Research Note

The Role of Control in Attributing Intentional Agency to Inanimate Objects

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ABSTRACT

Previous research into the perception of agency has found that objects in two-dimensional displays that move along non-inertial-looking paths are frequently attributed intentional agency, including beliefs and desires. The present experiment re-addressed this finding using a tangible, interactive, electromagnetic puzzle. The experimental manipulation was whether or not participants controlled the electromagnet that moved the marbles along unexpected trajectories. Thirty-one college undergraduates participated. Participants who lacked control over the movement of the marbles were significantly more likely to attribute agency to the marbles. Participants in control of the display rarely attributed intentional agency to the marbles. Implications are discussed for the identification of agents in the real world.

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"You stupid computer!" is not an uncommon exclamation heard within office buildings. Likewise, perfectly intelligent, rational adults frequently talk to their cars, tools, and other inanimate objects as if they were intentional agents with minds. "Ah ha! That's where you have been hiding, you naughty keys."

One of the most important cognitive competencies people have for surviving and thriving in the natural world and as social beings is the ability to detect intentional agents in the environment. Intentional agents,

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those objects that we understand as acting because of internal states such as beliefs and desires, are at once humans' greatest threat and greatest opportunity for survival. Perhaps because of the importance of detecting agents around us, our cognition responsible for these competencies are hyper-sensitive (Guthrie 1993). Little seems required for our minds to register something as an agent.

Indeed, attributing rich, psychological and social properties to an object does not require the object to even vaguely resemble a human or animal in form. Beginning with Heider's and Simmel's seminal work (1944), a number of studies have demonstrated that visual displays of two-dimensional geometric shapes, such as triangles and discs, readily evoke attributions of beliefs, desires, emotional states, and even genders (Bassili 1976; Berry, Misovich, Kean & Baron 1992; Michoette 1963 – see Scholl & Tremoulet 2000 for a review). These agent-attributions seem to be the result of the movement of the objects: being able to initiate another object's movement without "physical" contact and moving in, what appear to be, non-inertial paths, without being contacted, and moving in a goal-directed manner. This observation is corroborated by developmental research that suggests young children and infants are sensitive to the difference between objects that may be manipulated only through physical contact and those that may be caused to move without contact (Leslie 1995; Spelke, Phillips & Woodward 1995); but that they sometimes do attribute "social" causation to geometric shapes (Gergely, Nadasdy, Csibra & Biro 1995; Rochat, Morgan & Carpenter 1997). A standard contention is that in these studies, participants perceive these two-dimensional geometric forms as "self-propelled" and goal directed, and consequently attribute to them the properties of psychosocial beings (Premack 1990; Premack & Premack 1995).

Considering the broad range of stimuli that seem capable of triggering attribution of agency, another pressing question is how our Agency Detection Device (ADD) gets turned off. The survival advantages gained through a touchy or hyperactive ADD would quickly be outweighed if we were unable to disengage the device in cases that the object in question does not prove to be an actual agent. Perhaps a clue to when agency is not attributed can be found in the sorts of situations that seem to create obviously false positives. At least anecdotally, it seems that people more often treat inanimate objects as agents during some kind of interaction with the objects. It is rarely (if ever) the case that computers are verbally abused while sitting in a box, unused. Rather, in moments of losing *control* or frustrated use – frustration with the objects not "behaving" as anticipated – people appear likely to attribute agency to inanimates. That is, people might be more inclined to attribute agency to non-agents when they themselves perceive an action involving an object as outside their own agency.

The driving hypothesis for the present study is that people are more inclined to attribute agency to inanimate objects when the object appears to move (1) in an apparently non-inertial (e.g. self-propelled), goal-directed path (2) independent of the control of a human agent, than when the judge has some control over the movement of the object. The null hypothesis is that control over the movement is irrelevant and attribution of agency arises simply through the apparent self-propelledness and goal-directedness of the object, as demonstrated through previous research with adults and infants.

Given the concern with human control over objects, the current study extends previous research into the domain of real, manipulable, three-dimensional physical objects. In this study, participants placed a number of ball bearings on divots in a board. Fluctuating electromagentic current beneath the board created the illusion that the bearings moved on their own toward particular "goals," the poles of the magnet. Previous studies are impressive because geometric shapes presented as a film or video display are implicitly identified as agents and attributed psychological properties even though they are not even objects, let alone human-like. Recently it has been argued that perception of animacy is a purely perceptual modular process (Scholl & Tremoulet 2000), and that is why two-dimensional displays are sufficient for evoking attributions of agency. If so, ball-bearings suddenly moving to a particular location without any physical contact event to launch them should provoke the same sorts of attributions.

Method

Participants

Thirty-one undergraduates participated to fulfill an introductory psychology course requirement. Seventeen were males and 14 females. Participants were randomly assigned to either the In-Control condition or No-Control condition, with 15 in the No-Control condition and 16 in the In-Control condition.

Materials

A card-stock board with thirty divots was placed on top of a cardboard box containing two hidden electromagnets. Each electromagnet was powered by a 9-volt AC/DC adapter and activated by a switch controlled by the experimenter via a switchbox hidden under the table upon which the display sat. All wiring was hidden under the box and table.

In the In-Control Condition, the cardboard box housing the electomagents also displayed two small lights and two switches. The experimenter controlled the lights using the same hidden switch box as the electromagnets. In the No-Control Condition, no lights were used.

Other materials included two tape recorders, one set of headphones, and a teddy bear. During the task, the participant wore the headphones and listened to a recording of clicks played by the first tape recorder. This noise was meant to encourage participants to speak loudly, and to keep them from hearing any inadvertent noises the experimenter made while turning the magnets on or off. The second tape recorder recorded participants' reactions to the task. The teddy bear was the target of the participants' reactions.

Materials for the two warm-up tasks were 7 children's building blocks and a 60 by 82 cm picture of animated villains from Disney films (e.g., Cruella deVille, Captain Hook, etc.).

Procedure

Warm-up exercises. A tape recorder was turned on before each participant entered the room. Then, two warm-up activities were conducted.[1] The first warm up activity consisted of the participant simply describing a the Disney Villain picture. The experimenter then introduced the participant to the teddy bear, which was blindfolded. The experimenter instructed the participant to explain what was happening to the bear because it was

[1] Pretests revealed the need to get participants feeling comfortable talking while performing the task or else they frequently had to be reminded to keep describing what they were doing.

not able to see. To practice step-by-step commentary, the participant was instructed to build a tower of blocks while talking to the bear.

Main task. The experimenter explained that the objective of the puzzle was to fill the divots of the puzzle board with ball bearings. When the puzzle was filled, the task was complete. Each participant sat directly in front of the puzzle board with a plastic dish filled with thirty metal balls adjacent to the board. Each participant wore headphones through which noise was played and was told to explain to the bear what was happening as they completed the puzzle.

In the In-Control condition, the experimenter explained to participants that when the right light came on, they were to flip the switch on the right to the "on" position. When the light went off, they would return the switch to the "off" position. The light would flash if ignored. In the No-Control condition, the experimenter gave no instructions regarding the lights or switches.

After these instructions, the experimenter instructed each participant to begin, and turned on the noise. After 5 minutes and 30 seconds, the recording of noise concluded with a message asking the participant to take off the headphones and stop the puzzle.

While the participant placed balls on the puzzle board, the experimenter activated the magnet (in the No-Control condition) or the light (in the Control condition) when the participant covered two of 16 predetermined holes in close proximity to the electromagnets. (These holes were not known to the participants and were the same for all.) Thus, in both conditions, the magnets came on at comparable times in the procedure, but in the Control condition, the participants activated the magnets and in the No-Control condition, the experimenter activated the magnets. The consequence of the magnets being turned on was the metal balls moving from the holes where they had been places and colliding with each other, similar to launching events in previous research (e.g., Michotte 1963; White & Milne 1999).

Results

Transcriptions of the participants' descriptions were analyzed by two hypothesis- and condition-blind coders. The experimenter told coders to "Specifically try to find language that is *only* used for animals and persons. Do not just look for language that is inappropriate for marbles, lights, or switches." Similar to analyses used by Oatley and Yuill (1986), coders coded for relational expressions and category mistakes. Relational expressions would include talking to the marbles (e.g. "Oops, sorry, Ball."), calling the marbles names (e.g., "Bob") and/or describing a relationship with the marbles in terms that are literally appropriate only for animals and people but not physical objects such as marbles (e.g. ". . .and a couple ones did not like me."). Category mistakes were using nouns, verbs, and adjectives to modify the marbles that are only literally applicable to humans and animals (e.g., "That one did not want to stay," "Oh, look. Those two kissed," "They are kind of fighting," "They are not cooperating.").[2] Both relational expressions and category mistakes of this kind were scored as attributing agency. To avoid overestimating the number of attributions, the most conservative coders' score was used in every case.

In general, the accounts participants provided were very analytic in tone, focusing on their own step-by-step intentions and actions. Nevertheless, a majority of the No-Control condition made agent-attributions to the marbles. Twelve of the 31 participants (38.7%) made some kind of agent-attribution to the marbles. Of these nine were in the No-Control condition (60% of the 15 in the group) and 3 in the In-Control condition (18.8% of the 16 in the group), $z = 2.318$, $p = .02$. The mean number of attributions for the No-Control group was 1.53 (SD = 1.96) as compared to .56 (SD = 1.75) for the In-Control group.[3] However, nearly all of instances of agent-attributions made in the In-Control group were made by a single individual who seemed to be unusually flippant about the task, calling the bear "Mister Bear" and at one point even naming a marble "Bob." Her record accounted for seven of the nine specific instances of attributing agency in the Control condition. Without this outlier, the Control group averaged only .13 (SD = .35) attributions each.

The vast majority of attributions suggesting the marbles were intentional agents consisted of category mistakes (84%). This pattern held across

[2]The quoted examples are all drawn from transcripts from actual participants.

[3]Non-parametric hypothesis tests were used because of the skewedness of the data and large number of participants with scores of zero.

conditions. Particularly prevalent were references to the marbles desires and dispositions such as “wanting,” “liking.”

Discussion

The key finding of this experiment was an effect of participants’ control over the attribution of agency to the objects. A majority of participants in the No-Control Condition appeared to attribute agency to the metal balls as in previous studies with animated displays, though perhaps not in the richness or consistency previously reported (e.g., Michotte 1963). However, with the exception of one participant, such attributions essentially vanished in the In-Control Condition. The difference between the two conditions was the control the participants had over the display and not the perceptual configuration or dynamics of the display. When indirectly in control of the movement of the balls, the balls were not perceived as agents. When having no control of the movement of the balls, the balls were much more likely to be perceived as agents. Transcripts revealed that in both conditions participants were aware that electromagnetism was at work. It appears that when the movement of the objects was explainable in terms of participants’ own agency, no agent-attributions were triggered; but when the movement or activity of objects exceeded obvious agency, the objects themselves were attributed agency.

That the No-Control Condition did not produce as rich psychosocial attributions as reported using animated displays may be a finding worth future experimental consideration. Though we closely matched the allegedly critical perceptual features (self-propelledness and goal-directedness) of previous research in this task, and participants did make agent-attributions, they fell short of the level of attribution previously found. Certainly the claim that “animate nature of the resulting percepts is nearly irresistible” (Scholl & Tremoulet 2000, p. 306), did not apply here. Why not?

That previous research did not replicate in this more natural context (using actual objects instead of animated displays) resurrects questions of ecological validity (White 1995). Perhaps the representational character of the animated displays introduces bias that contributes to the willingness of participants to attribute beliefs, desires, and personality traits to geometric shapes. At least adult observers understand that images in motion pictures often represent intentional agents. Further, while the shapes in these displays certainly do not have beliefs or desires, intentional agents who do have beliefs and desires orchestrate their movements. Perhaps these *conceptual* factors of the displays contribute to the attribution of agency in animated displays.

Regardless of interpretation, the ability to manipulate the degree of agent-like descriptions of displays similar to Heider's and Simmel's (1944) or their descendants challenges the claim that attribution of agency is purely a modular perceptual process driven only by objects changing acceleration or direction without contact. Simple perception may not be sufficient (Gelman et al. 1995). At least another factor, having some control over the objects' movement, appears to mitigate attributions.

The literature on agent detection certainly supports the notion that people have an ADD that is a bit hypersensitive, yielding more false positives than false negatives (Barrett 2000). If an object moves in such a way that violates our intuitive expectations for physical objects, it is identified as an agent, regardless of its resemblance to people or animals. Arguably, ignoring resemblance to known agents and risking false positives could have provided human ancestors with a selective advantage, detecting partially hidden, camouflaged, or disguised agents in the environment and only occasionally misidentifying wind-blown tree-branches as agents (Guthrie 1993). Perhaps, however, the agent detection device is also sophisticated enough to search for eligible agents to account for the mechanistically inexplicable action. When a suitable agent is located (such as the self) the "self-propelled" object is not identified as an agent. When no such suitable agent is identified, the object itself becomes the lead candidate for agency and may be attributed beliefs, desires, and so forth.

The suggestion is that we treat cars and computers as intentional agents *not only* because of their perceptual features or "self-propelledness." (Indeed, usually we berate our cars when they "refuse" to move not when they do move.) Rather, it is when objects' action violates our own sense of causal efficacy that we attribute agency to them. When the computer either does something I did not ask it to do or does not do something I asked it to do that I remark that it is angry with me. Feelings of frustration are the consequence of lacking control-feeling that it is no longer my agency that accounts for what I perceive but some other agency that I cannot control.

Tasks for future research would be further exploring the conditions under which real objects are attributed agency and when these attributions are disabled. During, heat-of the-moment, on-line processing people may be especially prone to overextend agency to inanimate objects, but clearly it is disadvantageous to continue to believe that a geometric shape, a ball bearing, and a car are actually intentional agents. What makes us continue to believe that each other are intentional agents whereas we quickly dismiss inanimates as intentional? Perhaps part of the answer is that people and not inanimate objects persist in appearing to move in self-propelled and non-inertial ways. Perhaps another part of the answer is that people and not inanimate objects also persist in moving in ways beyond our control.

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