Causation and norms of proper functioning: Counterfactuals are (still) relevant

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Abstract

Causal judgments are well-known to be sensitive to violations of both moral and statistical norms. There is ongoing discussion as to whether both effects are best explained through changes in the relevance of counterfactual possibilities, or if moral norm violations should be independently explained through a potential polysemy whereby 'cause' may simply mean 'is morally responsible for'. In support of the latter view, recent work has pointed out that moral norm violations affect judgments of agents, but not inanimate objects, and that their effects are moderated by agents knowledge states. We advance this debate by demonstrating that judgments of counterfactual relevance exhibit precisely the same patterns, and that judgments of inanimate objects are actually highly sensitive to whether the object violated a prescriptive norm by malfunctioning. The latter finding is difficult to account for through polysemy, but is predicted by changes in the relevance of counterfactual alternatives. We then go on to demonstrate that direct (non-moral) interventions on the the relevance of counterfactual alternatives affect causal judgments in precisely the same way as functional and moral norm violations.

Keywords: causation; norms; counterfactuals; morality; teleology

Introduction

A central question in research on causal cognition concerns the role of norms. It is well-known that both statistical and moral norms influence judgments of actual causation (i.e., a judgment that some event, *e*, was the cause of some outcome, *o*) (Alicke, 2000; Gerstenberg, Goodman, Lagnado, & Tenenbaum, 2015; Hitchcock & Knobe, 2009; Kominsky, Phillips, Gerstenberg, Lagnado, & Knobe, 2015). Specifically, people are more inclined to judge that *e* was the cause of *o* if *e* was either very unlikely to happen or morally prohibited. Despite the wide-spread agreement on the existence of the phenomenon, there has been little corresponding agreement on how these effects should be explained.

Most researchers take the impact of *statistical* norms to reveal part of the basic underlying processes that support causal reasoning (e.g., Gerstenberg et al., 2015; Icard, Kominsky, & Knobe, in press; Samland & Waldmann, 2016). They differ, however, in whether they treat the impact of moral norms similarly, or argue that it arises from a fundamentally different set of processes.

On one side, researchers have argued that the impact of both statistical and moral norms is best explained by changes in the relevance of counterfactual possibilities. These accounts propose that when a norm violation occurs, it increases the relevance of counterfactual alternatives wherein the norm violations are replaced by norm-conforming events (e.g., Halpern & Hitchcock, 2015; Kominsky et al., 2015; Bello, 2016). In support of this account, recent work demonstrated that norm violations affect explicit assessments of counterfactual relevance in precisely the same way they affect causal judgments (Phillips, Luguri, & Knobe, 2015).

On the other side, other researchers have argued for separate explanations of the two effects. The most recent approach has suggested that the term 'cause' is polysemous: It can be used to talk about whether an agent is morally responsible for an outcome, or it can be used to talk about whether some event causally contributed to an outcome (Samland & Waldmann, 2016). On this approach, the impact of violations of moral norms can be accounted for by arguing that participants are more likely to interpret the word 'cause' as being about moral responsibility in cases where moral norms have been violated.

Advancing this debate, Samland and Waldmann (2016) (S&W hereafter) reported two important new data points: First, the violation of moral norms selectively influences causal judgments about whether agents caused an outcome, but not causal judgments of whether inanimate objects used by the same agents caused the outcome. Second, factors that affect the moral responsibility of the norm violator (such as their knowledge states) also affect causal judgments (see also Samland, Josephs, Waldmann, & Rakoczy, 2016). S&W suggest that these findings are best accounted for by assuming that participants were interpreting the causal question to be about moral responsibility when asked about an agent, but about simple causal contribution when asked about an object.

In arguing that these results provide evidence against a unified counterfactual account, S&W rely on the assumption that when a norm violation occurs, people consider counterfactual alternatives to the event in its entirety. That is, they consider a counterfactual alternative that involves both the agent who violated a norm and the inanimate object used by that agent. If this assumption is correct, then a polysemy account seems to better capture S&W's results, since a unified counterfactul account would predict that causal judgments of both the agent and the inanimate object would *both* be affected.

At the same time, though, it is possible that the counterfactual alternatives people represent are more granular. That is, when a norm violation occurs, people may consider a counterfactual alternative that involves the norm-violating agent, but not necessarily the inanimate object used by that agent. If this turns out to be correct, then S&W's findings are actually entirely compatible with a unified counterfactual explanation, as one would then expect causal judgments of the agent, but not the object, would be affected.

To distinguish these possibilities, we ask whether the effects uncovered by S&W also arise in participants assessments of which counterfactuals are relevant. One possibility is that, because moral norms apply to agents but not inanimate objects, participants will regard counterfactual alternatives to what the agent did as relevant, but not alternatives to what the inanimate object did. If so, it would suggest that they are rep-

resented somewhat independently. Furthermore, changes to agents mental states may affect both the agents moral responsibility and similarly whether it is relevant to consider counterfactual alternatives to their actions, which may help explain why changes to agents mental states affect causal judgments. For example, intentions affects causal judgments in double-prevention scenarios where counterfactual reasoning directly informs causal judgments (Lombrozo, 2010). To foreshadow our findings, we replicate S&W's results, and additionally find corresponding changes in which counterfactual alternatives participants regard as relevant, demonstrating that these effects are consistent with a unified account.

In a second experiment, we then investigate whether causal judgments of inanimate objects are sensitive to violations of prescriptive norms of proper functioning, even though they are not sensitive to violations of prescriptive moral norms. We find that they are, and that the changes in participants causal judgments are mirrored by a corresponding change to their judgments of the relevance of counterfactual alternatives. This pattern is uniquely predicted by accounts that explain the impact of norms in terms of changes in the relevance of counterfactual alternatives.

Finally, in a third experiment, we directly manipulated the relevance of counterfactual alternatives by asking participants to generate alternatives to one particular part of the causal structure that lead to the outcome (e.g., to the agent or to the inanimate object). This manipulation resulted in a precise pattern: participants causal judgments were affected by the generation of counterfactual alternatives, but only for the part of the causal structure that the counterfactual alternative focused on.

Experiment 1

Methods

Participants. 610 participants ($M_{age} = 37.28$, $SD_{age} = 12.14$; 338 females, 1 unreported) from Amazon Mechanical Turk participated for a modest monetary compensation. Participant recruitment was automated through TurkPrime (`www.turkprime.com`) to prevent repeat participation and limit recruitment to participants with a high approval rating.

Stimuli and procedure. This experiment was a modified version of S&Ws Experiment 4 with an additional DV. The overall design was 4 (norm condition) x 3 (question) and administered fully between-subjects. Participants read one of four vignettes (see Supplemental Materials available at `https://github.com/phillipsjs/stillRelevant`). In all conditions, Tom owns a garden and has two gardeners, Alex and Benni, who each take care of 1/3 of the plants on their own, and jointly tend to the remaining 1/3. Additionally, Alex and Benni always use two fertilizers "A-X200®" and "B-Y33®". Tom reads that fertilizers are good for plants, but using more than one kind of fertilizer could damage his plants, so Tom decides he wants both gardeners to use only fertilizer A-X200. In all cases, however, Alex applies fertilizer A-X200 and Benni applies fertilizer B-Y33, and the plants cared for by both of them are damaged.

The four conditions varied the reason that Benni used B-Y33. In the Standard norm-violation condition, Benni simply decides to use B-Y33; in the Unintended norm-violation condition, Benni believed he was applying A-X200, but accidentally applied B-Y33; in the Ignorant norm-violation condition, Tom neglects to tell Benni to use only A-X200, and he uses B-Y33 instead; and in the Deceived norm-violation condition, Alex deliberately lies to Benni about which fertilizer he is supposed to use to get him in trouble.

Additionally, the questions that participants answered varied. Participants were either asked questions that focused on the two agents ("Alex" and "Benni"), the two actions ("the application of fertilizer by Alex" and "the application of fertilizer by Benni"), or the two chemicals ("the application of chemical A-X200" and "the application of chemical B-Y33").

After reading the vignette, participants were first asked whether it was relevant to consider counterfactual alternatives to some aspect of the event (following Phillips et al., 2015). For example, in the Agent condition, participants were asked whether it was relevant to consider what Alex(/Benni) could have done differently.

Subsequently, as in S&W, participants were asked to judge who or what caused the plants to dry up (depending on the Question condition), and were allowed to choose one or both of the two options. Following this question, participants received two check questions that tested their understanding of which chemicals were applied by which gardener, and which chemicals Tom wanted each gardener to use. Following S&W, they were also asked to estimate the proportion of the flowers that dried when (1) only fertilizer A-X200 was applied, (2) only fertilizer B-Y33 was applied, and (3) both were applied.

Results

We excluded participants who did not answer both of the check questions correctly, and analyzed the remaining 439 participants judgments. We both qualitatively and quantitatively replicated the pattern of causal judgments observed in S&W. We graph this replication by comparing the average causal judgment for each of the two agents in each of the 12 conditions for both our data and S&Ws data (Fig. 1a, also see the Supplemental Materials for complete information on the replication of the key statistical tests reported in S&W).

To examine the effects of our manipulation on both causation and relevance judgments, we categorized participants responses as assigning causal responsibility (or counterfactual relevance) to (1) only the norm-violating agent, (2) both agents, or (3) only the norm-conforming agent, and then subjected both kinds of judgments to a proportional odds logistic regression using the probit function in the MASS package in R. For causal judgments, we observed an effect of the norm-condition ($LRT = 20.49$ $[df = 3]$, $p < .001$), an effect of question ($LRT = 44.53$ $[df = 2]$, $p < .001$), and critically, a norm-condition x question interaction effect

($LRT = 19.94$ $[df = 6]$, $p = .003$). For relevance judgments, we observed a highly similar pattern of results: an effect of norm-condition ($LRT = 13.93$ $[df = 3]$, $p = .003$), an effect of question ($LRT = 73.34$ $[df = 2]$, $p < .001$), and a norm-condition x question interaction effect ($LRT = 14.15$ $[df = 6]$, $p = .028$. The similarity of the pattern of these two judgments across the various conditions can be seen in Fig. 1b. At the level of each participants responses, judgments of the causal responsibility were highly correlated with judgments of whether it was relevant to consider alternatives to the agents actions. This was true both for judgment of the norm-violating agent/action/object, ($r = 0.553$, $p < .001$), and for the norm-conforming agent/action/object ($r = 0.406$, $p < .001$), and moreover, held whether participants were making judgments about agents ($r = 0.651$, $p < .001$), actions ($r = 0.262$, $p < .001$), or simply inanimate objects ($r = 0.280$, $p < .001$).

Experiment 2

Methods

Participants. 403 participants ($M_{age} = 34.96$, $SD_{age} = 11.90$; 205 females, 1 unreported) from Amazon Mechanical Turk participated for a modest monetary compensation. Participant recruitment was again automated through TurkPrime.

Stimuli and procedure. This experiment used a 3 (Norm violation; norm-conforming vs. moral violation vs. malfunction) x 2 (Question: agent vs. object) design, administered fully between-subjects.

Participants read one of three vignettes involving a vending machine in an academic department (see Supplemental Materials). In every condition the machine had three levers (red, black, and white): two that produce pencils and one that produces an eraser but which frequently malfunctioned and also gave a broken pencil. There were also two agents: an administrative assistant, and Professor Smith (a recent hire who did not know about the malfunctioning lever). Prof. Smith always pulls the red lever, and the assistant always pulls the black lever, which later results in a problem for a student who needs a pencil to take a test but cannot get one.

In the norm-conforming condition, the red lever and black lever both produce pencils, and the white lever produces erasers (but also consistently malfunctions). Additionally, both administrators and faculty were allowed to take pencils from the machine. Both agents request pencils using the black and red levers, which both function appropriately. The moral violation condition was identical to the norm-conforming condition, except that the faculty are not allowed to get pencils from the machine (but administrative assistants are allowed), and this rule was known by Prof. Smith. Lastly, the malfunction condition was identical to the norm-conforming condition except that it was the red lever that produced erasers (and malfunctioned), and Prof. Smith wanted an eraser, so Prof. Smith pulled the red lever and got an eraser and a broken pencil.

Participants were then asked a relevance of counterfactual alternatives question and a causal question in random order on separate pages. The relevance of alternatives question was worded and presented the same way as Experiment 1, and either focused on the agents (Prof. Smith, administrative assistant) or the objects (red lever, black lever). The causal question similarly asked either who caused the problem (agent condition) or what caused the problem (object condition), and participants could select one or both.

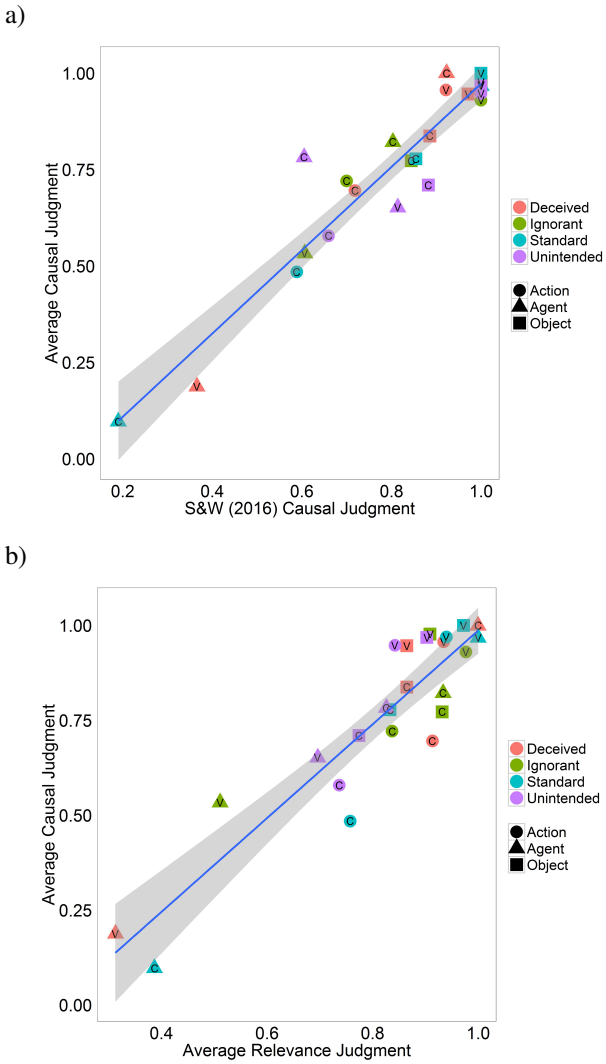

Figure 1: Depiction of the relationship between participants' causal judgments in Experiment 1 and the previous causal results from S&W (a), and the mean relevance judgments (b). Judgments related to the norm-conforming agent are marked with a 'C'; Judgments related to the norm-violating agent are marked with a 'V'.

These were followed by three comprehension check questions and two additional manipulation-check questions. The comprehension questions ensured that participants understood the key facts about the levers, agents, and outcome of the scenario. Additionally, participants rated, on a 0-

100 scale, how likely the malfunction was to occur, in order to verify that participants did not think the malfunction was a descriptive norm violation. Finally, participants rated their agreement with the statement "It was morally wrong for Prof. Smith to pull the red lever" on a 7-point Likert scale, with the expectation that ratings should be higher in the moral violation condition than the other two conditions, which should not differ from each other. The predictions for both manipulation-check questions were overwhelmingly confirmed, meaning that any effect of the functional norm violation cannot be explained by appealing to statistical or moral norms (see Supplementary Materials).

Results

We excluded participants who did not answer all three of the check questions correctly, and analyzed the remaining 258 participants' judgments. To facilitate comparison of participants' judgments, we computed a measure of participants' preference for selecting the norm-violating event as a cause. Participants who selected only the norm-violating event as a cause were assigned a score of 1; participants who selected both or neither events as causes were assigned score of 0; and participants who selected only the norm-conforming event were assigned a score of -1. We then analyzed participants' causal preference scores with a 2 (Causal Question: Agent vs. Object) x 3 (Norm condition: Immoral vs. Malfunction vs. Normal) proportional odds logistic regression, as in Study 1. This analysis revealed a main effect of Norm condition, ($LRT = 71.49$ $[df = 2]$, $p < .001$), no main effect of Causal question ($LRT = 0.045$ $[df = 1]$, $p = .832$), and critically a Norm condition x Causal question interaction effect ($LRT = 31.42$ $[df = 2]$, $p < .001$).

We decomposed this interaction effect by separately analyzing participants' causal preference scores for each of the different conditions. When the relevant norm was moral and thus applied to the agent but not the object, participants tended to prefer the norm-violating agent as a cause, but did not similarly prefer the norm-violating object as a cause ($LRT = 15.33$ $[df = 1]$, $p < .001$). When the relevant norm was functional, and thus the norm applied to the object but not the agent, this pattern was reversed: participants tended to prefer the norm-violating object as a cause, but did not similarly prefer the norm-violating agent as a cause ($LRT = 12.36$ $[df = 1]$, $p < .001$). When there was no norm that applied to either the agent or the object, there was small and non-significant preference for the norm-conforming agent but not the object ($LRT = 1.13$ $[df = 1]$, $p = .288$).

We next analyzed participants' judgments of the relevance of counterfactual alternatives in exactly the same way. Just as with participants' causal judgments, we observed a main effect of Norm condition, ($LRT = 40.53$ $[df = 2]$, $p < .001$), no main effect of Relevance question ($LRT = 0.10$ $[df = 1]$, $p = .747$), and critically a Norm condition x Relevance question interaction effect ($LRT = 33.70$ $[df = 2]$, $p < .001$). We decomposed this interaction effect by separately analyzing participants counterfactual preference scores for each of the different conditions. When a moral norm was salient, participants tended to prefer counterfactuals for the agent, but not the object ($LRT = 16.63$ $[df = 1]$, $p < .001$). When the relevant norm was functional, this pattern was reversed: participants preferred counterfactuals for the object, but not the agent ($LRT = 11.20$ $[df = 1]$, $p < .001$). When there was no norm violation that applied to either the agent or the object, there was a small and significant preference for the norm-conforming agent, but not the object ($LRT = 4.48$ $[df = 1]$, $p = .034$).

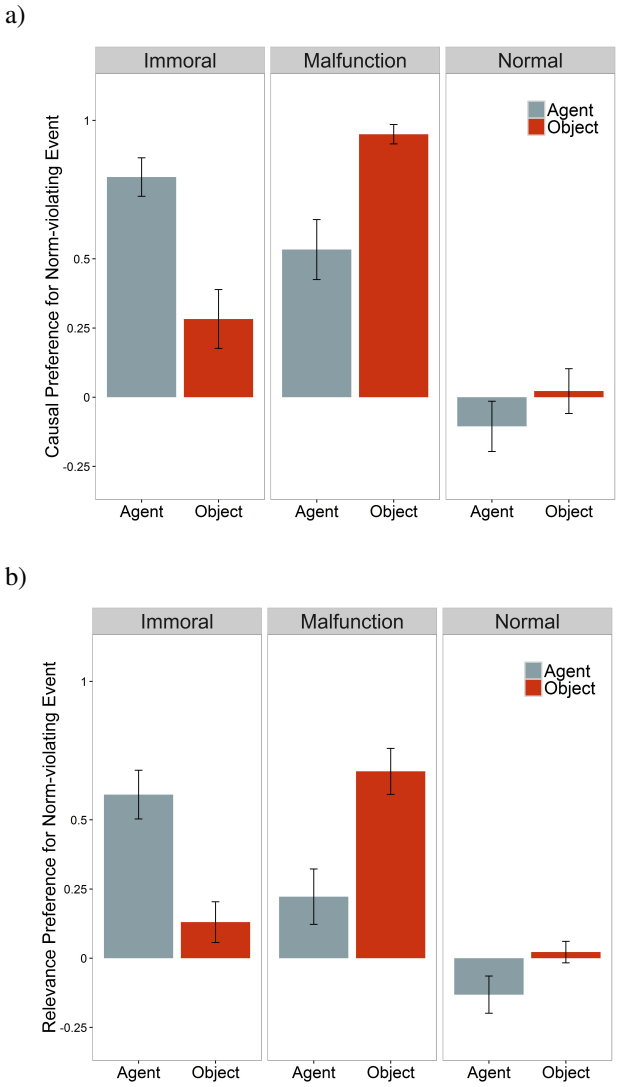

Figure 2: Average preference score for the norm-violating event in causal judgments (a) and counterfactual relevance judgments (b), as a function of which norms were relevant (split into panels). Grey bars depict responses to questions about agents; Red bars depict responses to questions about inanimate objects. Error bars depict +/- 1 SEM.

Experiment 3

Methods

Participants. 601 participants ($M_{age} = 35.96$, $SD_{age} = 15.58$; 304 females, 2 unreported) from Amazon Mechanical Turk participated for a modest monetary compensation. Participant recruitment was again automated through TurkPrime.

Stimuli and procedure. This experiment used a 3 (Agent-Counterfactual vs Object-Counterfactual vs No Counterfactual) x 2 (Agent Question vs Object Question) design. Counterfactual condition was manipulated between-subjects and Question was manipulated within-subjects.

All participants read the norm-conforming condition from Experiment 2, where the red lever and black lever both produce pencils, and the white lever produces erasers (but also consistently malfunctions). Additionally, in this scenario, both the administrators and the faculty are allowed to take pencils from the machine. Both the administrative assistant and Professor smith request pencils using the black and red levers respectively, and both levers function appropriately to produce pencils. A problem then arises from a lack of pencils.

After reading the vignette, participants underwent the counterfactual manipulation. In the Agent-Counterfactual condition, for example, participants were asked to think about Professor Smith's decision to take a pencil from the vending machine, and then to consider and describe one relevant way that things could have gone differently such that the professor would not have taken one of the pencils from the vending machine. In the Object-Counterfactual condition, by contrast, participants were instead asked to consider and describe a relevant way in which the red lever could have functioned differently such that it didn't produce a pencil from the vending machine. In the No Counterfactual condition, participants were simply asked to describe the story they read.

After completing this task, they rated their agreement (on a scale from 0 ('Completely disagree') to 100 ('Completely agree') with a statement that the Professor caused the problem, and separately with a statement that the red lever caused the problem. The statements were presented in counterbalanced order and on separate pages. Participants then completed a series of control questions that asked them about which levers were actually pulled and about who actually received a pencil in the original story.

Results

We excluded participants who did not answer both of the check questions correctly, and analyzed the remaining 423 participants judgments. First, we analyzed the agreement with the two causal statements by comparing a series of linear mixed-effects models using the lme4 package in R (Bates, Maechler, Bolker, Walker, et al., 2014). This analysis revealed a main effect of Question ($\chi^2(1) = 53.135$, $p < .001$) and a main effect of Condition ($\chi^2(2) = 13.492$, $p = .001$). Critically, however, these were qualified by a significant Question∗Condition interaction effect ($\chi^2(2) = 23.04$, $p < .001$). We decomposed this interaction using a series of planned comparisons.

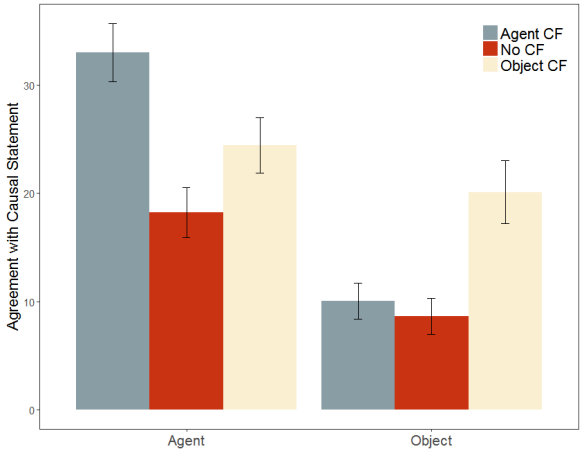

Figure 3: Agreement with the causal statement concerning the agent (left bars) and the object (right bars) as a function of Counterfactual condition). Error bars depict +/- 1 SEM.

Planned comparisons revealed that participants more tended to agree that Professor Smith was a cause of the problem when they considered alternatives to Professor Smith's action ($M = 32.99$, $SD = 33.33$) than when they considered alternatives to the way the lever functioned ($M = 24.43$, $SD = 29.12$), $t(279) = 2.27$, $p = .024$, $d = 0.272$, or when they did not generate any relevant counterfactual alternatives, ($M = 18.22$, $SD = 27.28$), $t(282.48) = 4.12$, $p < .001$, $d = 0.482$.

We also observed a corresponding pattern in participants' agreement with the statement that the red lever caused the problem: participants agreed that the lever was more of a cause when they considered alternatives to the way the lever functioned ($M = 20.11$, $SD = 33.34$), than when they considered alternatives to what Professor Smith did ($M = 10.05$, $SD = 20.59$), $t(213.65) = 2.99$, $p = .003$, $d = 0.367$, or when they did not generate any relevant counterfactual alternatives, ($M = 8.62$, $SD = 19.64$), $t(211.21) = 3.42$, $p < .001$, $d = 0.421$.

General Discussion

The results of these three experiments favor a counterfactual relevance account of the impact of norms on causal judgments. Experiment 1 replicated S&W's finding that moral norm violations primarily affect casual judgments of intentional agents and not inanimate objects. Experiment 2 further found that violations of norms of proper functioning primarily affect judgments of inanimate objects but not intentional agents. In both experiments, judgments of counterfactual relevance tracked the impact of different norm violations on causal judgments for both intentional agents and inanimate objects. Then, Experiment 3 demonstrated that non-normative manipulations of counterfactual relevance result in

precisely the same pattern of causal judgments and primarily affect the specific aspect of the causal structure on which the the alternative focused.

The extant literature on causal judgment now provides evidence for three distinct types of norms that all show similar effects: descriptive *statistical* norm violations (e.g., Kominsky et al., 2015), prescriptive *moral* norm violations (e.g., Hitchcock & Knobe, 2009), and prescriptive *functional* norm violations (demonstrated here). The demonstration of additional norms that have similar a impact on causal judgments makes a parsimonious explanation increasingly desirable. To extend the polysemy account, for example, one would now have to propose three independent explanations for the qualitatively similar effects of each of the three different kinds of norms. By contrast, an account that appeals to the relevance of counterfactual alternatives provides a unified explanation of these effects and specifically predicts that these different norms should have a qualitatively similar impact.

While the present work suggests that counterfactual relevance remains the most promising explanation for the role of norms in causal judgments, many aspects of the relationship between counterfactual representation and causal cognition remain poorly understood.

A critical insight which arises in both S&W and in the current studies is that norms have a highly specific effect on causal judgments: They preferentially affect causal judgments of the entities to which the norm applies and typically do not extend to other aspects of the same event. Experiment 1 & 2 found a similar effect in participants' counterfactual judgments. Experiment 3 then found a similarly specific effect on causal judgments when directly manipulating counterfactual relevance. Taken together, these findings suggest that, rather than representing a counterfactual alternative to an event in its entirety, participants causal and counterfactual cognition represents events more granularly.

Not only does this shape our interpretation of S&W's original result, it opens an exciting new frontier in the study of causal cognition. How events are represented in causal and counterfactual cognition, and which aspects of an event are represented independently, are almost completely unexplored topics (e.g. Halpern & Hitchcock, 2015 explicitly acknowledge this issue). However, as emerging research makes clear, it will be difficult make precise predictions about the impact of norms without a well worked-out theory of how events are represented.

This opportunity cuts in both directions. These results are, to our knowledge, the first empirical investigation of what causes are considered separately, or included at all. As much as we need to create theories of how these events are represented in order to understand how norms will affect causal judgments, we can also use the effect of norms to determine which causes are distinct. We look forward to exploring these questions in future work.

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