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Automatic goal inferences☆

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Abstract

The social psychological literature on automatic social inferences has focused on one construct that helps explaining human behavior—traits (e.g., Gilbert, Pelham, & Krull, 1988; Trope, 1986; Winter & Uleman, 1984). The dispositional roots of behavior, however, go beyond relatively stable constructs such as traits to include more transient causes such as one's intentions and goals. Evidence from young infants and adult chimpanzees, knowledge acquired in the text-comprehension literature and hypotheses derived from the Automatic Causal Inferences framework (Hassin, Bargh, & Uleman, 2002), seems to converge: they all suggest that perceivers may automatically infer goals from behaviors. This paper reports four studies that examine this hypothesis. The first two use surprise cued-recall, and look at goal inferences when the road to goal achievement seems straightforward and when it seems blocked. Studies 3 and 4 use on-line methodologies—probe recognition task and lexical decision—to examine whether these inferences are made at encoding.

Keywords: Goals; Automaticity; Control; Inferences; Cause; Attribution; Spontaneity

The survival of social animals depends, amongst other things, on an understanding of others' intentions, plans, and objectives. One of the basic prerequisites for such an apperception is an ability to perceive others—friends and foes alike—in terms of the goals that they pursue and set themselves to attain. This ability offers an important extension to the understanding of others in terms of their traits because unlike traits, that are relatively stable mental characteristics, goals are more flexible and context-dependent. As such, they motivate many behaviors that seem less explicable in terms of more stable dispositions. To take just one example, when someone runs after a cab it is usually not because she is athletic.[2]

Furthermore, thinking about behaviors in terms of the goals they serve allows an appreciation of how the same behaviors, conducted in different circumstances, have different meanings. Think, for example, about the act of going to the other room and putting on pajamas.

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[2] The relations between the concepts 'goal' and 'trait' are less straightforward than the current formulation suggests, alas a thorough discussion of these issues is beyond the scope of the present paper. To take just one example, it has been suggested (e.g., Miller & Read, 1991; Read & Miller, 1989) that traits may be thought of as *relatively stable* structures of goals. It is important for us to note that views of this sort do not challenge the above assertion, because even under these definitions goals in general are more flexible than traits in general.

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It may serve the goals of getting to sleep; preparing for general anesthesia; somewhat aggressively letting your guests know that it is time for them to go home, or (even less subtly?) hinting to others to stay. For social animals like ourselves, it is important to know what *caused* the agent's behavior, and which one of the end states s/he views as *desired*. Importantly, in some circumstances answers to both questions—i.e., what causes behavior and what are its desired outcomes—are based on an understanding of an agent's goals. Understanding of this type may prevent mistakes that are oftentimes embarrassing and potentially harmful.

Third, thinking about others in terms of their goals may carry important implications to one's own conduct. So, for example, it has been argued that humans and greater apes can use others' hierarchical goals to organize and guide their own courses of goal-directed actions (Byrne & Russon, 1998; Tomasello, Kruger, & Ratner, 1993).

On some occasions others' goals are easily accessible to us because they are communicated explicitly. On others, contemplation may compensate for lack of explicit communication. But in yet other cases knowledge of others' goals is more difficult to attain. This may be the case when people engage in effortful attempts to disguise their goals, or when goals operate non-consciously and are not even accessible to the person who pursues them (see Ferguson, Hassin, & Bargh, 2004). Lastly—and this seems to us to be the more frequent category—given the limited resources of consciousness on the one hand, and the constant buzz of our lives on the other, we often lack the time needed to form intentions to infer goals and/or the resources necessary for the actual inference.

A cognitive system that unintentionally and non-consciously infers goals may overcome the latter obstacles. Given the potential benefits of goal inferences that were discussed above, such a system may be highly advantageous for social animals: it allows a deeper comprehension of the social environment without the costs that are associated with conscious mental processes. The arguments and data that are outlined below suggest that there are good reasons to suspect that humans may be able, at least under certain circumstances, to infer goals automatically. This paper reports four studies that examine this hypothesis.

Automatic social inferences

Social psychology has extensively examined the automatic and controlled aspects of *trait* inferences. The two major theories in this regard are that of Trope (e.g., Trope, 1986; Trope & Alfieri, 1997) and that of Gilbert (e.g., Gilbert, Pelham, & Krull, 1988). The models of both teams suggest that the process of identifying a behavior in terms of its associated trait-like term can occur automatically. For example, the models agree that when we see Alex sitting in front of the TV smiling, we immediately categorize the behavior as 'happy.' Gilbert's model suggests that the dispositional attribution occurs automatically too (e.g., we automatically conclude that Alex is a happy person), and that the only controlled part is the correction process (e.g., if his favorite basketball team has just won a game we may conclude that Alex is less dispositionally happy than might seem at first). The Trope model suggests, however, that the post-identification integration of information into an attribution is a controlled process.

Another large body of research in the social psychology of automatic trait inferences has focused on a specific aggregation of automaticity features, namely—spontaneity. An inference is defined as spontaneous if (1) it is not suggested by the experimental instructions, (2) people are usually unaware of their intention to make it, and (3) people are usually unaware of the inference itself (Uleman, 1999). In almost 20 years of research we have learned a lot about spontaneous social inferences. Uleman and his colleagues (e.g., 1989; Uleman, Newman, & Moskowitz, 1996) have convincingly argued that, in the notion introduced above, *trait* inferences may occur spontaneously. Thus, e.g., upon reading the sentence "Marci solved the mystery half way through the book" readers spontaneously infer that Marci is smart. These inferences do not require conscious impression-formation goal: They occur even when participants are instructed to memorize sentences, judge how interesting they are, or to merely read them. Lately it has been convincingly demonstrated that STIs are linked in memory to the actor (Todorov & Uleman, 2002, 2003; Van Overwalle, Drenth, & Marsman, 1999).

Automatic causal inferences: The case of goals

Recently it has been suggested that various types of automatic inferences described in the literature may be included under one conceptual roof, that of automatic causal inferences (the ACI framework; see Hassin, Bargh, & Uleman, 2002; see also, Aarts & Hassin, 2004). Specifically, it has been proposed that STIs (e.g., Winter & Uleman, 1984), and predicting inferences (e.g., McKoon & Ratcliff, 1986), can be thought of as instances of causal inferences—the former in terms of possible *reasons* for behavior, and the latter in terms of its expected *results*.

An interesting implication of the ACI framework suggested by Hassin and colleagues is that people should be able to automatically infer various (social) constructs may be perceived as serving a prominent role in a causal chain of behaviors. One such construct are goals—the mental representations of desired states that people

strive to attain (Aarts & Dijksterhuis, 2000; Austin & Vancouver, 1996). To the extent that goals are perceived as causes for behavior, argues the ACI framework, people should be able to automatically infer them.

That the understanding of others in terms of their goals is somewhat automatic was already suggested by the classic studies of Heider and Simmel (1944), in which participants tended to interpret the "behavior" of geometric shapes in terms of their goals and intentions. Given certain conditions, these kinds of interpretations occur immediately and effortlessly, and they seem to be the natural default of a mature cognitive system.

Infants and chimps

Other evidence that pertains to the automaticity of goal inferences suggests that they do not require full-blown human conscious awareness. This has been recently demonstrated with two special populations—very young infants and adult chimpanzees. In the former case, investigators have shown that infants—as young as 9 months old—understand behavior in terms of its underlying goals (Csibra, Gergely, Biro, Koos, & Brockbank, 1999; Gergely, Nadasdy, Csibra, & Biro, 1995). Similar findings have been recently reported for adult chimpanzees (Uller & Nichols, 2000). This research suggests, then, that inferences of goals seem to occur even in the absence of full-blown human conscious awareness, hence in the absence of fully developed capacity for cognitive control. Thus, they indirectly support the suggestion that goal inferences, at least under certain circumstances, could be automatic.

Text comprehension

Causal inferences in general, and goal inferences specifically, are studied by researchers who are interested in the processes that underlie text comprehension. This literature is highly relevant to social psychologists who are interested in inferences (at least those who use verbal materials), alas a review of it is well beyond the scope of this paper (cf. Balota, d'Arcais, & Rayner, 1990; Graesser & Bower, 1990; Graesser, Singer, & Trabasso, 1994; McKoon & Ratcliff, 1992). In the following paragraphs, then, we succinctly discuss those aspects of this literature that are important for understanding the wider context of the current investigation.

Researchers in this field consider protagonists' goals as central to narrative comprehension and, accordingly, the consensus seems to be that readers make goal-relevant inferences when they are *actively* trying to understand texts (e.g., Graesser et al., 1994; McKoon & Ratcliff, 1992; Myers, 1990; Trabasso & van den Brook, 1985). However, for many (if not most) text-comprehension researchers the automatic vs. controlled distinction is less central than that between on-line and off-line inferences (but see Long & Golding, 1993; Long, Golding, & Graesser, 1992; McKoon & Ratcliff, 1992). Thus, for example, although Graesser et al.'s (1994) treatment of goal inferences implies that they may occur automatically, they explicitly note that the question of automaticity is not central to their argument and hence leave it open (p. 372). Similarly, Dopkins, Klin, and Myers (1993), Suh and Trabasso (1993), and Poynor and Morris (2003), amongst others, examine on-line goal-related inferences, without examining their automaticity.

It is important to note here that although they seem close these distinctions are conceptually orthogonal: on-line inferences may be automatic or strategic, and the same holds for off-line inferences. This orthogonality allows researchers to focus on one distinction, and not the other. To make this point more concrete consider an example. Recently, Poynor and Morris (2003) used an eye-tracker to examine goal inferences. Their results show that participants spend more time on areas in which goal-implying sentences appear (vs. similar sentences in which goals are stated explicitly). Moreover, they show that participants tend to revisit passages that describe a protagonist as performing actions that are inconsistent with her implied goal (vs. consistent actions). These findings suggest that people tend to infer protagonists' goals, which are later used to direct (re)reading. However, since the researchers focused on the on-line vs. off-line distinction, the experiment's design does not ensure that these inferences are made automatically.

To sum up, then, evidence from studies carried on infants and chimps suggests that these two populations that, in all likelihood, do not possess fully developed consciousness, can nonetheless infer goals. Similarly, the text-comprehension literature clearly shows that goal inferences occur on-line and suggests that they may occur automatically. To date, however, there is no conclusive evidence for automatic goal inferences.

The current research

In the last half century Social Psychology has been more interested in trait inferences than in any other kind of inferences. This tendency is reflected, and maybe even magnified, in the literature that concerns automatic inferences. The current paper, that builds on the ACI framework, suggests that *goal inferences* may also occur automatically. We report four studies that examine whether this is indeed the case. The first two studies use surprise cued-recall to examine whether goals can be automatically inferred, and whether they can be inferred even when the road to goal attainment is blocked. Studies 3 and 4 use probe recognition and a lexical decision task to examine whether goal inferences occur automatically at encoding.

Study 1

The study has three distinct parts. In the first, participants read short scenarios under instructions to rate "how interesting they are." Then, they engage in a filler task for 5 min. The purpose of the filler task is to remove all contents of the scenarios from short term memory. Upon finishing the filler task, participants are presented with a surprise cued-recall task for the scenarios presented earlier.

The short scenarios that participants read either imply a goal or not. So, for example, *Josh's wife frequently annoys him and he thinks the time has come to call his lawyer*, implies that Josh adopted the goal of *divorcing*. Similar words, ordered somewhat differently, do not imply the goal—*Josh calls his lawyer, who tells him that his wife annoys him frequently*.

In the recall stage, participants are presented with two kinds of cues: the implied goals and words from the scenarios (in the above case, "divorce" and "frequently"). Based on Tulving's encoding specificity principle (Tulving & Thomson, 1973) we expected an interaction, such that goal cues would help retrieve goal scenarios more than no-goal scenarios, but no such pattern would be found for the condition in which words from the scenarios are used as cues. In order to rule out semantic relations between the cues and words in the scenarios as an alternative explanation for the results, the scenarios share all critical words. Thus, if the goal-cue "divorce" helps retrieving the first scenario above more than the latter, it cannot be due to semantic relations between the goal and words in the scenario.

Method

Participants

Forty-three undergraduates (21 from NYU and 22 from Cornell University) enrolled in Introductory Psychology course participated in the study in partial fulfillment of course requirements (28 females and 15 males). Their mean age was 20 years.

Materials

Forty short scenarios that were designed to imply goals were put to a pretest. Participants in the pretest were 20 NYU undergraduates, who took the pretest for course credit. Participants were presented with the scenarios and were asked to choose one of four goals that best describe the protagonist in the scenario. The 20 short scenarios that resulted in the highest inter-judge agreement were chosen for the study, and two versions of each were constructed. Each goal-implying scenario was altered such that it would not imply the goal. In doing so, the authors made sure that the words that were semantically related to the goal appeared in both scenarios. To take another example, the pilot showed that *The student is riding his bicycle to the university as fast as he can* implies that the student is pursuing the goal of attending a lecture (Goal condition). However, a change of one word suffices to eliminate this implication, i.e.,—*The student is riding his bicycle away from the university as fast as he can* (No-goal condition). Each short scenario had two different recall cues. One was the implied goal (Goal cue condition) and the other was a word taken from the scenario (Repetition condition). A sample of the scenarios and recall cues is presented in Appendix A.

Winter and Uleman (1984), among others, made considerable efforts to ensure that the different types of cues they used would not differ in terms of their semantic relatedness to the scenarios. This measure was crucial for them because it ruled out an alternative explanation of the results in terms of semantic proximity. The current study solves this problem differently, by adding the Scenario factor. If the effect of the cue factor results from semantic relations between cues and words in the scenarios, then it will reveal itself in both Scenario conditions, resulting in a main effect, and not the hypothesized interaction (cf. Hassin et al., 2002).

Design

The basic design is a within participants' 2 (Scenarios: Goal vs. Control) × 2 (Cues: Goals vs. Repetition). In order to control for order effects the scenarios were presented in one of two random orders. Half of the participants received each order (Order factor). In order to control for the effects of the specific versions of the scenarios, one half of our participants viewed one half of the scenarios in their Goal version and another in the No-goal version. And finally, in order to control for the effects of specific versions of cues, one half of our participants viewed one half of the cues in their Goal form, and the other half in their Repetition form; the other half of the participants received the complementary forms (Cue-version factor).

Procedure

Participants were run in groups ranging in size from two to seven people. They were told that the experiment contains three parts and that the directions for each would be given separately. For the first section, they were instructed to rate how interesting they found the scenarios (the scale had five check off points from 'not interesting' to 'interesting'; for similar procedures see Hassin et al., 2002). All participants finished this part in less than 5 min. The second section was a filler task consisting of sixteen faces. Participants were asked to rate "how interesting are the faces," and then to explain in a word or two why they gave them that rating. This section took 6 min. Afterwards, the surprised cued-recall section was introduced. Participants were told that the cues are intended to help them retrieve scenarios, and

they were asked to retrieve the scenarios and write as many details as they can. If they recalled more than one scenario per cue, they were told to write both down. Basically, they were told that whatever they remembered should be written. They were allowed 15 min for this part of the study. Finally, all subjects were debriefed and thanked.

Scoring

Each answer was rated by two judges on a scale of 0 to 3, where 0 indicated no memory at all for the scenario and 3 indicated that the scenario was almost fully, or fully recalled. The inter-judge agreement was 91%, and all disagreements were resolved by a third judge.

Results and discussion

In a thorough debriefing participants were asked whether they were aware of inferring goals, whether they had an intention of doing so, and whether they were aware of the nature of the task. One participant suggested that she "tried to understand what were the actors' motivations" and her data were excluded from the analysis. No other participant indicated either awareness of inferring goals, or intention to infer them. No order or counterbalancing factor had a significant effect on the results, and hence the data were collapsed and analyzed using a 2 (Scenario: Goal vs. Control) × 2 (Cue: Goal vs. Repetition) ANOVA.

A significant interaction between Scenario and Cue revealed that the goal cues helped recalling the goal scenarios more than the control scenarios, but no such effect was obtained for the repetition cue, $F(1,41) = 5.64$, $p < .05$ (see Table 1). Planned contrasts corroborated: Goal cues facilitated the recall of goal-implying scenarios more than that of control scenarios, $F(1,41) = 4.41$, $p < .05$; no such effect was found for the repetition cue, $F < 1.4$.

The main effect of Scenario was significant too, revealing that goal-implying scenarios ($M = .810$, $SD = .549$) were better recalled than control scenarios, ($M = .519$, $SD = .494$), $F(1,41) = 22.59$, $p < .001$. This effect was not anticipated, but one simple explanation may be that goal-implying scenarios are more elaborately processed (cf. Poynor & Morris, 2003). Further research is needed in order to establish this effect and its causes.

The significant interaction shows that goal cues helped retrieving goal-implying scenarios more than control scenarios, even though the two shared all the words that were semantically related to the cue. No such effects were found with repetition cues, i.e., words taken from the scenarios. Importantly, the effects of the cues were obtained in the absence of intention to infer goals and awareness of inferring them. These results, then, support our contention that goals implied by agent's behaviors are automatically inferred upon reading about these behaviors.

Table 1
Mean recall as a function of scenario type and cue type

	Goal cue	Repetition cue
Goal-implying scenario	.926 (.527)	.694 (.552)
Control	.457 (.433)	.581 (.547)

Note. Means are on a scale of 0–3. Numbers in parentheses are the standard deviations.

Study 2

One possibility left open by Study 1 is that subjects inferred future events that are implied by the scenarios, engaging in what McKoon and Ratcliff (e.g., 1986, 1992) call predicting inferences. Thus, for example, whereas we suggested that "divorce" was Josh's goal in *Josh's wife frequently annoys him and he thinks the time has come to call his lawyer*, it might simply be the case that "divorce" is the likely future result of Josh's actions, and hence its inference falls under the category of predicting inferences.

We concur that sometimes goal- and predictive inferences are indistinguishable (e.g., when goals are likely to be attained; cf. McClure, 2002). The current hypothesis states, however, that people may be capable of automatically inferring goals, *irrespective* of their attainment. If this is indeed the case, then goals should be inferred even when the road to goal achievement is blocked, rendering the expected results less likely to occur. Put differently, the automatic goal inference hypothesis holds that goals are inferred even when they do not predict future events. Study 2 explores this hypothesis.

Method

The short scenarios that participants read either imply an easily achievable goal, or a goal whose attainment has been blocked. Thus, for example "*Kate walked from the bus stop to the supermarket. The minute she arrives, the manager unlocks the terrace gate leading to it*" implies the goal of buying groceries, and given the circumstances this goal seems highly achievable (Goal condition). However, "*Kate walked from the bus stop to the supermarket. The minute she arrives, the manager locks the terrace gate leading to it*," implies the same goal of buying groceries but this time it's attainment is blocked (Blocked goal condition). Like in the first study, in the recall stage participants are presented with two kinds of cues: the implied goals (Goal-cue), and words from the scenarios (Repetition cue; in the above case, "buy groceries" and "bus"). For a sample of the scenarios and recall cues see Appendix B.

If, indeed, the inferences observed in Study 1 were merely predicting inferences then they should only occur

in the Goal condition. This pattern of results would reveal itself in an interaction between Cue and Goal conditions: Goal cues would help recalling Goal scenarios more than locked goal scenarios, but no such effect would occur with Repetition cues. We, however, expect no interaction: It is our contention that others' goals are inferred even when the road to goal achievement is blocked. Thus, we expect a main effect of Goal (Goal cues would help retrieving both kinds of scenarios) that is not qualified by an interaction.

Note that the two versions of each scenario use as many of the same words as possible. Thus, none of the effects reported below can be easily explained in terms of spreading of activation from the words that constitute the scenarios.

Participants

Twenty-nine juniors and seniors (mean age 17) attending Stuyvesant High School volunteered to participate in this study.

Materials

A group of 20 scenarios, that were picked based on the pilot for Study 1, were used in this study. Two versions of each scenario were constructed. In one version, the goal of the actor was easily attainable (Easy Goal condition). Minimal changes created scenarios in which goal attainment was blocked (Blocked Goal condition). For example, the scenario "*Jessica puts on her shorts, her Walkman and her Adidas shoes, and leaves for the park talking with a friend; when she gets to the course she says goodbye to her friend*" implies the easily attainable goal of running. With a change of a few words the goal become blocked—"*Jessica puts on her shorts, her Walkman and her Adidas shoes, and leaves for the park; when she gets to the course she meets a friend and begins a heart-to-heart talk*." Each short scenario had two different recall cues. One was the implied goal (Goal cue condition), and the other was a word taken from the scenario (Repetition condition).

Design

The basic design is a within participants' 2 (Goal attainment: Easy vs. Blocked) × 2 (Cues: Goals vs. Repetition). In order to control for order effects the scenarios were presented in one of two random orders. Half of the participants received each order (Order factor). In order to control for the effects of the specific versions of the scenarios, one half of our participants viewed one half of the scenarios in their Easy goal condition and another in the Blocked Goal condition. And finally, in order to control for the effects of specific versions of cues, one half of our participants viewed one half of the cues in their Goal form, and the other half in their Repetition form; the other half of the participants received the complementary forms (Cue-version factor).

Table 2
Mean recall as a function of scenario type and cue type

	Goal cue	Repetition cue
Block goal scenario	.510 (.333)	.345 (.223)
Easy goal scenario	.410 (.377)	.317 (.261)

Note. Means are on a scale of 0–2. Numbers in parentheses are the standard deviations.

Procedure

This was similar to Study 1.

Scoring

This was similar to Study 1. The inter-judge agreement was 92%, and all disagreements were resolved in discussion.

Results and discussion

In a thorough debriefing, in which participants were asked whether they were aware of inferring goals, whether they had an intention of doing so, and whether they were aware of the nature of the task, all participants pleaded ignorance: none indicated awareness or intention. None of the order factors had any significant effect, all Fs < 1, hence the data were collapsed and analyzed in a 2 (Goal: Easy vs. Blocked) × 2 (Cue: Goal vs. Repetition) within subjects ANOVA.

The Cue factor significantly affected recall, such that goal-cues helped retrieve the scenarios more than actual words from the scenarios, $F(1,28) = 4.50$, $p < .05$. Neither type of scenario (Easy vs. Blocked Goal), nor the interaction of the two factors, significantly affected recall (see Table 2 for means and SDs).

These results imply that automatic goal inferences occur even when the road to goal achievement is blocked. When goal attainment is blocked the goal no longer predicts future outcomes and events. The current findings suggest, then, that automatic goal inferences are not subsumed under predictive inferences—they are truly about the nature of the goals one sets herself to achieve.

Study 3

It has been argued that the relative benefit created by the cue in surprise cued-recall paradigms may result from reasoning processes at the time of retrieval, and not from inferences at encoding (e.g., McKoon & Ratcliff, 1986). The general form of the argument is this: upon encountering a cue one tries to think of similar words, concepts, and scripts. This focused effort leads to preferential recall of scenarios that are semantically related to the cue. Goal cues, the argument continues, are more strongly related to goal scenarios than to control scenarios. Hence, they serve as better recall cues for the former. This is not the case with repetition cues,

which are similarly related to both kinds of scenarios. These processes, then, yield an interaction that is not caused by differential pattern of inferences at encoding, but by differential reasoning processes at retrieval.

One way to deal with this critique was employed in the first two studies: all the words that were semantically related to the goals appeared both in the Goal- and the No-goal scenarios. Another way to deal with it is to examine whether goal inferences occur on-line, at encoding. Study 3, then, uses a probe recognition task to measure on-line inferences of goals. In this task, which is devised after McKoon and Ratcliff (1986), participants read short sentences after which they see a probe word. The time allotted for reading is short (2.5 s), and the probe word appears shortly thereafter. Participants' task is to decide whether the word had appeared in the previous sentence or not. There are two kinds of experimental sentences: those that imply a goal and those that do not. The probe word, in both cases, is a goal that is not explicitly mentioned in the sentence. If goals are automatically inferred, then their accessibility should increase after reading goal-implying sentences, thus rendering the judgment task more difficult. Hence, performance after goal-implying sentences should be worse than performance after control sentences.

Participants and design

Forty undergraduates participated in the study in exchange for 6 Dutch Guilders (approximately US$ 2.5). They were randomly assigned to the cells of a 2 (Type of scenario: control vs. goal) within participants × 2 (Order: control/goal vs. goal/control) between participants design.

Stimulus material

Following McKoon and Ratcliff (1986), three types of single-scenario stimuli are used: five that imply a goal, five controls, and 70 filler scenarios. Each sentence describes an action and is accompanied by a single test word. To control for semantic priming effects, the experimental sentences—the 10 control and goal-implying ones—are matched in terms of the goal-related words they contain. These sentences and the test words were obtained in a pilot study, in which participants were asked to rate the likelihood that the behaviors described in a sentence were performed in order to achieve a specified goal. This same goal is used as the probe word. So, for example, *The man with the suitcases goes to Schiphol* implies the goal (and probe word) *Travel* whereas *The man sells suitcases at Schiphol* does not imply that goal.

Notice, that like in the first two studies, all of the critical words of the scenarios appeared in both conditions. Thus, if *Travel* in the example above is more strongly associated to the former scenario than to the latter, this difference cannot result from dissimilar semantic relations between the words that comprise the sentences and the goal. Rather, it most probably reflects the fact that the cue is the goal of the behaviors in one scenario, but not in the other. In other words, it reflects the goal inference itself.

The fillers include 30 sentences accompanied by a test word that does not appear in the sentence and is not related to it semantically (i.e., a probe that requires a "no" response) and 40 sentences accompanied by a test word that appears in the sentence (i.e., a probe that requires a "yes" response). The average number of words for each type of sentence was 10. In total, then, there are 40 trials that require a 'no' response and 40 that require a 'yes' response. The test words in the filler trials that require a 'no' response are not related to the described action.

Procedure

Upon arrival at the laboratory, participants were seated behind a computer and told that they would take part in research on language comprehension. The computer program provided all the instructions. Participants worked in individual cubicles.

Participants were told that we were interested in how fast and accurate they can determine whether a word appeared in a sentence they had read earlier. They were also told that each sentence describes an everyday activity performed by a person. Each sentence was presented for 2.5 s, immediately followed by a row of asterisks (500 ms), which was immediately followed by the test word. The row of asterisks served as a warning signal that indicated the location of the test word. The test word remained on the screen until participants indicated whether the word had appeared in the sentence or not. Participants were asked to respond as fast and as accurately as possible, pressing the key marked "yes" if the test word had appeared in the paragraph, and pressing "no" if it had not. Response times were measured from the onset of the test word until the moment participants pressed a response key. The time interval between consecutive trials was 2 s. The order of the sentences was randomized.

To control for order effects, one half of the participants were first exposed to the five control sentences embedded in 35 fillers, and then to the five goal-implying sentences (embedded in another group of 35 fillers), whereas the other half received the reverse order. After the first 40 trials there was a short, 1 min, break. Upon completion of the task, participants were debriefed, thanked, paid, and dismissed.

Results

In a thorough debriefing participants indicated no intention to infer goals, nor awareness of any such infer-

ences. This is partly due to the fact that in all of the filler sentences that required a 'no' response, the test words were not related to the sentences, thus obscuring the relation between the experimental sentences and their probes.

The dependent measure of interest was the average response latency for the test words that followed the goal-implying sentences and the controls. Incorrect (''yes'') responses on these words were excluded from the analyses (only 1.75% of the responses were incorrect, and they were evenly distributed across conditions). Response latencies that deviated more than 3 SDs from the overall mean were excluded from the analyses as well.

The RTs were subjected to a 2 (Sentence: control vs. goal) within participants × 2 (Order: control/goal vs. goal/control) between participants ANOVA. The analysis yielded a significant main effect of Sentence, $F(1,38) = 5.46$, $p < .03$. Responses to test words were significantly slower when preceded by the goal-implying sentences ($M = 829$ ms, $SD = 152$) than when preceded by the control sentences ($M = 786$ ms, $SD = 117$). The Order factor did not have a main effect, and it did not interact with Type of sentence.

The results of the current study indicate, then, that goals implied by behaviors become available to perceivers very rapidly—without intention or awareness. This evidence supports our contention for automatic goal inferences at encoding. Furthermore, it suggests that the results of the first two studies do not solely result from retrieval processes.

Study 4

Study 4 uses a lexical decision task to replicate and extend the results of Study 3. The structure of the study, and its target sentences and test words, are identical to those in the previous study. Instead of judging whether a test word had appeared in a previous sentence, however, participants in the current study are asked to make a lexical decision, i.e.—they are asked to decide whether a string of letters that appears after a target sentence is a word or not. Like in Study 3, the interesting test words are those that denote goals and that follow either a goal-implying- or a control sentence.

Study 4 serves two main purposes. First, unlike Study 3, where participants' task explicitly related scenarios to cues (i.e., participants had to decide whether a probe word had appeared in the previous scenario), the lexical decision task does not make this explicit demand. As a result the lexical decision task obscures even further the relations between the sentences and the test words, and hence the true nature of the study. Study 4, then, is an extension of Study 3 that puts the bar for automaticity of goal inferences at encoding higher up.

Second, it has been argued that slower RTs to related (vs. unrelated) scenarios in probe recognition task may result from processes that occur at retrieval. Specifically, even if one does not make an inference while reading, one may be led to draw an inference at test time. This process, in itself, may yield higher RTs after goal-implying scenarios than after control scenarios, because in the latter case the reader is not drawn to make an inference. To take an example, if one has to decide whether ''travel'' had appeared in ''the man with the suitcases goes to Schiphol'' one may engage in an inference (''oh, so this is why he was going to Schiphol, he was traveling''); this inference is less likely to occur when ''travel'' follows ''the man sells suitcases at Schiphol.'' By using lexical decision Study 4 rules out this alternative explanation (cf. Keenan, Potts, Golding, & Jennings, 1990; Wigboldus, Dijksterhuis, & Knippenberg, 2003).

Method

Participants and design

Fifty-one undergraduates participated in the study in exchange for 6 Dutch Guilders (approximately US$ 2.5). They were randomly assigned to the cells of a 2 (Type of sentence: control vs. goal) within participants × 2 (Order: control/goal vs. goal/control) between participants design.

Stimulus material

These were identical to Study 3, with one modification: the positive test words in the filler sentences were replaced by non-words (that is, words that had no meaning in Dutch, e.g., zakhozen). Thus, 40 sentences were followed by an existing word (including the five control and the five goal-implying sentences), and 40 sentences were followed by a non-word. Similar to Study 3, the order of presentation of sentences (control vs. goal-implying sentences) was counterbalanced.

Procedure

Upon arrival at the laboratory participants were seated behind a computer and told that they would take part in research on language processing. Participants worked in separate cubicles, and a computer program provided all the instructions.

Participants were instructed that letter strings would appear on the screen, and that their task was to decide whether these strings were words or not. As a cover story, they were told that we are interested in whether these kinds of decisions are facilitated or impaired by processing of verbal materials. Hence, they were told, each test word was preceded by a short sentence describing an everyday activity performed by an actor. Each sentence was presented for 2.5 s, followed by a 500 ms row of asterisks, which was immediately followed by a test word. The test word remained on the screen until participants pressed the marked keys. Participants were

further instructed to respond as fast and as accurately as possible. Response times were measured from the onset of the test word until the moment participants pressed a response key. The order of the sentences was randomized, and the time interval between trials was 2 s.

Upon completion of the task participants were debriefed, thanked, paid, and dismissed. A thorough debriefing revealed that none of the participants intended to infer goals, or had any conscious awareness of doing so. Furthermore, none of the participants expressed suspicion regarding the true nature of the task.

Results

The dependent measure of interest was the average response latency for the test words that followed the five goal-implying sentences and the five control sentences. Incorrect (''no'') responses on these words were excluded from the analyses (only 1% of the responses were incorrect, and they were evenly distributed across conditions). Furthermore, response latencies that deviated more than 3 SDs from the overall mean were excluded from the analyses.

The RTs were subjected to a 2 (Type of sentence: control vs. goal) within participants × 2 (Order: control/goal vs. goal/control) between participants ANOVA. This analysis yielded a significant main effect of type of sentence, $F(1,49) = 6.22$, $p < .02$, such that responses to the test words were significantly faster when preceded by the goal-implying sentences ($M = 588$ ms, $SD = 120$) than when preceded by the control sentences ($M = 612$ ms, $SD = 123$). No other effects were reliable.

General discussion

Four studies support our contention for automatic inferences of goals. Study 1 used a cued-recall paradigm and showed clear evidence for goal inferences without intention or awareness. Goals, that were never mentioned in the scenarios, served as better recall cues for goal-implying scenarios than for control scenarios; no such effect was found when recall cues were words that appeared in the scenarios. Study 2 showed that this is the case even when the road to goal achievement is explicitly blocked. This result suggests that automatic goal inferences are not mere predictive inferences, because goals are automatically inferred even when they do not predict future outcomes of behaviors. Surprise cued-recall paradigms have been rightfully criticized both in regard to the time of inference (i.e., whether it occurs at encoding or retrieval), and the exhaustiveness of their awareness assessment. However, they hold an important advantage: they tell us something about the long term representations of automatic inferences, something that goes far beyond on-line measures.

Studies 3 and 4 complement the first two studies by providing evidence for the automatic on-line inferences of goals. Study 3 used a probe recognition task, in which the probes were goal concepts that had not appeared in the target sentences. The results show that correct rejection of these probes is more difficult after goal-implying scenarios than after control scenarios. A thorough debriefing revealed no evidence for intention or awareness. Study 4 used a lexical decision task and obtained similar results: evidence for on-line inferences of goals in the absence of intention or awareness.

Previous research in social psychology has focused on automatic inferences of traits (e.g., Uleman, Blader, & Todorov, in press; Winter & Uleman, 1984). The current studies add an important mental construct that can be automatically inferred, a construct that plays a prominent role in our understanding of other people's behaviors—goals. These results fit nicely into the framework suggested by Hassin et al. (2002), according to which people may be able to automatically infer the whole range of the causal schema—from causes to effects. The current findings not only extend those of Hassin et al. (2002) in terms of the content of the inferences (i.e., adding goals), they also add to their findings it in terms of the paradigms used and the type of inferences examined. While this previous research has focused on surprise cued-recall paradigms, the current studies also use on-line paradigms, providing direct evidence for inferences at encoding.

The current results also extend extant research and theorizing in the field of text comprehension, which suggest that goal inferences may occur automatically but fail to demonstrate it. Due to the nature of the paradigms and stimuli used here, though, the current findings do not shed new light on the debate between the minimalistic hypothesis of Mckoon and Ratcliff (e.g., 1992) and more constructionist views (e.g., Graesser et al., 1994).

Why do we automatically infer goals? One possible reason may be that people are meaning seekers, and in their search for meaning they try to maximize coherency (e.g., Graesser et al., 1994). A detailed definition of ''coherence'' aside (cf. McKoon & Ratcliff, 1992), we grant that the short scenarios depicted in the above studies were not *incoherent*. However, the inferred goals may have given them extra coherency by suggesting a kind of a ''causal closure''—the behaviors actors engaged in were done *for a reason* and in order to accomplish a *desired result*.

But, as suggested in the introduction, automatic goal inferences may serve a further role—facilitating social adaptation. A deeper understanding of the social world in terms of the goals that motivate others' actions is not only important in terms of correctly mapping our surroundings. Crucially, such improved understanding may allow for a more precise tuning of our own goals

and behaviors. Whereas going along with flirting may be fun and socially acceptable under some circumstances, it might be less so in others. Automatic inferences of goals may allow for implicit adjustment of our own behaviors and goals to the environment, thus promoting our own well being (see Aarts, Gollwitzer, & Hassin, in press).

Appendix A. Sample of the stimuli used in Study 1

Note: "C" denotes control sentences; the words in parentheses are the recall cues with goal cue first.

1. The father holds a spoon and tells his boy "even the Ninja turtles like steaks."
1-C. The boy holds a spoon and tells his father "even the Ninja turtles like steaks."
(Feed; Turtles)
2. While passing the pet shop the girl tells her father that everyone in her class has a dog.
2-C. While passing the pet shop Peter tells his wife that Anna, the girl next door, has a dog.
(Buy dog; Class)
3. Josh's wife frequently annoys him and he thinks the time has come to call his lawyer.
3-C. Josh calls his lawyer, who tells him that his wife annoys him frequently.
(Divorce; Frequently)
4. The student is riding his bicycle to the university as fast as he can.
4-C. The student is riding his bicycle away form the university as fast as he can.
(Attend Lecture; Riding)
5. Mel is so desperate that he takes a gun and points it to his head.
5-C. Mel was appointed to head a new gun company called "Desperate."
(Suicide; Mel)
6. Kate is on her way from the bus to the supermarket.
6-C. Kate has just passed by the supermarket on her way to the bus.
(Buy groceries; Bus)

Appendix B. Sample of the stimuli used in Study 2

Note: "B" denotes blocked goals; the words in parentheses are the recall cues with goal cue first.

1. When the father holds a fork and tells his boy that "even the Ninja turtles like veggies" the boy opens his mouth widely.
1-B. When the father holds a fork and tells his boy that "even the Ninja turtles like veggies" the boy shuts his mouth tightly.
(Feed; Father)
2. While passing the pet shop the girl tells her father that everyone in her class has a dog. Her father leads her into the store as a gorgeous German Shepherd inside barks at them.
2-B. While passing the pet shop the girl tells her father that everyone in her class has a dog. Her father drags her away from the store as she looks desperately at a German Shepherd.
(Buy; Class)
3. Josh's wife frequently annoys him and he thinks the time has come to call Jim, the only lawyer he trusts. Josh became very nervous as he sets up an appointment for the next day with the help of his lawyer's secretary.
3-B. Josh's wife frequently annoys him and he thinks the time has come to call Jim, the only lawyer he trusts. When Josh tries to set up an appointment, his lawyer's secretary says that he is on a very long vacation. Josh became very nervous.
(Divorce; Appointment)
4. The student was riding his bicycle to the university as fast as he could while furiously avoiding a stray nail with his front wheel.
4-B. The student was riding his bicycle to the university as fast as he could; when the front wheel rolled flat on a stray nail, he was furious.
(Attend a lecture; Stray)
5. Mel is so desperate that he takes a gun and points it to his head as the housekeeper leaves his apartment after the weekly cleaning.
5-B. Mel is so desperate that he takes a gun and points it to his head. However, the housekeeper enters his apartment for the weekly cleaning.
(Suicide; Cleaning)
6. Kate walked from the bus stop to the supermarket. The minute she arrives, the manager unlocks the terrace gate leading to it.
6-B. Kate walked from the bus stop to the supermarket. The minute she arrives, the manager locks the terrace gate leading to it.
(Buy groceries; Bus)

Appendix C. Stimuli used in Studies 3 and 4

Note. The recall cues consist of one word in the original Dutch.

Goal-implying sentences and test words (between parentheses)

1. The girl buys tools at the DIY shop. (going to do *manual labor*)

2. The toddler puts on the pajama and turns off the light. (going to *sleep*)

3. The boy walks fast to the counter of the supermarket. (going to *pay*)
4. The man with the suitcases goes to Schiphol. (going to *travel*)
5. The woman connects the garden hose and walks towards the car. (going to *wash*)

Control sentences and test words (between parentheses)

1. The girl sells tools at the DIY shop. (going to do *manual labor*)
2. The toddler turns on the light and hangs up the pajama. (going to *sleep*)
3. The boy watches TV behind the counter of the supermarket. (going to *pay*)
4. The man sells suitcases at Schiphol (Dutch airport). (going to *travel*)
5. The woman walks to the car and throws the garden hose into it. (going to *wash*)

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