

# Imagining what might be: Why children under-estimate uncertainty.

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## Introduction & Summary

Young children behave overconfidently in the face of uncertainty (e.g. Beck & Robinson, 2001; Flavell, Speer, Green, & August, 1981). However, most research has focused on epistemic uncertainty (where there is an unknown fact of the matter).

Children's difficulties are reduced when uncertainty existed about how the future could turn out (physical uncertainty). In a game where children had to catch a object that could fall from one of two doors, 5- and 6-year-olds were more likely to place two mats, thus ensuring that the object was caught, when the object had yet to be hidden behind a door (physical uncertainty) than when it was already in place (epistemic uncertainty. Robinson, Rowley, Beck, Carroll, & Apperly, 2006). Children also preferred to guess the outcome under epistemic rather than physical uncertainty (Robinson, Pendle, Rowley, Beck, & McColgan, 2009).

We explored whether children's difficulties came about because they tended to imagine a possible outcome and treat this as if it is known. In two experiments we manipulated the ease with which children could imagine an outcome.

When the outcome was more difficult to imagine children's overconfidence in the face of epistemic uncertainty was reduced.

## Experiment 1

**Participants:** 60 5- to 6-year-olds, within subjects design.

**Procedure:** Children placed a mat to catch an object falling from one of three doors in the Doors apparatus (Fig.1). The door was determined by the throw of a die, which the child did not see.

### Two practice trials:

Epistemic practice trial: mat is placed when object is hidden behind an unknown door.

Physical practice trial: mat is placed before object is hidden behind an unknown door.

### One experimental trial:

Children chose which way (epistemic/physical) to play the third trial

### Two conditions

Specified: children saw that the object to be hidden was a yellow pom pom and the experimenter referred to it as a pom pom throughout the trials.

Unspecified: children did not know the identity of the object and the experimenter referred to it as 'something' throughout the trials.

### Results:

Table 1: Children's preferences for physical and epistemic versions of the game in Experiment 1.

		Specified	
		Physical	Epistemic
Unspecified	Physical	9	20
	Epistemic	7	25

Specified Condition: preference for guessing under epistemic uncertainty,  $p < .001$

Unspecified: No preference,  $p = .789$

Significant difference between conditions:  $p = .019$

The preference for epistemic uncertainty was reduced when the identity of the object was not known.

## Experiment 2

**Participants:** 29 5- to 6-year-olds, within subjects design.

**Procedure:** We used a two door version of the apparatus (Fig. 1). We used only epistemic uncertainty trials: mat/s placed when object is hidden behind an unknown door. The experimenter decided where to place the object and children placed a mat for mats to catch it.

### Two conditions

Specified: children saw that the object to be hidden was a yellow pom pom and the experimenter referred to it as a pom pom throughout the trials.

Unspecified: children did not know the identity of the object and the experimenter referred to it as 'something' throughout the trials.

### Results

Table 2: Children placing 1 or 2 mats consistently on epistemic trials in Experiment 2.

		Specified	
		1 mat	2 mats
Unspecified	1 mat	12	9
	2 mats	1	7

Children were consistent in the number of mats placed on any trial type.

Children were more likely to place two mats in the unspecified condition than the specified condition.

When the object was unknown, children were better able to handle the uncertainty by marking both possible outcomes.



Figure 1: Doors Apparatus used in Experiment 1. In Experiment 2 the apparatus had only two doors.

## Discussion

When tasks involved objects with known identity 5- and 6-year-olds behaved as if they were overconfident. They:

- showed the expected preference to guess under epistemic uncertainty rather than physical uncertainty (Exp 1)
- they tended to put out only one mat to catch a known object that could fall through one of two doors (Exp 2)

However, when the object's identity was unknown they did not show the same preference and they were more likely to put out two mats.

We speculate that children imagine a possible outcome of an uncertain chance event. The ease with which they do this can lead to a metacognitive error, akin to fluency effects seen in adults (Alter & Oppenheimer, 2009)

## References & Contact

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