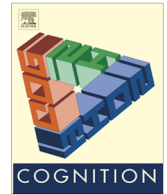




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Brief article

# Indicators of causal agency in physical interactions: The role of the prior context



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## ARTICLE INFO

## Article history:

Received 12 June 2013

Revised 5 May 2014

Accepted 22 May 2014

## Keywords:

Force dynamics

Causal reasoning

Agency

Intervention

Michotte task

Physical causality

## ABSTRACT

The question how agent and patient roles are assigned to causal participants has largely been neglected in the psychological literature on force dynamics. Inspired by the linguistic theory of Dowty (1991), we propose that agency attributions are based on a prototype concept of human intervention. We predicted that the number of criteria a participant in a causal interaction shares with this prototype determines the strength of agency intuitions. We showed in two experiments using versions of Michotte's (1963) launching scenarios that agency intuitions were moderated by manipulations of the context prior to the launching event. Altering features, such as relative movement, sequence of visibility, and self-propelled motion, tended to increase agency attributions to the participant that is normally viewed as patient in the standard scenario.

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## 1. Introduction

In demonstrations of phenomenal causality, subjects are presented with moving colliding objects (Michotte, 1963). For example, in a launching scenario, Object X, a ball, moves towards a resting Object Y, another ball, and touches it. This stops Object X and sets Object Y into motion (see Fig. 1, Condition A, for an illustration) eliciting a causal impression. The strength of the causal impression depends on various parameters, such as the time lag between X stopping and Y starting its movement, or the ratio of pre- and post-movement velocities of the colliding objects (see, e.g., Hubbard, 2013; Scholl & Tremoulet, 2000).

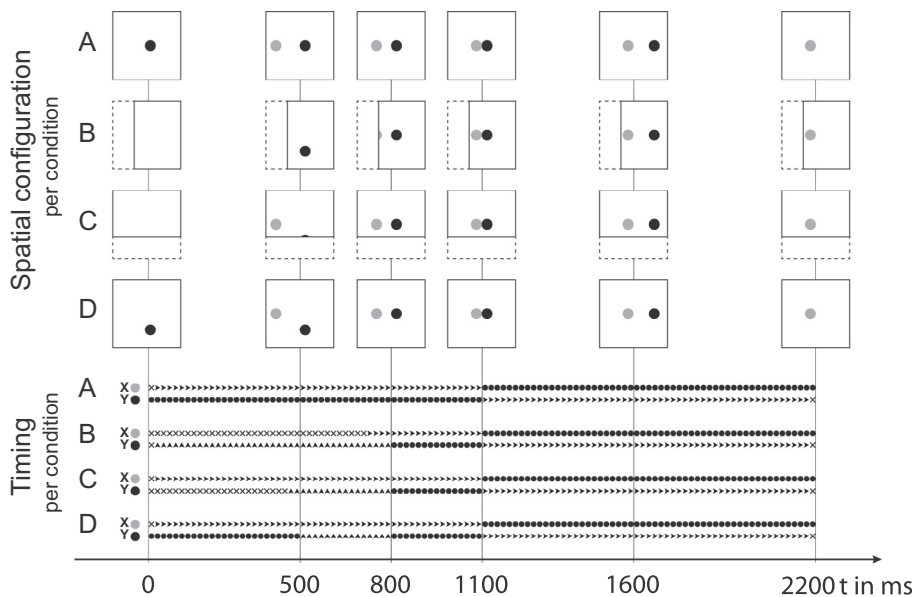
Observers typically describe this kind of launching scenario as a case in which Object X is the causal agent (i.e., “X launched Y”) but not that Object Y is the causal agent (i.e.,

“Y stopped X”); see White, 2006a). This asymmetrical preference seems very natural, but in fact Newtonian physics does not provide us with a reason that can explain why we view object X as primary: the physical force on Object Y exerted by Object X is equal in magnitude (but opposite in direction) to that on Object X exerted by Object Y. Thus, describing the causal interaction as a case of Object Y stopping Object X would be equally justified. But what, then, leads us to make such an asymmetric agency ascription?

Unlike in Newtonian physics, asymmetric ascriptions are natural from the viewpoint of force dynamics, a theoretical framework that has become increasingly popular in recent years for explaining causal reasoning (see Waldmann & Hagmayer, 2013; Wolff & Shepard, 2013, for overviews). Force dynamics was initially developed in linguistics in the context of verb semantics (see Riemer, 2010; Talmy, 1988) and relies on the notion that semantic causatives can be analyzed with respect to the configuration of forces that are attached to the participants in causal interactions (see Wolff, 2007; Wolff, Barbey, & Hausknecht, 2010; Wolff & Song, 2003). Its concepts can be traced back to Aristotle's philosophical treatment of causality

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**Fig. 1.** Illustration of the experimental setup showing the spatial configuration of the balls at significant time points, and the timing and direction of the ball movements in Conditions A to D. Each symbol in the time line represents one frame of 20 ms in length indicating whether the ball is not visible ( $\times$ ), is visible but at rest ( $\bullet$ ), moves upward ( $\blacktriangle$ ) or moves rightward ( $\blacktriangleright$ ).

(see Gnessounou & Kistler, 2007). Aristotle explained efficient causation as a consequence of the interaction of two entities, an agent and a patient. An agent is, according to Aristotle, a substance operating on another substance, the patient, which is passive with respect to the process of operation. The acting agent who affects the patient therefore has the disposition to act, and the patient has the disposition to be affected by the agent.

In psychological research on force dynamics, the main focus has been on how causal intuitions and semantic ascriptions can be predicted on the basis of configurations of forces attached to agents and patients. In research using verbal instructions, linguistic cues are typically used to signal which of the causal participants is playing the active and which the passive role (see Mayrhofer & Waldmann, *in press*). However, the question remains how people assign causal roles in perceptual tasks, such as Michottean launching scenarios.

### 1.1. Current psychological accounts of agency assignments in perceptual tasks

One line of research addressing the question of agency assignment in perceptual scenarios, mainly pursued within developmental psychology, studies the role of features of the involved objects. According to this approach, there are objects, *dispositional agents*, that are more agent-like than others and are therefore more likely to be assigned the agent role in causal interactions (see, e.g., Leslie, 1994; Rakison, 2005, 2006; Saxe, Tzelnic, & Carey, 2007). Features of dispositional agency include human- or animal-like appearance (e.g., eyes, fur) or the presence of dynamic parts. Intuitions in the Michotte task, however, cannot be explained by this account because the moving objects typically do not carry such features.

White (2006b) has focused on kinematic properties to answer the question how observers attribute agency. He hypothesized that in the Michotte task the movement of Object X relative to the resting Object Y in the moment of the causal interaction (i.e., collision) might be the reason for the attributions of agency to Object X (*prior-motion hypothesis*; see also Michotte, 1963). However, White (2012a) recently showed that in other scenarios prior movement is not always the primary criterion for assigning causal agency. In situations in which Object X's direction of movement after contact reverses and Object Y starts moving in Object X's direction after contact, Object Y may be viewed as actively pushing Object X. Similarly, Hubbard and Ruppel (*in press*) showed that there are Michottean setups in which Object Y does not move at all but is attributed more agency than the moving Object X. The prior-motion hypothesis, therefore, cannot explain all cases of differential attributions of agency. Our main goal, therefore, is to offer a more comprehensive list of context features that are used in the assignment of the agent and patient roles.

### 1.2. Proto-agency theory

In linguistics, the question of agent role assignment has received substantial attention because of its interaction with grammatical subject roles in causal language. Given that in perceptual scenarios agency assignment is typically measured via a verbal response, linguistic theories, therefore, seem promising candidates for a theory of agency ascription.

According to the linguistic theory of Dowty (1991), agency is not all-or-none but a prototype concept that can be assigned on the basis of a number of criteria. None of these criteria is necessary (hence prototype) but the

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