, $\beta = -.07$, $t(44) = -0.43$, *ns*.

To further explore the pattern, a 2 (prime: no vs. yes) × 3 (frequency: low, medium, high) ANOVA was conducted with a trichotomised frequency index in which we tested for a linear effect of frequency. Means are presented in Figure 2. A significant effect of prime was found, $F(1, 87) = 3.95$, $p = .05$, along with a marginally significant effect of frequency, $F(1, 87) = 3.74$, $p = .06$. The interaction, however, was highly significant, $F(1, 87) = 7.74$, $p < .01$. The effects of frequency in the no-prime, $F(1, 89) = 11.29$, $p < .01$, and prime condition, $F(1, 89) = 0.22$, *ns*, corroborated the findings of the regression analyses. More important, accessibility increased as a function of priming in the low-frequency condition, $F(1, 89) = 8.35$, $p < .01$, but not in the medium, $F(1, 89) = 1.85$, *ns*, or high-frequency conditions, $F(1, 89) = 1.02$, *ns*.

The results show that goal accessibility increased as a function of frequency of goal pursuit. Moreover, it was found that this goal accessibility was high for frequent pursuers irrespective of goal priming: It is one of the first things they think of when asked to list their goals in the domain of physical appearance. For nonfrequent pursuers, however, goal priming significantly increased goal accessibility to a level similar to that of chronic pursuers. These results corroborate our assumption that goal accessibility increases as a function of frequency of goal pursuit. Therefore, they provide further support for the suggestion that the effects obtained in Experiment 1 were actually due to chronic accessibility of the goal. Moreover, they reveal that priming does temporarily increase the accessibility of the goal representation for people that do not frequently pursue the goal, but not for frequent pursuers, for whom accessibility is high irrespective of priming.

EXPERIMENT 2B

To investigate the effect of goal accessibility resulting from temporal and chronic sources on spontaneous reactions to goal discrepancies, we conducted Experiment 2b, in which subliminal priming was used to experimentally manipulate the accessibility of the goal representation in the probe-recognition paradigm. If reacting to goal discrepancies indeed requires an accessible goal representation, then goal priming should lead to the facilitation of instrumental actions upon perceiving a goal-discrepant situation for people that nonfrequently pursue the goal. However, based on the results of Experiments 1 and 2a, we expected that for frequent pursuers, this goal is chronically accessible and that instrumental actions would be facilitated irrespective of goal priming.

Method

Participants and Design

One hundred and forty-nine undergraduate students of Utrecht University participated in the experiment, receiving €4,–. They were randomly assigned to either the prime or no-prime condition. Frequency of goal pursuit was measured and treated as a quasi-experimental factor.

Procedure

The procedure of the experiment was exactly the same as in Experiment 1. Participants were seated in front of a 100-Hz computer screen in separate cubicles and first completed a probe-recognition task and then participated in a 30-min filler task after which frequency of goal pursuit was measured.

The probe-recognition task, however, differed from that in Experiment 1. On the experimental trials, which only featured discrepant situations, the two Dutch synonyms of well-groomed (*netjes* and *verzorgd*) were primed. The two words were each presented three times for 20 ms during the presentation of the fixation point (see Wigboldus et al., 2003, for a similar procedure of subliminal priming in the probe-recognition task). In the no-prime condition, two nonwords were presented in exactly the same manner. The frequency index was obtained in the same way as in the previous experiments ($r = .71$, $p < .01$). No significant effect of the experimental manipulation on the frequency index was found, $F(1, 147) = 2.23$, *ns*.

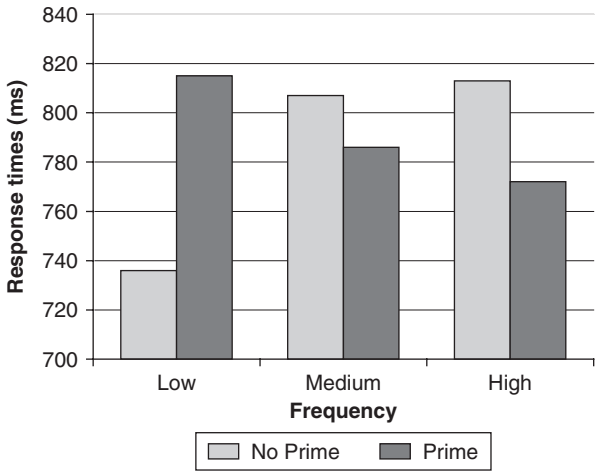

Figure 3 Mean response times (RTs) as a function of frequency and prime (Experiment 2b).

Results and Discussion

Reaction Times on Probe Words

The RTs of the correct responses on the five experimental sentences describing the discrepant situations were analyzed. RTs slower than 1,500 ms and faster than 150 ms (2.28%) were regarded as outliers and discarded.

We subjected the RTs to a moderated hierarchical multiple regression analysis in which RTs were predicted by prime (coded as no = 1, yes = 2), frequency, and the Prime × Frequency interaction term. Variables were standardized before computing the cross-product. The analyses revealed no effect of prime, $\beta = .01$, $t(145) = 0.14$, *ns*, or of frequency, $\beta = .07$, $t(145) = 0.87$, *ns*. The predicted interaction was, however, significant, $\beta = -.17$, $t(145) = -2.12$, $p = .04$. RTs increased as a function of frequency in the no-prime condition, $\beta = .26$, $t(70) = 2.25$, $p = .03$, but not in the prime condition, $\beta = -.09$, $t(75) = -.81$, *ns*.

To further examine the pattern, a 2 (prime: no vs. yes) × 3 (frequency: low, medium, high) ANOVA was conducted, with a trichotomised frequency index, testing for a linear effect of frequency. Means are presented in Figure 3. No effects of prime, $F(1, 145) = .08$, *ns*, or frequency, $F(1, 145) = .31$, *ns*, were found. The Prime × Frequency interaction, however, was marginally significant, $F(1, 145) = 3.45$, $p = .07$: A linear effect of frequency emerged in the no-prime condition, $F(1, 147) = 2.97$, $p = .09$, but not in the prime condition, $F(1, 147) = .77$, *ns*. Furthermore, priming increased RTs in the low-frequency, $F(1, 147) = 3.05$, $p = .08$, but not in the medium $F(1, 147) = 0.15$, *ns*, or high-frequency conditions, $F(1, 147) = 0.76$, *ns*.

Error Rates

Regression analyses on the proportion of errors on the experimental trials revealed no effects of frequency, $\beta = 0.06$, $t(145) = .75$, *ns*; prime, $\beta = -0.04$, $t(145) = -.51$, *ns*; or their interaction, $\beta = -0.08$, $t(145) = .96$, *ns*.

These results first of all replicate the findings of Experiment 1: In the no-prime condition, an increase in accessibility of instrumental actions was found as a function of the frequency with which participants pursued the goal. Moreover, in line with the effects of goal priming and frequency of goal pursuit on goal accessibility obtained in Experiment 2a, the results show that priming led to the facilitation of instrumental actions for nonfrequent pursuers. This priming effect provides further experimental evidence for our claim that reacting to goal-discrepant situations requires an accessible goal representation.

GENERAL DISCUSSION

The present research was conducted as a first step in addressing the important issue of whether people can detect and prepare reactions to goal discrepancies automatically, without explicit instructions or conscious intentions to do so. Together, the results of three experiments demonstrate that (a) the mere perception of a goal-discrepant situation can automatically facilitate access to mental representations of actions that are instrumental in resolving the discrepancy and (b) for such automatic goal-directed reactions to goal discrepancies the goal representation needs to be either temporarily or chronically accessible.

Our current findings show that reactions to goal discrepancies that are instrumental in maintaining a desired state are moderated by the accessibility of the goal representation. Hence, reactions to goal discrepancies seem to reflect the accessibility of the goal representation. It must be noted, however, that it is commonly assumed that people's reactions to goal discrepancies reveal people's commitment to, or the desirability of, the goal state (Lewin, 1936; Moskowitz et al., 1999; Wicklund & Gollwitzer, 1982). How can these findings be reconciled? The answer is that the present research is breaking new ground in demonstrating spontaneous preparation of instrumental actions in reaction to goal-discrepant situations. Whereas previous studies have established that goal discrepancies do have motivational effects on cognition and behavior (e.g., Fein & Spencer, 1997; Koole et al., 1999; Moskowitz, 2002), both the discrepancy and the goal were in this research as a rule explicitly pointed out. Under these conditions, people's reactions may indeed be dependent mainly on the desirability of the goal state. However, when the goal and discrepancy are not explicated and people first

have to categorize the situation as being discrepant with the goal state, accessibility of the goal state may become an additional factor of importance (cf. Kay & Ross, 2003). In fact, when the desirability of the goal state is uniformly high (as was, according to our pilot study, the case for the goal that was used in the current experiments), it may be the crucial factor that determines whether people react to a goal discrepancy. Thus, whereas reactions to explicit goal discrepancies may reflect the commitment to, or the desirability of, the goal, reactions to implicit goal discrepancies seem to be mainly affected by goal accessibility.

This is not to say that the desirability of the goal state may not play an important role in propelling the actual execution of spontaneous reactions aimed at maintaining the goal state. Although in the current research we focused on the spontaneous facilitation of action representations, increased accessibility may—as we already noted in the introduction—have direct effects on behavior without conscious interventions. One reason that it may do so is because of an overlap that exists between representations that are used in perception and action (Hommel, Muesseler, Aschersleben, & Prinz, 2001). Because of this perception-behavior link (Dijksterhuis & Bargh, 2001), ideomotor action (James, 1890) occurs as mere activation of the action representations directly triggers corresponding motor programs that cause the body to execute these actions. The resulting behavioral effects, however, are believed to be short lived and easily overruled by obstacles (Dijksterhuis & Bargh, 2001). However, in our earlier research, we have demonstrated that such behavior may acquire motivational properties, such as persistence, when the accessible goal representation producing the behavior is represented as a desired state, that is, is associated with positive affect (Custers & Aarts, 2005b, 2007). Based on this notion, it can be concluded that when execution of instrumental actions requires effort, or negotiating obstacles, activation of an action representation is more likely to result in behavior when the activated goal representation that triggers this behavior is more desired or associated with positive affect. Thus, although activation of action representations on perception of a goal discrepancy may be primarily influenced by the accessibility of the goal representation, the actual execution of these actions may, under some circumstances, be influenced by the desirability, or affective valence, of the goal.

This conclusion that behavioral responses to goal discrepancies may be moderated by both desirability and accessibility not only reconciles our present findings with the existing literature on the topic but also paints a broader picture in which nonconscious goal pursuit in general is dependent on the accessibility and desirability of the goal state as well as the discrepancy between this goal and the person's actual state. Indeed, we have recently argued for a framework that holds that nonconscious goal pursuit will only occur if these three prerequisites are satisfied (Custers & Aarts, 2005a). According to this notion, satisfying one of these three parameters should yield motivational, goal-directed behavior if the other two are satisfied. This view may have implications for research on nonconscious, motivational processes in general.

It may, for example, have implications for the literature on self-regulation of behavior. Although in this literature maintaining and restoring desired states plays a crucial role, and regulation processes often are assumed to operate outside conscious awareness (see Baumeister & Vohs, 2004; Palfai, 2006), these processes are rarely discussed in terms of nonconscious goal pursuit. The current findings, however, suggest that regulation of behavior and nonconscious goal pursuit may have the same underlying process, which can occur in different forms. Hence, the present research may help to bridge the gap between these different but related lines of research by proposing that both goal accessibility (the key variable in goal-priming research) and discrepancies play an important role in nonconscious goal-directed (or goal-maintaining) behavior. Whereas goal-priming effects on behavior may be moderated by goal discrepancies, self-regulatory processes may be moderated by the accessibility of goal representations.

This crucial role of goal accessibility in the process of maintaining desired states may have previously gone unnoticed because this accessibility is not only subject to temporal changes but also differs chronically from individual to individual. In the current studies, we used frequency of goal pursuit as an indicator of chronic accessibility because the frequency with which people think of and use a mental construct are believed to be the main antecedent of chronic accessibility (Higgins, 1996). Although this relation between frequency of goal pursuit and goal accessibility can be expected to be rather strong (see Experiment 2a), the correlation between chronic accessibility and variables that determine goal pursuit may be mediated by such a frequency measure. Frequency of goal pursuit may, for example, be determined by other overarching goals (Kruglanski, 1996), people's inclination to comply to social norms (Aarts, Dijksterhuis, & Custers, 2003), environmental constraints (Aarts & Dijksterhuis, 2003), and past behavior itself (Aarts & Dijksterhuis, 2000), to name a few. Hence, chronic accessibility can be seen as a product of numerous variables that affect frequency of behavior that is itself not necessarily strongly, or only distally, related to any one of them.

However, methodologically, it could still be argued that because of the individual-differences approach we used to

investigate the effect of chronic accessibility on reactions to goal discrepancies, these reactions were in fact produced by another variable correlated with the frequency measure. Although we cannot rule out this possibility completely, we like to stress that our claim for the role of chronic accessibility is not solely based on this individual difference measure but also on the results of our priming manipulations in Experiments 2a and 2b that provide experimental evidence for the hypothesized role of goal accessibility. Because the findings of Experiment 2b in particular show that experimentally increasing goal accessibility leads to an increase in reactions to discrepancies for nonfrequent pursuers, we can at the very least argue that if frequency of goal pursuit is associated with increased goal accessibility (which, according to the results of Experiment 2a, is the case), then this increased accessibility in itself could be enough to produce these effects.

To conclude, in the present studies, we observed that mere perception of a goal-discrepant situation triggers the preparation of instrumental actions when goals are temporarily or chronically accessible. Having an accessible goal in mind, then, enables people to maintain their social goals without much conscious thought, in much the same way that a thermostat maintains the temperature in a room (Powers, 1973; Wiener, 1948) or homeostasis maintains our body temperature (Cannon, 1932). This process of automatically maintaining a goal state may be just as, or even more, important than the ability to nonconsciously pursue a primed desired state. After all, the chief advantage offered by a thermostat is not that it achieves the desired temperature once we have set it but that it maintains it by automatically reacting to discrepancies with the goal state, thus allowing us to attend to other matters that require our conscious attention without having to worry about the furnace.

NOTE

1. Whereas the word *well-groomed* may be a rather formal word in English, it captures the meaning of the Dutch words *netjes* and *verzorgd* that are commonly used in Dutch language and refer to neat and orderly in terms of physical appearance. A pilot study ($n = 50$) in which participants were asked to rate on a 10-point scale for several goals how desirable they deemed them to be and how much they wanted to attain them revealed that desirability ($M = 8.52$, $SD = 0.99$) and wanting or motivation for this goal were indeed high ($M = 8.46$, $SD = 1.01$, $r = .81$) for our student population.

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