English-Speaking Adults Readily Deploy Agent and Patient Categories in Both Non-Linguistic and Linguistic Tasks

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Languages syntactically distinguish the Agent of an event (the doer) from the Patient (the affected entity) [1-3]. The universality of these roles suggests that these concepts may originate in our prelinguistic conceptualization of events [4]. This hypothesis is supported by perceptual studies in which adults rapidly and spontaneously encode these roles, even when irrelevant to the task [5-6]. This work suggests that these roles are readily available *implicitly*; however, prior work found adults struggle to deploy these roles for *explicit* categorization [7]. It is unclear whether this reflects the inaccessibility of these concepts for explicit categorization, or potential task ambiguity. These experiments explored whether adults learn to select Agents and Patients in an unambiguous imitation task with animated events (Exp-1 & Exp-2). Next, we investigated the nature of these representations, exploring whether the rules participants created were syntactic or semantic (Exp-3). Finally, in an ongoing study we explore whether the arguments encoded by agent-patient verbs parallel those used by psychological state verbs (Exp-4), as would be predicted under decompositional theories that use the causal approach [8,9].

In **Exp-1,** adult English-speakers (N = 90) watched animations of two-participant events and selected a character based on a rule they had to infer. Each participant saw both conditions (Agent and Patient) (counterbalanced). In Training-1, participants saw a *contact* event and the experimenter chose a target character, the event was played again, and the participant copied the experimenter. In Training-2, participants selected a character without the experimenter's example, but received feedback. In the Test Phase, participants received no feedback and were tested with new contact and new *caused-motion* events, assessing generalization (Fig1). *Results:* Participants performed almost perfectly at test, both for new contact (M = 95%) and caused-motion (M = 95%) events. There was no significant difference across the event types (Z = -.45, p < .65, Fig3), demonstrating that participants could infer these categories and were equally good at extending them to new instances of the same event type and a new event type.

Exp-2 tested whether generalization was symmetric across the two event types. Adult English-speakers (N = 90) were trained on caused-motion actions and tested on new caused-motion and contact actions, using the same paradigm as Exp-1 (Fig1). *Results:* Participants robustly generalized to new caused-motion (M = 97%) and contact (M = 87%) events, although they were significantly better in caused-motion compared to contact events (Z = 4.15, p < .001, Fig3). This suggests that generalization, while robust, was not perfect. Results from Exp-1 and Exp-2 suggest that Agent and Patient can easily be accessed in an explicit categorization task.

Exp-3 explored the possibility that participants generated linguistic descriptions of the events. If participants used linguistic encoding, this would have led them to learn a syntactic rule (choose the subject or choose the object, e.g., selecting the subject of a passive sentence in the Agent Condition). Exp-3 was identical to Exp-1 but we added a *Linguistic Test Phase*. Here, English-speakers (N = 84) were tested on whether they could generalize the inferred rule to active and passive sentences (Fig2). If the learned rule was syntactic, then performance should be poor with passives. *Results:* Participants performed almost perfectly at test, both for actives (M = 93%) and passives (93%) (no difference in performance across the sentence types, Z = -.78, p = .44, Fig4). Participants easily transitioned from the non-linguistic phases to the Linguistic Test Phase, suggesting that they were engaging in some form of semantic encoding.

In ongoing work (**Exp-4**), we explore whether there is conceptual overlap between the roles used by agent-patient verbs and psych verbs and if this overlap is different for the two categories of psych verbs (e.g., clear overlap for experiencer-object verbs but not experiencer-subject). **Overall,** these experiments show the concepts of Agent and Patient are readily available for explicit categorization and the representations accessed rely on semantic rather than syntactic encoding.

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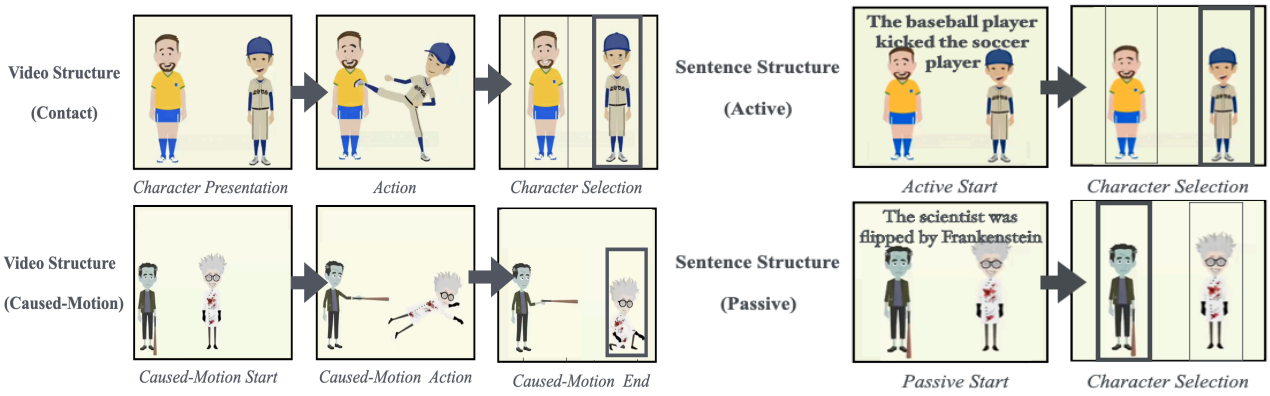

Fig1. Structure of Test Phase in Exp-1 & Exp-2. Participants first viewed a novel (to them) contact or caused-motion event (panels 1+ 2). Then, they selected one of the characters in the event and received no feedback from the experimenter before proceeding to the next trial.

Fig2. Linguistic Test Phase in Exp-3. Participants saw an active or passive sentence with an image (4 seconds). They then were prompted to select a character based on the sentence that they read and received no feedback before proceeding to the next trial. The same structure is used in Exp-4 with psych verbs.

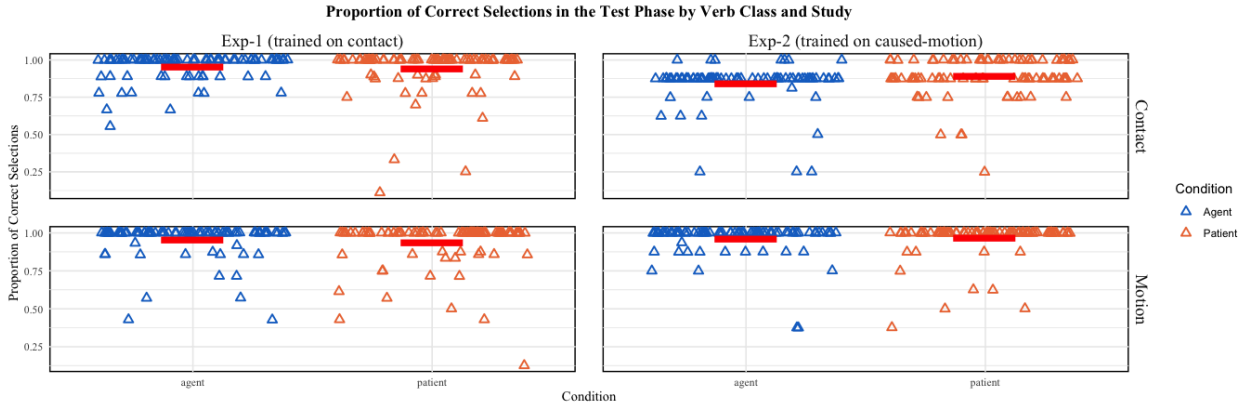

Fig3. Proportion of correct selections (Exp-1 and Exp-2). Performance in the Test Phase is graphed. Performance with the contact verbs (top) and with the motion verbs (bottom). Triangles symbolize individuals, and the red line marks the group mean.

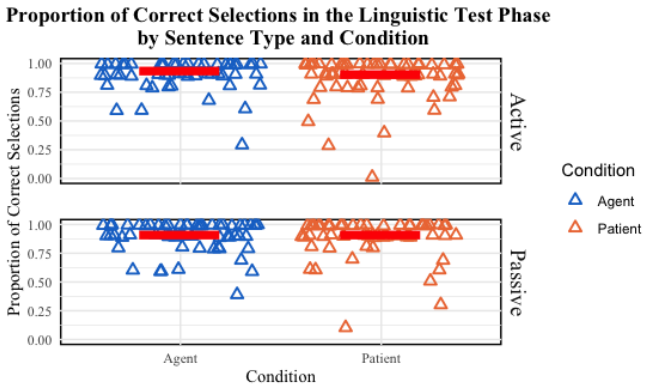

Fig4. Proportion of correct selections in Exp-3. Performance in the Linguistic Test Phase is graphed. Actives are on top and passives are on the bottom. Triangles symbolize individuals, and the red line marks the group mean.

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