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Behavioral cues to others' motivation and goal pursuits: The perception of effort facilitates goal inference and contagion ☆

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Abstract

Recent research demonstrates that people spontaneously, i.e., without conscious intent, infer and pursue the goals perceived in others' behavior, a phenomenon termed goal contagion [Aarts, H., Gollwitzer, P., & Hassin, R. R. (2004). Goal contagion: perceiving is for pursuing. *Journal of Personality and Social Psychology, 87*, 23–27]. Three experiments extend this work by studying the basic role of perceived behavioral effort in goal inference and pursuit. In an adaptation of the Animated Film Technique, participants were exposed to a movie featuring movements of a ball that implied the goal of helping. The amount of effort in pursuing the implied goal was experimentally varied. Results showed that an increase in perceived effort led to stronger inferences of the implied goal, as was established by enhanced accessibility of the goal representation in a word completion and lexical decision task. Furthermore, as a result of these inferences, participants more strongly pursued the inferred goal of helping. Implications for research on goal inferences and pursuit are briefly discussed.

Keywords: Goal-inferences; Goal-contagion; Effort; Animated film technique

Introduction

Humans attribute goals to the behaviors of other beings. For social animals like ourselves, it is important to know what *caused* another agent's behavior, and which end state she views as *desired*. Importantly, in some circumstances answers to both questions—i.e., what causes the behavior and what are its desired outcomes—are based on an understanding of an agent's goals (Heider, 1958; Meltzoff, 1995). Understanding the goals of others allows an understanding of their intentions, and to anticipate how, when, and where these others may act on the basis of these intentions. Furthermore, perceiving what others try to achieve may have important implications for one's own behavior. For instance, it has been argued that humans and great apes can use others' goals to represent, organize and guide their own courses of goal-directed actions (Byrne & Russon, 1998; Tomasello, Kruger, & Ratner, 1993). Knowing, for example, that an interaction partner's goal is to be helpful may cause one to readily pursue the same goal, especially when this goal signifies a positive, desired state to oneself. This way, grasping the goals of others aids the pursuit of one's own needs, desires and goals. However, taking on the goals of others renders people also more similar in what they desire and strive for, and hence in their plans for the future. Inferring goals as potential causes of others' behavior, then, is crucial for personal and social functioning (Aarts & Hassin, 2005).

Research on social perception shows that people often go beyond the behavioral information given, and that, under certain circumstances, social (causal) inferences occur spontaneously (Gilbert, 1989; Hassin, Bargh, & Uleman, 2002; Uleman, Newman, & Moskowitz, 1996). Furthermore, recent investigations into the mental

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processes guiding motivated social behavior demonstrate that enhancing the accessibility of the mental representation of goals can produce behavior directly, and that motivated goal-directed activity can start and operate without the person's conscious awareness of the cause of this activity (Aarts & Dijksterhuis, 2000; Bargh, 1990; Bargh, Gollwitzer, LeeChai, Barndollar, & Trötschel, 2001; Moskowitz, Li, & Kirk, 2004). Lately, these two separate major developments in social psychology research have been integrated theoretically. It is proposed that people are capable of inferring goals from others' behavior without conscious intent, and consequently, act on these goals in a rather mindless fashion, a process termed goal contagion (Aarts, Dijksterhuis, & Dik, in press).

This paper aims to advance this idea. Specifically, we examined whether individuals are more likely to infer the goals implied by another agent's actions when the agent's movements are perceived as more effortful. Furthermore, we investigate behavioral consequences of these inferences for the perceiver. Effort is a basic characteristic of motivational goal-directed behavior and, we propose, is therefore readily used as a cue to identify goal-directed movement, facilitating the occurrence of spontaneous goal inference and, as result, goal contagion. In line with previous work on social inferences, we focus on the notion of spontaneity, which means that the inference can be drawn without conscious intent (Uleman, 1999). Thus, the mere perception of an agent's effortful behavior renders the goal implied by the behavior more accessible and, as previous research has shown (see for a review, Custers & Aarts, 2005a), may cause the perceiver to pursue the same goal. Three studies investigated this idea.

Spontaneous goal inferences

Although goal attribution is traditionally treated as a deliberative and reflective process (e.g., McClure, 2002), there is research to suggest that people spontaneously infer the goals they perceive in others' behavior (Aarts et al., in press). For instance, studies on text comprehension have shown that people spontaneously infer goals when they encounter scripted behavioral information implying these goals as causes of behavior (Hassin, Aarts, & Ferguson, 2005; Long & Golding, 1993; Poynor & Morris, 2003). In a test of their Automatic Causal Inference (ACI) model, Hassin et al. (2005) exposed participants to sentences that described a behavior implying the achievement of a specific goal (e.g., "the toddler puts on the pajamas and turns off the light" implies the goal of going to sleep), or a similar behavior that does not imply this goal (e.g., "the toddler turns on the light and hangs up the pajamas"). The goal implying behavior did not directly reveal the cause and end-state as to the goal of sleeping and thus, had to be inferred. The emergence of goal inferences was assessed by measuring enhanced mental accessibility of the goal representation in a lexical decision task after each sentence was read. Results showed that goal-implying sentences did enhance the accessibility of the goal representation, indicating that goals were inferred. Of importance, these causal inferences occurred without conscious intent; participants did not require explicit instructions to infer goals and were unaware of the fact that they made the inferences. These findings provide strong evidence for the notion that people spontaneously infer other people's goals from descriptions of behaviors.

The research discussed above attests to the occurrence of spontaneous goal inference in making sense of other people's actions expressed through verbal and written language. However, other research utilizes animated displays to convey behavioral information. This research examines the attribution of mental states to movements of animated objects to test the basic human capability of ascribing goal-directedness to agents on the basis of perceiving behavioral cues. One of the first demonstration in this domain is Heider and Simmel's (1944) Animated Film Technique study on causality and social perception. They exposed participants to a short movie displaying movements of geometrical shapes. For example, participants observed how a small triangle and a small ball left a room by opening a door, but were directly and hastily followed by a larger triangle that was also inside that room. When participants reported their thoughts about the movie they came up with descriptions such as "the large triangle wants to separate the small triangle from the ball" or "the large triangle chases the small triangle and ball"; descriptions that clearly refer to goal-directedness and specific social goals. These findings indicate that people have a strong tendency to impute human causal characteristics (such as goals) to the movements of inanimate objects.

For a long time, Heider and Simmel's work enjoyed an anecdotal status, and their evidence for goal inferences was mostly taken for granted. Fortunately, subsequent studies conducted by other research groups replicated their findings with a wide range of different stimuli and movements, which corroborated the notion that people tend to ascribe goals to non-living entities as long as they move in a manner that 'looks alive' (for a summary, see Kassin, 1982). Recently, investigators have started to explore the basic features of movements that cause people to perceive an inanimate object as behaving intentionally or goal-directed (e.g., Csibra, Gergely, Biro, Koos, & Brockbank, 1999; Gergely, Nadasdy, Csibra, & Biro, 1995; Premack, 1990; Premack & Premack, 1997). For instance, several studies have revealed that when the speed of an object changes by itself (e.g., it can start or stop by itself), people (even at very young age) are more likely to see the object as a living entity that is capable of forming and enacting intentions. These behavioral cues to perceived intentionality are used in a rather automatic way (for a review, see Scholl & Tremoulet, 2000).

Perceived effort as a cue to others' goals

The work alluded to above shows that different behavioral cues influence people's perception of agency and

goal-directedness. Cues that enhance these percepts might be important for the emergence of goal inferences, because they can account for manifestations of motivational goal-directed behavior and thus facilitate the mental accessibility of specific goals motivating the agents' behavior in the context at hand. That is, whenever behavior is perceived more in terms of goal-directedness, the goal, in terms of the cause and desired effect, to which the behavior is aimed at may be identified with a greater likelihood, thus increasing the mental accessibility of the inferred goal in the mind of the observer.

The present work seeks to extend our knowledge of the role of behavioral cues in the perception of goal-directed behavior by examining the effects of these cues on the occurrence of spontaneous goal inferences and pursuit. In particular, we aim to analyze one of the cues that an observer can use to readily identify the goal guiding an agent's movements: The effort that the agent exhibits in her goal pursuits.

In personality and social psychology research, effort is often treated as one of the hallmarks of human motivation and goal-pursuit (Brehm & Self, 1989; Geen, 1995; Pervin, 1989; Weiner, 1992). Effort signals the person's willingness to mobilize energy and recruit resources to pursue and attain a desired goal in the context at hand. When a person engages in several different actions to overcome an obstacle, for example, she usually does not perform these actions because they are in themselves especially desirable, but because they are instrumental in attaining a goal (Kruglanski et al., 2002). Furthermore, modern animal learning researchers conceived of effort as an important observable feature of motivated goal-directed behavior, allowing to infer goals within the confines of the experimental situation (Bindra, 1974; Bolles, 1972; Toates, 1986). The more effort, the more likely the animal's behavior is seen as being directed to the goal object under investigation. As a matter of fact, it is quite common for people to use perceptions of effort as a heuristic in the assessment of goals. For instance, in a recent set of studies (Kruger, Wirtz, Van Boven, & Altermatt, 2004) showed that perceptions of effort are used to infer the incentive value of a produced item or behavior. Thus, increasing the amount of perceived effort renders another person's behavior more likely to be seen as motivational, aimed at reaching a desired goal state. Perceived effort, then, may be a cue to infer the goal implied by an agent's movements.

How do goal inferences occur when people observe an agent's behavior? To understand behavior, people try to construct a coherent causal scenario of the behavior they observe (Read, 1987). Usually, the causal chain that an agent goes through when behaving in a goal-directed manner consists of the following sequence: First, a mental representation of a desired end-state is activated is an agent's mind. Second, the agent will employ means (that usually involve behavior) to bring about an outcome that corresponds with the mental representation. Third, if the means were sufficient and the behavior was successful, the outcome of the behavior is the same as the agent's representation of the desired end-state that caused the behavior, and her goal is attained. The goal inference process starts with an observer that is exposed to the second step; an agent that behaves in a certain context, employing means to attain a desired end-state. The observer subsequently draws an inference about the first step (the cause) of the causal sequence; the goal representation that is present in the agent's mind. This occurs even when it is unlikely that the behavior is successful in leading to the desired end-state. See for example the following sentence: "When passing the pet shop the girl tells her father that everyone in her class has a dog" (taken from: Hassin et al., 2005). Participants inferred that the girl has the goal to get a dog, even when it is uncertain that she will get one.

According to the reasoning above, in the present research we created stimulus material that showed behavior (increasing in effort) aimed at reaching a desired outcome. However, the behavior turned out to be unsuccessful and the outcome of the behavior was not similar to the agent's desired state. So if participants would infer the desired state, it had to be because they understood that it was the state that agent *wanted* to attain. They would have inferred the mental representation of the agent's goal that caused the behavioral sequence.

The present research

We report three experiments to test the hypothesis that an increase in perceived effort in an agent's actions renders spontaneous goal inference more likely to occur, and also that this can lead to the pursuit of the inferred goal by the perceiver. In our experiments, we exposed participants to a specifically designed movie featuring animated movements of a ball that implied the goal of helping. The amount of effort in pursuing the implied goal was experimentally manipulated by varying the number of different movements the bal initiated in trying to attain the goal. Previous research has shown that when an agent reinitiates his behavior, using different but related actions, that agent's behavior is perceived as more effortful (e.g., Jones, 1995). Following previous work on the spontaneous processes in goal inferences (e.g., Aarts, Gollwitzer, & Hassin, 2004; Hassin et al., 2005; Long & Golding, 1993), implicit measures were used to assess the mental accessibility of the helping goal representation in a word-completion task (Experiment 1) and a lexical decision task (Experiment 2) after exposure to the film. Higher accessibility reflects stronger goal inferences.

As an important extension to previous work on the role of movement cues in the perception of goal-directed behavior, in a third experiment we explored the emergence of goal contagion by examining the potential effects of perceived effort on motivated behavior in the perceiver. Specifically, we tested whether stronger goal inferences as a result of perceiving more effort also will lead to stronger goal pursuit effects.

Experiment 1

The first study serves as an initial test to demonstrate that an increase in perceived effort increases the likelihood of making goal inferences. Participants were exposed to a short film displaying animated movements of a ball implying the goal of helping another ball getting a kite out of a tree. To reach this goal, the ball had to obtain a ladder that was inside a room containing four doors. Accordingly, it is assumed that the perception of the focal action of "retrieving the ladder from the room" renders goal inferences (and hence, enhanced accessibility of the goal) more likely to occur when the effort pertaining to the focal behavior increases. The number of doors that the ball tried to open served as the manipulation of the amount of effort. Participants thus saw the ball attempted to open either none, one, two or all four doors (no, low, medium or high effort). Next, they had to list as many Dutch six-letter words as possible starting with an H. The rationale behind this word completion task was that if the accessibility of the goal of helping is higher, participants are more likely to list the word *helpen* (i.e., the six-letter word of helping in Dutch). It was expected that goal accessibility increases as a result of an increase in effort.

Method

Participants and design

One hundred and sixteen Dutch undergraduates participated in the experiment and received € 3 for their participation. They were randomly assigned to either the no, low, medium, or high effort condition.

Procedure

Upon arrival to the laboratory, participants were told that they would take part in research conducted by different research teams, and that they had to perform several tasks serving as pilot work for future research. Participants worked in separate cubicles on two consecutive tasks: A perceived effort manipulation movie task and a word completion task. The computer program provided all the instructions.

Manipulation of perceived effort. After some general instructions about the computer program, participants were given a movie task. They were asked to watch a computerized movie, and to answer questions about it at the end of the session. The movie contained the following features: a white background with several different houses, trees and a church. On the left side of the screen a square was situated that contained a ladder. All four borderlines of the square were a little thicker in the middle, representing doors leading to the inside square. On the right side of the screen there was a tree that had a kite stuck in its branches. Below the tree was a small ball, which provided the impression that it wanted to obtain its kite back from the tree. After a few seconds, a bigger ball entered the scene from the right side.

Depending on condition, participants then watched the large ball 'behave' in different ways. In the *no effort condition*, the ball moved across the screen to the left side, leaving the scene. In the *low effort condition*, the ball moved to the square, touched one of the doors, moved back one step and left the scene on the left side. In the *medium effort condition*, the ball touched two different doors and left the scene. In the *high effort condition* the ball attempted to open all four doors and left. The moving-speed of the ball was fixed in all conditions, as was the amount of time participants were exposed to the film (11 s).

Word completion task. Next, participants were told that the researchers were interested in the kind of words that students associated with the letter H, because they needed these words for upcoming research. Participants had to type in as many six-letter words as possible that began with an H. The words remained on screen until participants indicated that they could not come up with any more word.

Goal accessibility scores were dependent on the position of the word "helpen" in the total list of words participants had generated. For example: if "helpen" was mentioned on the ninth position in a list of ten, a score of 2 was assigned. If "helpen" was mentioned as the first word in a list of twelve, it received a score of 12. To control for the total number of entries, for each participant this score was divided by the total number of words that they had come up with. So in the first example, goal accessibility score was $2/10 = 0.2$; whereas in the second example it was $12/12 = 1$. Participants that had not mentioned "helpen" received a score of 0. Thus, goal accessibility scores ranged from 0 to 1 and a score of 1 represented the highest goal accessibility (for similar procedure see, e.g., Aarts et al., 2004; Higgins, King, & Mavin, 1982).

Manipulation check. After the word completion task, participants were asked to indicate how much effort the ball had put in entering the square. This question was rated on a nine point-scale [*no effort at all* (1) to *a lot of effort* (9)] and served to check whether we have succeeded in increasing the perceived amount of effort proportional to the four different effort conditions.

Debriefing. At the end of the study, participants were thoroughly debriefed. The debriefing indicated that participants were unaware of the true nature of the study. Furthermore, none of the participants indicated that the exposure to the movie had influenced their responses on the word completion task. Thus, if effects on the accessibility of the goal occur as a function of the different perceived effort conditions they seem to operate without participants' awareness (Bargh & Chartrand, 2000).

Results and discussion

Manipulation check

To assess whether the perception of effort corresponded proportionally to the number of attempted doors, the

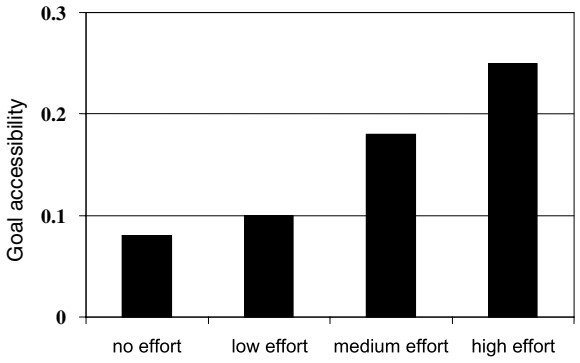

Fig. 1. Average goal accessibility scores as a function of effort (Experiment 1).

manipulation check was subjected to an ANOVA with perceived effort as the dependent variable and the manipulated amount of effort as the independent (between-participants) variable. This analysis yielded a strong linear effect, $F(1, 114) = 83.00$, $p < .01$, $\eta^2 = .42$ ($r = 0.65$, $p < .01$), supporting the notion that the perceived effort increased linearly with the manipulated amount of effort.

Goal accessibility

To investigate our specific hypothesis as to the effect of manipulated effort on the accessibility of the goal of helping, we subjected the accessibility scores obtained from the word completion task to an ANOVA in which the linear effect of manipulated effort on the accessibility measure was tested. Fig. 1 presents the means of the goal accessibility measure of each cell in the design. As can be seen in Fig. 1, more effort led to higher accessibility of the goal. This pattern was supported by a significant linear effect, $F(1, 114) = 5.50$, $p = .02$, $\eta^2 = .05$.

Furthermore, to examine our hypothesis that an increase in perceived effort renders goal inferences more likely, we analyzed the effects of manipulated effort on the accessibility of the goal concept once again, this time controlling for the scores on the perceived effort ratings. An ANCOVA, using the manipulated effort and accessibility measure as the independent and dependent variables and the perceived effort ratings as a covariate, revealed that the effect of manipulated effort vanished, $F(1, 113) = 2.37$, *ns*. This finding suggests that participants inferred the goal to help more strongly because they perceived more effort.

Experiment 2

This second experiment served two purposes. First, we attempted to replicate the results from Experiment 1, using a different implicit accessibility measure based on response latencies. In the present study we therefore used a lexical decision task. Based on the findings of Experiment 1, we expected that if the mental representation of the goal of helping increases in accessibility, reaction times to words related to the goal would be faster.

The second purpose of this study was to more directly examine whether goal inferences as a function of perceived effort occur spontaneously—without conscious awareness of making the inference. To investigate this, participants were also explicitly asked to indicate whether the large ball pursued the goal of helping. This way, we obtained a conscious attribution about the ball's "behavior," and measured whether participants recognize the goal implied by the behavior as a result of perceiving more effort. However, according to the present line of reasoning, participants do not necessarily have to make this conscious attribution to infer the goal of helping at the time they are exposed to the film. That is, if participants' enhanced accessibility of the goal of helping results from a spontaneous inference process, as we hypothesized, then the conscious attribution measure should not mediate the effect of manipulated effort on the accessibility measure.

Method

Participants and design

Ninety-eight Dutch undergraduates participated in the experiment, receiving €3 in return. They were randomly assigned to either the no, low, medium, or high effort condition.

Procedure

The procedure was largely similar to the one used in Experiment 1, except that a lexical decision task was used to measure the accessibility of the goal.

Goal accessibility. After exposure to the movie, participants were given a lexical decision task in which they had to respond to 36 words. Eighteen of the words were existing words (all verbs) and 18 were nonsense words. For every word appearing on the screen they were asked to decide as fast and accurately as possible whether the word was an existing word or not. Participants pressed keys on the PC's keyboard marked *yes* or *no*. All words appeared at the same location on the screen, preceded by a fixation point for 500 ms. Response latencies were measured in milliseconds from the onset of the words to the time participants pressed a key. The time interval between word-trials was 2 s. The words were presented in random order, and were preceded by 4 practice trials. Among the existing words 3 target words represented the goal of interest: "helping", "assisting", and "supporting" (translated from Dutch). The other 15 existing words were not related to the goal of helping, and thus served as (filler) control words to test the specificity of the effort manipulation effects. The average of the experimental goal and control words were matched on word length.

Explicit goal attribution measure. After the lexical decision task, an explicit measure of goal attribution was administered (see McClure, 2002). Specifically, participants were asked to indicate whether they thought that the large ball

wanted to help the small one. Ratings could be given on a nine-point scale [ranging from *not at all* (1) to *very much* (9)].

Debriefing. At the end of the session, participants were debriefed. The debriefing revealed that participants did not realize the true nature of the study. Furthermore, none of them indicated that the exposure to the movie had influenced their responses on the lexical decision task.

Results and discussion

Goal accessibility

The averaged response latencies on goal words and control words were subjected to a 4 (Amount of effort: no, low, medium vs. high) between-participants × 2 (Type of word: goal vs. control) within-participants ANOVA, testing for the linear effect of effort. Incorrect ("no") responses across these words were excluded from the analyses (3% out of all responses). The number of incorrect responses did not differ between conditions or between goal and control words (F's < 1). To lessen the influence of outliers, response latencies that were above or below two standard deviations of the mean were also excluded from the analyses (Hassin et al., 2005). A significant linear effect of effort was found, $F(1, 96) = 4.09$, $p = .05$, $\eta^2 = .04$, but no effect of type of word, $F(1, 96) = 1.82$, ns. Furthermore, the Effort × Type of words interaction effect was significant as well, $F(1, 96) = 10.84$, $p < .01$, $\eta^2 = .10$.

To gain further insight in the significant interaction effect and to test our specific hypothesis, we conducted simple tests to analyze the linear effect of effort on each type of words. These tests revealed that responses latencies to the goal words significantly decreased with the increase in the amount of effort, $F(1, 96) = 8.41$, $p < .01$, $\eta^2 = .08$ ($r = -.28$, $p < .01$), whereas the effect on the filler control words was unreliable, $F < 1$. In other words, participants responded faster to helping words when they perceived more effort in the movements of the bal. Fig. 2 presents the means of the response latencies on the goal words for each cell in the design.

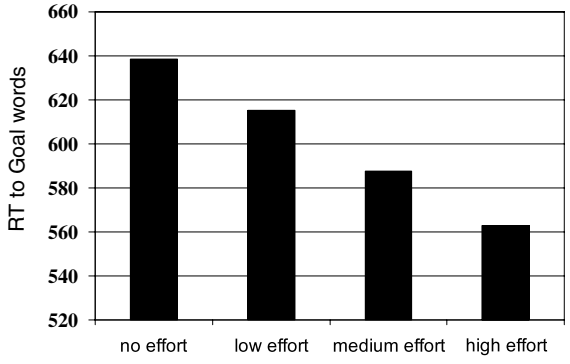

Fig. 2. Average reaction times to goal words as a function of effort (Experiment 2).

The potential role of explicit goal attribution

With the assessment of the explicit goal attribution question, we wanted to explore the potential mediational role of conscious awareness of inferences in the accessibility of the helping goal as a result of the effort manipulation. We first tested the relation between the effort manipulation and the explicit goal attribution item. Next, we performed an ANCOVA on the latency measure with the explicit attribution measure as covariate.

The linear relation between effort and explicit goal attribution was significant, $F(1, 96) = 5.14$, $p = .03$, $\eta^2 = .05$ ($r = 0.23$, $p = .03$), showing that participants were able to consciously attribute the goal of helping to the ball's movements when displaying more effort. However, the linear effect on the latency measure of the goal words did not disappear after controlling for the explicit attribution measure, $F(1, 95) = 10.42$, $p < .01$, $\eta^2 = .10$. The regression effect of the explicit rating on the accessibility measure showed no relation between these two measures, $F < 1$. Interestingly, the linear relation between manipulated effort and the explicit goal attribution rating did not disappear either when controlled for the implicit accessibility measure, $F(1, 95) = 7.11$, $p < .01$, $\eta^2 = .07$. These results show that conscious goal attribution did not mediate the effect of effort on implicit goal accessibility and vice verse, suggesting that explicit and spontaneous (more implicit) inferences occurred independently.

In sum, the pattern of findings on the goal accessibility and explicit goal attribution measures in Experiment 2 replicated and extended the results of the first experiment. Participants inferences as to the goal of helping were stronger when the agent's goal-directed movements increased in effort. Participants made these goal inferences when they were explicitly (and thus consciously) asked to do so. Furthermore, participants' responses to the goal words in the lexical decision task indicate that these inferences do not need explicit (conscious) instructions to become manifest. Covariance analysis revealed that the goal inferences occurred independently from explicit goal attributions, suggesting that goal inferences occurred spontaneously—without awareness of doing so.

Due to the design of the film, Experiment 1 and 2 were effective in demonstrating that participants had acquired an understanding of the cause of the agent's behavior, i.e., the mental representation of the goal or desired state of helping. Because the desired state of helping was actually not attained, it became apparent that participants knew that the ball *wanted* to help, and thus that the actor's goal to help was accessible in participants minds at that point. Experiment 3 investigates the potential behavioral consequences of this inference of the goal of helping as a function of perceived effort.

Experiment 3

So far, the results show that perceived effort is a behavioral cue that signals the pursuit of goals in a given context

and increases the mental accessibility of the actor's goal by affecting the likelihood of making goal inferences. Based on recent investigations into priming effects on behavior (e.g., for a review see Dijksterhuis, Chartrand, & Aarts, in press), an interesting implication of this spontaneous goal inference effect is that the enhanced accessibility of the inferred goal construct may have consequences on overt behavior.

Recent findings have revealed that goal inferences can lead to motivational, goal-directed behavior aimed at the inferred goal, without awareness of the operation of the inferred goal. This process has been termed goal contagion (Aarts et al., in press). Evidence for this goal contagion effect comes from a recent study conducted by Aarts et al. (2004). Employing a text reading paradigm, in one of their studies they briefly exposed students to a short script implying the goal of earning money or not. After reading the goal-implying scenario, participants were told that they could participate in a lottery, providing an opportunity to attain the goal to earn money, but only if there was enough time left. They were then given a mouse-click (filler) task, and the question was whether participants would speed up their performance to make sure that they could participate in the goal-relevant task. Results showed a goal contagion effect: Participants who were exposed to the behavior implying the goal of earning money were indeed faster than those in the control condition. These effects have been replicated for other goals, such as seeking casual sex.

Expanding on this goal contagion research, Experiment 3 was set out to test the behavioral effects as a result of inferring the helping goal of the ball. It was hypothesized that higher perceived effort would lead (via inferences) to motivational behavior aimed at the inferred goal. Participants watched the same films as in the previous experiments, after which they were asked whether they were willing to fill out an additional questionnaire, without receiving anything in return (participants usually get paid for such research participation). At this point participants could either decide to leave the lab and go on with other things or to volunteer in another questionnaire study. Similar to studies on nonconscious goal pursuit (e.g., Fitzsimons & Bargh, 2003), this request represents an opportunity to attain the goal of helping. An increase in willingness on this request implies a stronger pursuit of the goal to help, especially because participants expected that they would fill out the questionnaire only when their reported willingness was high enough. Therefore, responses to the request served as a measure to assess the contagiousness of the implied helping goal.

Experiment 3 served two other purposes. First, we assessed the explicit attribution measure used in the previous study to examine the role of conscious awareness of the inferences in the hypothesized effects of manipulated amount of effort on the behavioral measure. Second, we included a potential mediator variable to rule out alternative accounts for the observed goal contagion effects. Specifically, perceiving more effort to help someone else may increase participants' mood. Previous research has demonstrated that mood can be positively related to individual helping (Carlson, Charlin, & Miller, 1990), and thus effects of perceived effort on goal-directed activity may be attributable to variances in mood. Hence, for the present purpose, mood seemed highly relevant to test for mediator effects.

Method

Participants and design

One hundred and sixty-six Dutch undergraduates participated in the experiment in return for course credits. They were randomly assigned to either the no, low, medium, or high effort condition

Procedure

The procedure and instructions for the exposure to the different films to manipulate amount of effort were similar to those used in the previous experiments.

Goal contagion measure. Next, participants engaged in an allegedly unrelated part of the experiment. In this part, they were told that the researchers needed a few participants to fill out an additional questionnaire, but could not give anything in return. To determine which participants actually would participate in the extra survey study after the session, they were asked to indicate their willingness to fill out a questionnaire for the researchers. Participants were thus given the idea that we only needed a small number of students that actually wanted to participate in an unrelated study without any payment. Note that we did not ask participants directly whether they wanted to help; they were asked to fill out a questionnaire for free, thus constituting an opportunity to attain the goal of helping. Responses were collected on a nine-point scale [*absolutely not* (1) to *absolutely* (9)].

The measurement of mood. After participants indicated their willingness to fill out a questionnaire, the mood items from the modified version of Salovey and Birnbaum (1989) Affect-Arousal Scale was administered. The items aim to differentiate feelings of mood on 10-point scales. The mood items were *bad-good*, *sad-happy*, and *displeased-pleased.* Participants responded to each item in terms of how they felt at that moment.

Debriefing. Next, participants rated the explicit goal attribution item and were then fully debriefed. As in the previous two studies, the debriefing indicated that none of the participants reported awareness about a relation between the film and the willingness question, nor did they indicate that exposure to the film had influenced their responses.

Results and discussion

Goal contagion

To test the idea that increased effort leads to stronger goal contagion effects in the perceiver, we first subjected

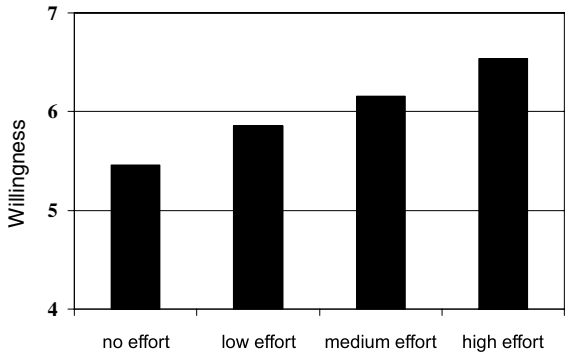

Fig. 3. Average willingness to fill in a questionnaire as a function of effort (Experiment 3).

participants' willingness scores to a single factor (Amount of effort: no, low, medium vs. high) between-participants ANOVA. The average willingness is displayed in Fig. 3. As can be seen in Fig. 3, the amount of effort showed a linear effect on willingness, $F(1, 164) = 6.29$, $p = .01$, $\eta^2 = .04$ ($r = .19$, $p = .01$), thereby confirming our hypothesis.[1]

The potential role of explicit attributions

The linear relation between effort and explicit goal attribution was significant, $F(1, 164) = 4.43$, $p = .04$, $\eta^2 = .03$ ($r = 0.16$, $p = .04$), showing that participants more strongly identified the goal of helping when perceiving more effort. However, the ANCOVA showed that the linear effect of effort on the willingness measure did not disappear when the explicit goal attribution measure was introduced as a covariate, $F(1, 163) = 5.76$, $p = .02$, $\eta^2 = .03$. Furthermore, the regression effect of the explicit rating on the goal contagion measure was non-significant, $F < 1$. In addition, the linear effect of manipulated effort on the explicit goal attribution rating did not disappear either when controlled for the goal contagion (willingness) measure, $F(1, 163) = 3.91$, $p = .05$, $\eta^2 = .02$. These findings replicate the pattern of results obtained in Experiment 2, and suggest that the effects of manipulated effort on the goal contagion measure was not mediated by conscious attribution of the goal.

Potential mediation by mood

With the assessment of participants' mood, we wanted to rule out a potential mediator for the manipulated effort effects on the willingness to help. We first conducted an ANOVA using effort as the independent variable and the average of the three mood items ($\alpha = 0.91$) as the dependent variable. Next, we performed a between-participants ANCOVA to assess the effects of effort on willingness once again, with the mood measure as covariate. Analyses revealed no significant main effect of effort on mood, $F < 1$, indicating that mood was not affected by the effort conditions. Analyses of covariance yielded the same pattern of significant results for goal after controlling for mood, $F(1, 163) = 6.15$, $p = .01$, $\eta^2 = .04$. Taken together, then, these analyses indicate that the observed pattern of results is not attributable to changes in subjective experienced mood.

General discussion

The results of three studies showed that perceiving effort in the movements of an agent affects the emergence of goal contagion. First, we established that perceiving more effort leads to stronger goal inferences, as was revealed by enhanced accessibility of the goal representation in a word completion task (Experiment 1) and a lexical decision task (Experiment 2). Furthermore, Experiment 3 showed that these goal inferences, as a result of perceiving more effort, led to a stronger pursuit of the goal by participants. These findings provide new and important evidence that an increase in perception of effort leads to stronger goal inferences and consequently, facilitates the occurrence of goal pursuit. They suggest that the mere perception of an agent's movements may cause the perceiver to mentally access and behaviorally pursue the very same goal implied by the movements.

The current studies bear on past research that has shown that people readily attribute mental goal states to moving animated objects (e.g., Heider & Simmel, 1944). Following this work, more recent research has revealed that specific movement cues are responsible for a heightened perception of animacy and intentionality of these objects, such as self-propulsion (Premack, 1990). Our results extend this research by showing that humans are more likely to attribute a specific goal to another being when its 'behavior' is characterized by more effort. Effort is a behavioral cue that signals motivational goal pursuit, increasing the probability of inferring the goal apparently driven the instrumental behavior.

Furthermore, the present studies expand on the progress researchers have made in two major developments in social psychological research – i.e., work on spontaneous processes in social causal inferences and goal pursuit. Remarkably, these two developments have led relatively separate

[1] An alternative explanation for the results in Experiment 3 pertains to the fact that participants' goal to help may have increased because they saw that the large ball needed help opening the doors. After all, participants observed that the ball put effort into entering the room, but never succeeded. To investigate this explanation, we randomly exposed participants to an extra condition that was similar to the high effort "unsuccessful" condition, except that the ball succeeded in opening the fourth door and therefore did not need help. If participants' pursuit of the goal to help increased because they perceive the large ball in need of help, then the willingness to fill out a questionnaire in this high effort "successful" condition should be less than in the high effort "unsuccessful" condition. However, ANOVA revealed that the willingness in the unsuccessful high effort condition and the successful high effort condition was virtually equal, $F < 1$. Furthermore, using the successful high effort condition instead of the unsuccessful high effort condition in the original ANOVA revealed a similar effect of manipulated effort on willingness, $F(1, 146) = 5.43$, $p = .02$, $\eta^2 = .04$ ($r = 0.19$, $p = .02$). These data suggest that the emergence of goal contagion was not attributable to variations in successfulness of performing the observed action. Instead, it was the increased effort that caused stronger goal inferences (Experiments 1–2), and hence, rendered goal contagion more likely.

lives and the question of whether, and how social (goal) inferences affect behavior have hitherto received little theoretical analysis and empirical attention (Aarts et al., in press). The present research contributes to closing this gap by showing that goal inferences, via the perception of effort, can lead to behavior in line with the inferred goal. Accordingly, our studies provide an original demonstration of how behavioral cues may link goal inferences to motivational, goal-directed behavior.

The present work on goal contagion might be viewed of as an instance of observational learning (e.g., Bandura, 1986). In our studies participants also observed behaviors of an agent (inanimate object). However, there are also clear differences with this classic phenomenon. For instance, while observational learning pertains to novel behavioral patterns that an observer acquires through observation, the goal contagion framework (Aarts et al., 2004) states that the representation of the goals already exist in the mind of the observer and merely become activated through observation. This difference is illustrated in Experiment 3. It is rather unlikely that participants learned what it means to have the goal to help by watching the ball's movements. Instead, the goal was rendered more accessible as a function of perceived effort because it was already represented in their minds. Moreover, observational learning usually involves direct imitation of the observed behavior. Our participants did not imitate the exact behaviors (a ball opening doors to retrieve a ladder) they observed; they were willing to fill out a questionnaire that was motivated by the desired goal to help they inferred from the behaviors. Thus, whereas the current research builds on the act of observing movements in a specific context, it also goes beyond the old notion of observational learning.

It should be noted that the results of Experiment 3 do not necessarily fall into the category of goal priming research. According to this research, a goal prime directly triggers a motivational state to pursue the goal because the primed goal concept preexists as a desired state in the participants' mind that they want to accomplish themselves (e.g., Aarts & Hassin, 2005; Bargh et al., 2001; Custers & Aarts, 2007). However, there are two important points that should be stressed here. First, we want to argue that the concept that is inferred does pertain to the goal of the actor (ball) in the film. After all, the accessibility of helping increased when participants perceived more effort in the context at hand. Because effort characterizes instrumental behavior aimed at pursuing and reaching a goal, this strongly suggests that participants saw the 'behavior' of the ball as being caused by, and directed at the goal to help. Additionally, the desired state of helping was not attained in the movies, so participants had to infer what the ball *wanted* to attain (i.e. wanted to help). However, this does not necessarily mean that the activated construct of helping functions as a motivational state right after participants saw the film (as suggested in previous work on goal contagion; Aarts et al., 2004). Second, we want to argue that the reported willingness measure represents participants' *motivation* to help. The question was presented to participants as a means that would lead to the act of helping someone; the higher their willingness, the more they wanted to help by filling out a questionnaire for free. Higher willingness therefore represents a higher motivation to attain the state of helping. Basically, our effects demonstrate that seeing an actor pursuing a goal can lead a person to act in a similar motivational, goal-directed manner as well.

In the literature, several underlying mechanisms have been proposed for behavior priming effects other than goal priming. One of the first account to understand these effects postulated that the priming of behavior concepts activates representations of the corresponding motor actions (for details, see Dijksterhuis & Bargh, 2001). These effects are said to result from a common coding system for perception and action. However, these effects are generally explained in non-goal directed and non-motivational terms, and hence, it is unlikely that this account pertains to the present data. Other investigators have recently suggested that behavioral effects of priming do not necessarily depend on a direct priming of the goal pursuit in the perceiver. Instead, it may depend on an interpretation or construal of the current situation, in which the situation is construed in line with the primed construct without awareness of the cause of this effect (e.g., Kay & Ross, 2003; Smeesters, Warlop, Van Avermaet, Corneille, & Yzerbyt, 2003; Wheeler & Petty, 2001). For instance, the situational construal explanation (Kay & Ross, 2003) would argue that the inference of the goal of helping causes participants to view that it would be appropriate in the current situation to apply to our request to fill out an additional questionnaire. Perhaps the activated construct of helping did not directly function as a goal after participants had seen the film, but became a goal when participants were given the request. They may have interpreted that it would be appropriate to help in the current situation and wanted to act accordingly.

In sum, although our results suggest that behavior changes resulted from the priming of a preexisting representation of a desired goal state (see Aarts et al., 2004, 2005; Custers and Aarts, 2005b), other explanations can hold as well. However, even though the exact underlying mechanism of the present findings cannot be extracted on the basis of the presented experiment, we believe that the present study does qualify as an instance of goal contagion. That is, the enhanced accessibility of the inferred goal to help as a result of perceiving more effort in another agent's behavior was shown to lead to a higher motivation to attain the goal oneself.

Limitations and future directions

Our research still leaves a number of questions open for further examination. First, the present research examined the role of perceived effort in spontaneous inferences of one particular goal, that of helping, and tested whether participants were prone to act on this generally favorable goal.

However, can these findings be generalized to all types of goals? Previous work has revealed that other type of goals are inferred and pursued as well (Aarts et al., 2004; Hassin et al., 2005). However, although we argued that the perception of effort mainly enhances the accessibility of the implied goal and that this leads to goal contagion, the question remains whether effort affects the desirability of the goal as well. In this respect, it may be useful to distinguish the inference that a person has a goal (which was the focus of the current studies) from the inference that a person tries hard to achieve the goal (intention versus exertion; cf. Heider, 1958). Accordingly, a goal concept that originally is neutral to a perceiver (that is, a concept that people represent as a goal but have no clear desire for) may become more desirable to that person upon seeing others working hard to attain it, as it may render the goal more valuable. Future research may explore when and how perceived effort as a cue to others' motivation and goal pursuits affects the accessibility or desirability of a goal.

Furthermore, in the current studies we used the animated film technique to manipulate perceptual cues of effort, namely by varying the number of different movements of a nonhuman object directed at a goal. Our findings thus bear on the basic role of effort by the specific animated movie treatment. It is important to note, though, that goal inferences also occur during text reading tasks (e.g., Hassin et al., 2005). Accordingly, perceived effort may also facilitate the understanding of protagonists' goal pursuits expressed through verbal and written language. There is research that shows that effortful behavior plays a role in judgments of other people's motivation when verbal information is employed (Jones, 1995). Jones demonstrated that when participants were told about a protagonist who attempted to reach a certain outcome, they explicitly judged the protagonist to be more motivated to reach the outcome when she tried several different attempts, as opposed to the same mean once or several times. Although these data do not directly address the occurrence of spontaneous goal inference and contagion, they suggests that behavioral effort, as a cue to motivational goal pursuit, may not be limited to the animated movie treatments and that the effects obtained in the present research represent psychological processes that operate in real life settings.

Finally, although we aimed to unobtrusively assess effects of goal inferences and contagion as a result of perceiving effort, the possibility remains that these effects were due to a conscious attribution process. Participants' responses to the explicit goal attribution question showed that they were more likely to recognize the given goal when they perceived more effort. However, it is important to realize that there was neither a relation between this explicit goal attribution measure and the implicit goal accessibility measure nor a relation between the explicit attribution measure and the behavior measure. Although this explicit rating consisted of only a singular item, and therefore the findings should be interpreted with severe caution, they suggest that goal inference and contagion did not necessarily require conscious attribution and reflective processes. This notion was corroborated by the post-experimental debriefing and is in line with other past work on social inferences (Hassin et al., 2005; Uleman, 1999). Further research could shed light on this important issue by studying the conditions that render people aware of their goal inferences, and how these conditions moderate the behavioral effects of these inferences.

Concluding remarks

The goals motivating other people's behavior are not always explicitly revealed and thus must be inferred from their behavior. Specifically, we often see people acting in a given situation, and do not know what *caused* their behavior, and which end states they view as *desired*. In that case, grasping an agent's goals promotes a better understanding of their behavior. We observed that humans have a basic tendency to rely on perceived effort to readily identify motivation in other agents' behaviors and to grasp what others want to attain. Observing motivation in other people tells us that another social being acts on an incentive or goal that is worth striving for, and might be worth our pursuits as well. Our ability to spontaneously integrate the perception of effort into a representation of others' goals and act on these goals ourselves points to the development of a mechanism that allows us to understand and to operate in the social world in a rather mindless fashion. This way, motivational goal-directed activity may pass on from one person to the other during everyday social interaction.

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