**Experiment 1. Structural prediction**

**Methods**

**Materials.**

We drafted a list of 16 candidate predictive verbs. These were partly drawn from Kukona et al. (2011)’s materials, and partly selected *ex novo* for this study on the basis of intuition. The list of candidate verbs was limited by the requirement that 3-to-5 year olds children should know them. As a guideline, we used both the CLEX Communicative Development Inventory for American English (http://www.cdi-clex.org/vocabulary/singlewordlist/search/language/2/corpora/1) and the age of acquisition norms of Kupermann et al. (2012).

For each of these verbs, we then identified a prototypical agent and a prototypical patient. We also matched each predictive verb with a non-predictive verb, such that neither the prototypical agent nor the prototypical patient would be strongly associated with this non-predictive verb. This list of 16 items was then pre-tested in two ways.

*Children pre-test.* 15 children (7 males) aged 3 to 5 (M = 52.7 months, range = [38, 66] months) were recruited through the University of Edinburgh nursery and using a database of families available at the Developmental Lab of the Department of Psychology. Children were either tested at their nursery in a quiet room or inside the Developmental Lab. In either case, the procedure was the same. The child and the experimenter sat at a table on which a cardboard stage was placed in front of the child. Opposite the child, on the other side of the stage, was a puppet. The puppet was introduced to the child at the start of the session and the child was told that the game involved showing things to the puppet on the stage, using some pictures. Then the experimenter played the game on one practice trial (verb: tickle), while explaining the rules (i.e., “You must pick two pictures”) and demonstrated how to act out the action using the pictures, while producing a verbal description of the event (e.g., “Look, [Puppet name]! Postman Pat is tickling Jess the Cat!”). On every experimental trial, the sequence of events was as follows. First, the experimenter lay down 8 colourful pictures of toy characters or animals on the table between the child and the stage, naming each picture in turn. Order was randomised separately for each trial and each child. Then, the experimenter said “Now, we have to show [Puppet name] “VERB-ing”!”. If the child did not pick any pictures, or did not use the pictures to act out the action, the experimenter encouraged the child by asking “Can you show [Puppet name] “VERB-ing”. If the child’s demonstration of the action was unclear, the experimenter asked “Can you tell [Puppet name] what’s happening?” to elicit a verbal description. If needed, the experimenter followed this up with a more specific question (e.g., “Who’s VERB-ing?”).

As in the adult norming, we created 2 lists, so that each child was only tested on the predictive or non-predictive verb in a pair. We collected both agenthood and patienthood ratings for every trial. To ensure independence of these two sets of ratings, the 8 pictures were photographic images of only 4 different characters or animals: the prototypical agent, the prototypical patient, and two distractors. Each character/animal was depicted in two versions, which were easily distinguishable from one another. For example, one picture for dog depicted a brown puppy, while the other depicted a black and white puppy of a different breed. In this way, it was possible for children to pick the same character or animal as agent and patient, which they often did (on 30.32% of codable and correct trials).

We discarded all trials on which the verb meaning was not acted out, or a different verb than the one intended was acted out, or the demonstration was unclear so that it could not be determined whether the child understood the verb meaning or not. In total, we discarded 39.63% of trials. A trial was also discarded if the child had picked one or more pictures before the experimenter mentioned the verb (a further 4.91% of trials). Agenthood (patienthood) ratings were then computed as the proportion of trials in which the prototypical agent or patient was selected as the agent (patient) of the action. Such proportions did not include a small number of cases in which the agent or patient were missing because the child interpreted the verb as intransitive or demonstrated the action using herself or the puppet instead of a second picture. The following criteria were used to identify agent and patient.

1. If the child verbalized the event using a transitive sentence, who was the agent of the sentence?
2. If the child acted out the verb, was one picture moving while the other remained static? If yes, the moving picture was taken to be the agent.
3. If the child acted out the verb, and both pictures moved, did the child move one picture before the other? If yes, the picture that moved first was taken to be the agent.
4. If the child acted out the verb, both pictured moved, and they moved at the same time, was there clear directionality in the action? If yes, the agent was taken to the picture that occupied the left-most position in the direction implied by the action.
5. If none of the above, then the trial was treated as non codable.

On the basis of the children pre-test, we discarded 4 predictive verbs, either because they did not have a clear agent/patient (hug, chase, marry), or because most children did not understand them (cure). For the remaining twelve predictive verbs, the agenthood of agents was higher than the agenthood of patients (agents, M = 0.70, SD = 0.06; patients, M = 0.20, SD = 0.11; t(11)=8.24, p<.0001), and the patienthood of patients was higher than the patienthood of agents (patients, M = 0.72, SD = 0.32; agents, M = 0.07, SD = 0.12; t(11)=5.45, p <.0005). One of the non-predictive verbs had to be replaced, because it behaved like a predictive verb with the agent-patient pair we had selected. Therefore, agenthood and patienthood ratings for non-predictive verbs are available for only 11 of the non-predictive verbs in the final set of twelve. Importantly, the difference between the agenthood of agents and the patienthood of patients did not differ significantly between the predictive and non-predictive verbs (non-predictive, M = -0.03, SD = 0.24; predictive, M = -0.02, SD = 0.37; t(21)=0.05, p =.955), and the average difference score for predictive verbs did not differ significantly from zero (t(11)=-0.19, p =.854). Finally, for non-predictive verbs, the agenthood of agents did not differ from the agenthood of patients (agents, M= 0.20, SD = 0.15; patients, M = 0.23, SD = 0.24; t(10)=0.34, p = .741), and the patienthood of patients did not differ from the patienthood of agents (patients, M= 0.22, SD = 0.17; agents, M = 0.24, SD = 0.20; t(10)=0.20, p = .847).

*Adult pre-test.* As in Kukona et al. (2011), we asked adult participants (N = XX) to rate all noun-verb combinations for agenthood and patienthood. We created 2 lists, so that a given participant rated only the predictive or the non-predictive verb in a pair. Each verb pair was rated in combination with 7 different nouns: the prototypical agent, the prototypical patient, three nouns that were relatively plausible agents/patients for the actions denoted by the predictive verbs, and two nouns that were implausible agents/patients. One group of participants was asked to produce agenthood ratings; they were asked the question: “How common is it for a NOUN to VERB somebody/something”? Another group of participants produced patienthood ratings and answered the question: “How common is it for a NOUN to be VERB-ed by somebody/something?”. Ratings were given on a 7-point Likert scale. For half of the lists, 7 corresponded to “extremely common” and 1 to “extremely uncommon”; for the other half, the scale was reversed. Participants completed the questionnaire online.

--------------------------------------------------------------------------------------------------------------------------------------

**NOTE on adult pre-test**

So far, I have data for 22 participants. I’ll wait for the full dataset (40) before reporting the stats.

As it stands, with predictive verbs the agenthood of agents is significantly higher than the agenthood of patients (p < .0001) and the patienthood of patients is higher than the patienhood of agents ( p <.0001). Difference scores are not significantly different from zero (p = .341) for predictive verbs and do not differ significantly between predictive and non-predictive verbs (p = .154). With non-predictive verbs, the patienthood of patients is no higher than the patienthood of agents (p = .868). **However, the agenthood of agents is marginally higher than the agenthood of patients with non-predictive verbs (p =.08).**

This is of course only looking at the 12 verbs we selected on the basis of the children data.

Finally, prototypical agents and patients are matched in terms of their semantic association with the predictive verbs. We measured semantic association using LSA scores (based on Reading material up to 3rd grade, 8 yrs; see http://lsa.colorado.edu/). Agents and patients are equally strongly associated with predictive verbs (agents, M = 0.156, SD = 0.147; patients, M = 0.176, SD= 0.149; t(11)=0.36, p = .725). Agents and patients are also associated to the same degree to non-predictive verbs (agents, M = 0.084, SD = 0.065; patients, M=0.093, SD =0.083; t(11)=0.51, p = .621).