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EXPLANATIONS IN CAUSAL CHAINS: SELECTING DISTAL CAUSES REQUIRES EXPORTABLE MECHANISMS

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SUMMARY

Background. If a chain of two events leads to a relevant outcome, there are different possibilities how to explain the occurrence of the outcome (**Figure 1**). One intuition is that the distal cause that started the sequence of events in the first place is crucial for the outcome's eventual occurrence, and that the proximal cause merely *mediates* the effect of the distal cause. Another intuition is that the proximal cause is the crucial explanation for the outcome's occurrence: even though the proximal cause was brought about by the distal cause, it is seen as an *alternative explanation* for the outcome (Nagel & Stephan, 2015). In deterministic chains, counterfactual tests equally support both intuitions—if either of the causes had not occurred, the outcome would not have occurred.

We investigate which factors determine the selection of explanations from deterministic chains. We propose that distal causes are devaluated as explanations when the causal relationships mediating between distal cause and terminal effect are highly *sensitive* (Woodward, 2006), that is, when the chain would break down under inessential variations of boundary conditions (**Figure 2**).

Experiments. In Experiment 1, subjects first learned a deterministic chain within a single exemplar of an unknown deep sea fish by repeatedly intervening on an animated display (**Table 1, Figure 3**). In a first assessment of explanatory appropriateness, they judged the distal and the proximal cause to be equally crucial for the outcome. Afterwards, they received information about the same relationship in the previous and nine additional exemplars of the same kind. In the sensitive condition, only the first exemplar again displayed again the same deterministic chain, while in all other exemplars, activation of the distal cause failed to activate the chain. In the insensitive condition, all additional exemplars behaved just like the first exemplar. In a second assessment, we found that subjects in the sensitive condition now selectively devalued the distal cause as crucial explanation for the outcome *in the first exemplar* (**Figure 4a**), even though here the distal cause covaried perfectly with the outcome throughout learning. These findings could not be explained by subjects contingency estimates on exemplar or kind level (**Figure 4b**). Experiment 2 replicates this finding with better controlled stimulus materials from the artefact domain (**Figures 3 and 5**).

Discussion. These findings underscore that good explanations have to be exportable beyond the concrete set of actual observations that is to be explained (Lombrozo & Carey, 2006). Even if an outcome is perfectly dependent on the occurrence of a distal cause, this cause is rejected as good explanation if the causal mechanism mediating the relationship does not work in inessentially different other contexts (e.g., different exemplars of the same kind).

FIG. 1: MEDIATORS VS. ALTERNATIVE EXPLANATIONS

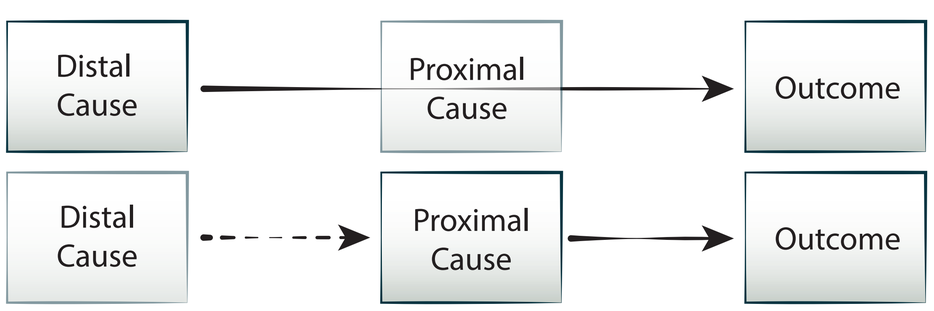


FIG. 2: HYPOTHESIS

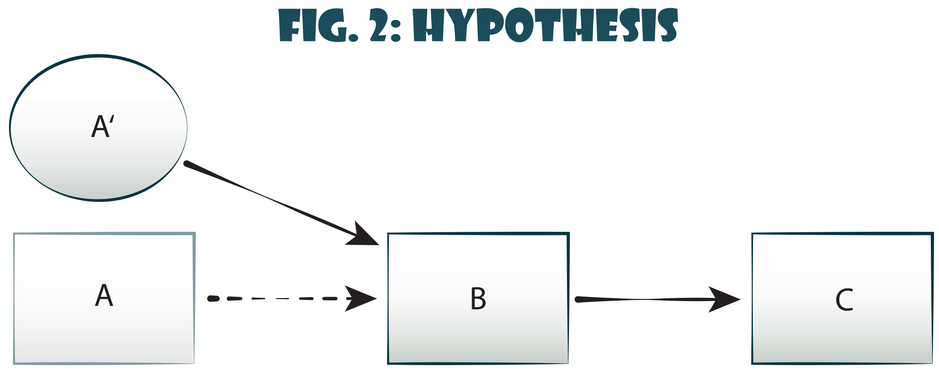


TABLE 1: PROCEDURE

Learning Phase 1: Single Exemplar	Pre Assessment	Learning Phase 2: Additional Exemplars of the Same Kind					vs.					Post Assessment
		Sensitive Condition						Insensitive Condition				
Exemplar #1		#1	#2	#3	...	#10		#1	#2	#3	...	#10	
A → B → C	How appropriate are the following descriptions for observations in Exemplar #1: „A is crucial for the occurrence of C." „B is crucial for the occurrence of C."	A	A	A	...	A		A	A	A	...	A	How appropriate are the following descriptions for observations in Exemplar #1: „A is crucial for the occurrence of C." „B is crucial for the occurrence of C."
		B	¬B	¬B	...	¬B	vs.	B	B	B	...	B	
		C	¬C	¬C	...	¬C		C	C	C	...	C	

FIG. 4: RESULTS OF EXP. 1 (N = 106)

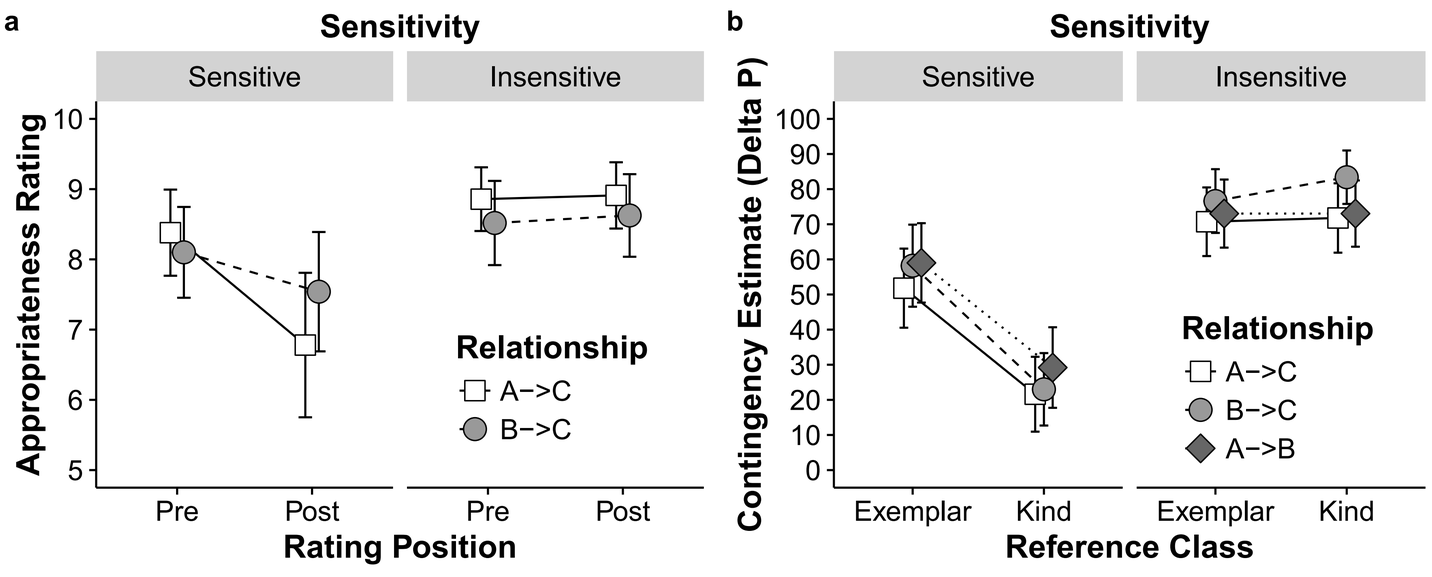


FIG. 5: RESULTS OF EXP. 2 (N = 216)

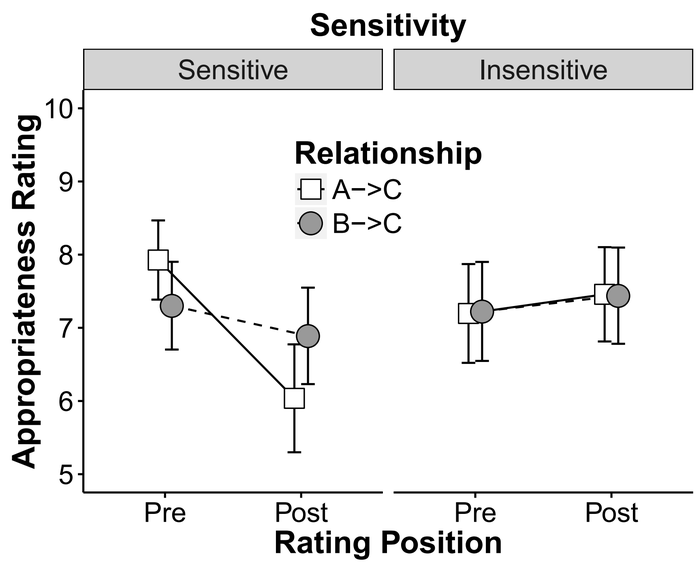
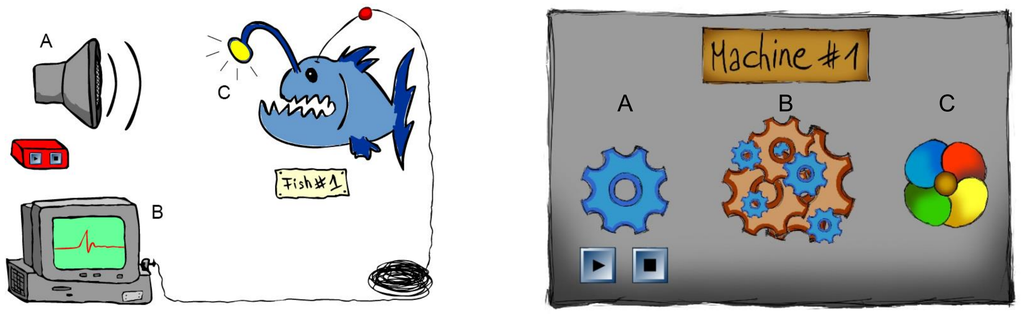


FIG. 3: MATERIALS



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