

Reply to Boogert et al.: The devil is unlikely to be in association or distraction

We agree with the suggestion by Boogert et al. (1) that manipulating the animacy of the predictor cue would be a useful follow-up to our recent study on causal reasoning in New Caledonian crows (2). However, it is important to note that the data presented in our paper cannot be fully explained by the issues Boogert et al. raise. They suggest that the crows may have paired the moving stick with a human leaving the hide. However, there are two sides of our results that need to be explained: (i) a lack of increase in inspections in the human causal agent (HCA) trials (in comparison with the final habituation trial); and (ii) an increase in inspections in the unknown causal agent (UCA) trials. An account based on the pairing of the emerging stick and human cannot account for the HCA results. The crows saw a stick emerge from the hide for the first time into a place where they were about to put their heads, and yet they showed no increase in inspections. Because New Caledonian crows are highly neophobic, the animals should have been averse to going near where the stick was, particularly one that might hit them. Therefore, the associative account would have to assume that the crows, on seeing a new object and an event that could cause them harm if repeated, immediately risked serious injury. We find this extremely implausible. The most probable reason why the crows reacted calmly was that they inferred that, because the human had left the hide, the stick could no longer hit them. This is consistent with the fact that, in the UCA condition, the crows inspected the hide, not the location from which the person might emerge.

A related possibility raised by Boogert et al. (1) is that the human leaving the hide in the HCA condition distracted the crows and, so, reduced their tendency to inspect the hole from which the stick emerged. However, in the UCA condition, the crows not only increased their inspection rate but also actually abandoned probing into the hole. Thus, this hypothesis has to assume that each time the crows saw a human leave the hide, their memory of the preceding event (i.e., the moving stick) was erased. Only a lack of memory of the moving stick could account for why the stick was sufficiently novel in the UCA for the crows to now show not only increased inspections but also a heightened neophobic reaction. We find this suggestion highly implausible for two reasons. First, the crows would have habituated to the human leaving the hide over the three HCA trials, making the event less distracting each time it was repeated. The distraction hypothesis, therefore, predicts that inspections should increase over the three HCA trials: a trend we did not observe. Second, the crows had seen a similar event daily (i.e., a human leaving the cage and closing the door). Thus, it is likely that habituation to events of this type had occurred before our experiment had even begun.

Alex H. Taylor^{a,b,1}, Rachael Miller^c, and Russell D. Gray^a
^aDepartment of Psychology, University of Auckland, Auckland 1142, New Zealand; ^bDepartment of Experimental Psychology, University of Cambridge, Cambridge CB2 3EB, United Kingdom; and ^cDepartment of Cognitive Biology, University of Vienna, 1091 Vienna, Austria

1. Boogert NJ, Arbilly M, Muth F, Seed AM (2012) Do crows reason about causes or agents? The devil is in the controls. *Proc Natl Acad Sci USA* 110:E273.
2. Taylor AH, Miller R, Gray RD (2012) New Caledonian crows reason about hidden causal agents. *Proc Natl Acad Sci USA* 109(40):16389–16391.

Author contributions: A.H.T., R.M., and R.D.G. wrote the paper.

The authors declare no conflict of interest.

¹To whom correspondence should be addressed. E-mail: alexander.taylor@auckland.ac.nz.