The Know-How Solution to Kraemer's Puzzle

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Abstract

In certain cases, people judge that agents bring about ends intentionally but also that they do not bring about the means that brought about those ends intentionally—even though bringing about the ends and means is just as likely. We call this difference in judgments the *Kraemer effect*. We offer a novel explanation for this effect: a perceived difference in the extent to which agents know how to bring about the means and the ends explains the Kraemer effect. In several experiments, we replicate the Kraemer effect in a variety of non-moral and moral scenarios, and we find support for our new account. This work accords with a burgeoning area of action theory that identifies an important connection between know-how and intentionality.

Keywords: Intentionality; Know-How; Experimental Philosophy

1 Introduction

Suppose Brown will win a game if he rolls a six with an ordinary, fair dice. Brown rolls a six, so he wins the game. It does not seem that:

1. Brown intentionally rolled a six.

But it does seem that:

2. Brown intentionally won the game.

Rolling a six, however, is as likely as winning the game, so this pattern of judgments is puzzling. Specifically, it seems that agents bring about ends (e.g., winning the game) intentionally but also that they do not bring about the means that brought about the ends (e.g., rolling a six) intentionally, even though bringing about the ends and means is just as likely. We call this contrast in judgments between means and ends the *Kraemer effect* and the puzzle it raises *Kraemer's puzzle*—as it was first raised by Butler (1978) and sharpened by Kraemer (1978).[1]

In the work on Kraemer's puzzle (Butler, 1978; Kraemer, 1978; Ross, 1978; Lowe, 1980; Stiffler, 1981; Mele & Sverdlik, 1996; Nadelhoffer, 2004; 2006; Cova et al., 2012), researchers have tried to explain the Kraemer effect in a number of different ways. Kraemer (1978: 116-17) proposed that the puzzle arises because of a difference in the degree of control that the agent has over the means relative to the ends (cf. Ross, 1978; Peacocke, 1979: 74; Stiffler, 1981; Mele & Sverdlik, 1996: 281-2). On this view, while people think Brown, for example, has some control over winning the game—because he has some control over whether to play the game—people think that Brown has no control over rolling a six—because it is entirely up to chance. For Kraemer (1978), this difference in the perception of control explains the Kraemer effect.

[1] Our labeling follows Blumberg and Hawthorne (unpublished manuscript).

This control solution to Kraemer's puzzle, however, has proved difficult to explicate. It is unclear why, for instance, Brown is more in control of winning the game than of rolling a six. According to Kraemer (1978), the difference in control is due to a differential ability to opt out. Brown, for instance, has the ability to opt out of playing the game, but he lacks the ability to opt out of rolling a six—once he rolls the dice, he cannot opt out of the roll. But this difference is unclear: it seems that while Brown can opt out of the game, he could also opt out of rolling the dice at all. So, if control is a matter of being in position to opt out, as Kraemer (1978: 116-17) suggested, then there is not a clear sense in which Brown is more in control of the ends than of the means (Lowe, 1980).

Such difficulties with this control solution led some theorists to offer a different approach, one that explains Kraemer's puzzle in terms of fundamental features of our concept of intentional action that are irreducible to features of agents' control (Cova et al., 2012; Nadelhoffer, 2004). Consider a representative example of this approach. Cova and colleagues (2012: 403-4) argue that what explains Kraemer's puzzle is a linguistic ambiguity in ascriptions of intentional action. On this view, the term 'intentional' is ambiguous between two senses: the *conative sense*—where 'intentionally acting' expresses a desire to perform that action—and a *control sense*—where 'intentionally acting' expresses having had control over that action. On this account, people read statements like 1 in the control sense, so it seems false. But people read statements like 2 in the conative sense, so it seems true. This ambiguity, they argue, explains the Kraemer effect (Cova et al., 2012). Along similar lines, Nadelhoffer (2004: 279) suggests that the Kraemer effect in morally neutral scenarios is due to a fundamental feature of our concept of intentional action—it simply asymmetrically tracks ends rather than means. These accounts and others share the idea that the Kraemer effect does not arise because of a difference in the agent's

control, but rather because of features of the concept of intentional action itself. We call this the *Intentionality Hypothesis*.

In this article, we explore a different approach, one that develops Kraemer's original control solution to the puzzle. According to the approach we will explore, a fundamental difference in the extent to which agents know how to bring about the ends and the means explains the Kraemer effect. According to an increasingly popular theory of control in action theory (e.g., Ryle, 1949; Wu, 2016; Shepherd, 2021; Beddor & Pavese, 2022), an agent's control of an action requires their knowing how to perform that action. To probe our intuitions, Ryle introduces the example of the clown and the klutz (Ryle, 1949: 5). The clown intentionally tumbles, but the klutz does not, for the former but not the latter is in control of their action. Plausibly this difference in control is explained by the fact that the former but not the latter knows how to tumble. Putting this together with Kraemer's original approach, if an agent intentionally brought about an outcome, they were in control of their action, and they were in control of it only if they knew how to bring it about.

This view comports well with some recent work in philosophy and cognitive science. Some philosophers have developed theories that establish a deep connection between the concept of intentional action and the concept of know-how (Ryle, 1949; Stanley & Williamson, 2001; Cath, 2015; Pavese, 2018; 2020). Moreover, some experimental work suggests that people's intentionality judgments are sensitive to their perception of know-how. People, for instance, do not judge cases of beginner's luck as intentional (Mele & Moser, 1994; Malle & Knobe, 1997; Knobe, 2003a). In one experiment, people tended not to judge a novice at darts as having intentionally hit a triple 20 on their first try (Malle & Knobe, 1997), plausibly because the novice

does not know how to hit a triple 20. As these and other examples suggest, the sort of control that is needed for intentional action may be explained, at least in part, in terms of know-how.

Recent experimental work has further explored this connection between intentional action and know-how. Pavese and colleagues (2023) found that people's judgments about an agent acting intentionally depend on their judgments about the extent to which the agent knows how to perform it. In a variety of cases in which people judged agents as not performing an action intentionally—because people perceived that the action was lucky and out of agents' control—Pavese and colleagues (2023) found that people correspondingly judged that the agents did not know how to perform the action and that people's judgments of intentional action were mediated by people's know-how judgments. For example, suppose you buy a normal lottery ticket for a lottery that you do not want to win and, as expected, you lose the lottery. Here, it seems wrong to say that you intentionally lost the lottery—precisely because you do not know how to lose the lottery. Pavese and colleagues (2023) found support for this explanation.

This connection between the concept of intentional action and the concept of know-how motivates a novel explanation for the Kraemer effect, according to which the Kraemer effect is explained by perceived differences in agents' know-how. Consider scenarios that give rise to the Kraemer effect like the game example at the outset. In these scenarios, the agent knows a reliable way to bring about the ends, but they do not know any reliable way to bring about the means. So, to some extent, they know how to bring about the ends, but they do not know how to bring about the means. Brown, for instance, knows of a reliable way to win the dice game: by playing the game and then rolling a six. So, he knows how to win the game. By contrast, in a fair dice game, Brown knows of no reliable way to roll a six. So, Brown does not know how to roll a six. As such, there is an apparent difference in the degree to which the agent knows how to bring about

the ends and the means. This observation, we suggest, explains the Kraemer effect: people's intentionality judgments vary between ends and means because of a more fundamental difference in the extent to which people judge that agents know how to perform the ends and the means. We call this the *Know-How Hypothesis*.

Our aim is to test the Know-How Hypothesis against the Intentionality Hypothesis. The Intentionality Hypothesis and the Know-How Hypothesis significantly differ in their predictions. The Know-How Hypothesis uniquely predicts that in the scenarios where there is the Kraemer effect there should also be a corresponding effect for know-how ascriptions. For instance, it predicts that people should agree more with statement 4 than with statement 3:

3. Brown knows how to roll a six.
4. Brown knows how to win the dice game.

The hypothesis also predicts that the Kraemer effect is explained in terms of this *know-how effect*. By contrast, the Intentionality Hypothesis predicts that the Kraemer effect will persist even when people think that the agent knows how to bring about the ends and the means since, according to this hypothesis, the Kraemer effect is not due to a more fundamental difference—like a difference in control or know-how—between the ends and the means.

In six experiments, we test these two hypotheses. Using a variety of non-moral cases in Experiment 1, we find that as people judge that agents brought about the ends more intentionally than the means, people also judge that agents know how to bring about the ends more than the means. That is, we conceptually replicated the Kraemer effect in non-moral scenarios, and we found the new know-how effect predicted by our new hypothesis. We also found that people's intentionality judgments that give rise to the Kraemer effect are fully mediated by people's know-how judgments. In Experiment 2, we found that reducing the know-how effect also

reduces the Kraemer effect. In Experiment 3, we ruled out a common cause explanation, according to which both Kraemer effect and the know-how effect are independently explained by the lack of reliable ways to bring about the means. In Experiment 4, we manipulated agents' know-how about the means, but we did not find that our manipulation significantly affected the pattern of intentionality judgments. In Experiments 5, we replicated our results from Experiment 1 using a moral scenario. In Experiment 6, we used this moral scenario in another manipulation experiment, and we found that manipulating the agents' know-how about the means affected people's patterns of intentionality judgments. Overall, we find substantial evidence for our Know-How Hypothesis, and we provide a satisfying solution to Kraemer's puzzle that supplements Kraemer's (1978) original solution.

2 Experiment 1

This experiment had two aims. First, we wanted to determine whether people's judgments about intentional action show the Kraemer effect using multiple non-moral scenarios and a graded measure of intentionality. Previous experimental work found this effect using a dichotomous measure (Nadelhoffer, 2004; 2005), so we aimed to conceptually replicate these findings with new materials. Second, we wanted to test the predictions of the Know-How Hypothesis. For this purpose, we first asked participants the extent to which the agent knew how to bring about the means and the ends before we asked participants the extent to which the agent intentionally performed the means and ends. We expected to conceptually replicate the Kraemer effect, and we predicted a know-how effect and a mediation of the Kraemer effect by know-how judgments.

2.1 Sample size

A pilot study using a variation of the game-show vignette found a Kramer effect (d = .25). We calculated the number of participants required for d = .25 for α = .05 at .95 power. We required 210 participants for each vignette. Expecting a exclusion rate of 1-2%, we aimed to recruit 850 participants.

2.2 Participants

We recruited all participants in all experiments in this manuscript on *Prolific*. All participants were United States nationals, were born in and resided in the United States, spoke English as their first language, had a 99% approval rating on *Prolific*, and took only one of our experiments.

A total of 852 participants completed the experiment that was programmed in Qualtrics. 9 participants reported not paying attention, so they were excluded. We analyzed data from the remaining 843 participants (M_{age} = 37, SD = 12.92, Range_{age} = [19–79], 49% female). After completing the survey, we compensated participants $0.35.

2.3 Materials and Procedure

After they consented to participation, participants were randomly assigned to read 1 of 8 vignettes in a 4 (Vignette: Game Show, Softball, Board Game, Carnival) × 2 (Outcome: Means, Ends) mixed design where the vignette was between-participants and the outcome was within-participants. So, each participant read a single vignette. Next, they answered the know-how questions about the ends and then the means and then the intentionality questions about the ends and then the means. The questions were displayed in fixed order each on a separate page where the vignette was displayed again for the participants' reference.

For example, participants who received the game-show vignette read the following (all materials included in Supplemental Materials):

> Jane is a contestant on a game show. In the game, Jane is given the opportunity to push a button that will randomly open exactly one of the ten doors in front of her.
>
> A brand-new car is behind one of the ten doors. If Jane pushes the button and the door with the brand-new car behind it opens, then she will win the car.
>
> Jane has no idea which door will open if she pushes the button. But she does know that the brand-new car is behind door three. And Jane really wants to win that car.
>
> Hoping to win the car, Jane pushes the button. To her great satisfaction, door three opens, and Jane wins the brand-new car.

Before each statement, we asked participants "To what extent do you agree with the following statement about the passage you just read?" Participants who received the game-show vignette responded to the following:

> Jane knows how to win the brand-new car.
>
> Jane knows how to open door three.
>
> Jane intentionally won the brand-new car.
>
> Jane intentionally opened door three.[2]

[2] Notice that the know-how statements are phrased in the present tense, where the intentionality statements are in the past tense. This difference is intended. Whereas the intentionality statements are most naturally phrased in the past tense, the past tense of the know-how questions might give rise to a version of what linguists call the 'actuality entailment'. If *S* succeeds at φ-ing, people tend to judge that *S* was able to φ (in the past), even though *S* got lucky (Bhatt, 1999; Hacquard, 2005). Still, people tend not to agree with the claim that *S* has the ability to φ or that *S* is able to φ (present tense). We suspect this actuality entailment might extend also to past tense know-how judgments. In

For each question, we asked participants for their level of agreement with each statement on a -50-50 scale [-50 = strongly disagree, 0 = neutral, 50 = strongly agree]. At the end of all experiments in this manuscript, we asked participants for basic demographic information and to respond to one explicit attention check. All materials, data, and analysis code for all experiments in this manuscript are available at https://osf.io/bj4np/.

2.4 Results

For this experiment, we fitted data to linear mixed-effects models, and we included vignette as a random intercept in the models. We report the descriptive statistics in the Supplementary Materials.

Participants agreed to a greater degree that the agent knew how to perform the ends (M = 12.91, SD = 34.88, n = 843) than that the agent knew how to perform the means (M = -28.38, SD = 29.39, n = 843) (b = -41.29, SE = 1.55, t = -26.49, p < .001, CI_b [-44.35, -38.24], d = -1.29). Participants also agreed to a greater degree that the agent intentionally performed the ends (M = -10.97, SD = 35.73, n = 843) than that the agent intentionally performed the means (M = -28.01, SD = 30.31, n = 843) (b = -17.04, SE = 1.57, t = -10.83, p < .001, CI_b [-20.13, -13.96], d = -.52) (Figure 1).

order to control for this possible interference of the actuality entailment, here we focused on judgments about know-how in the present tense.

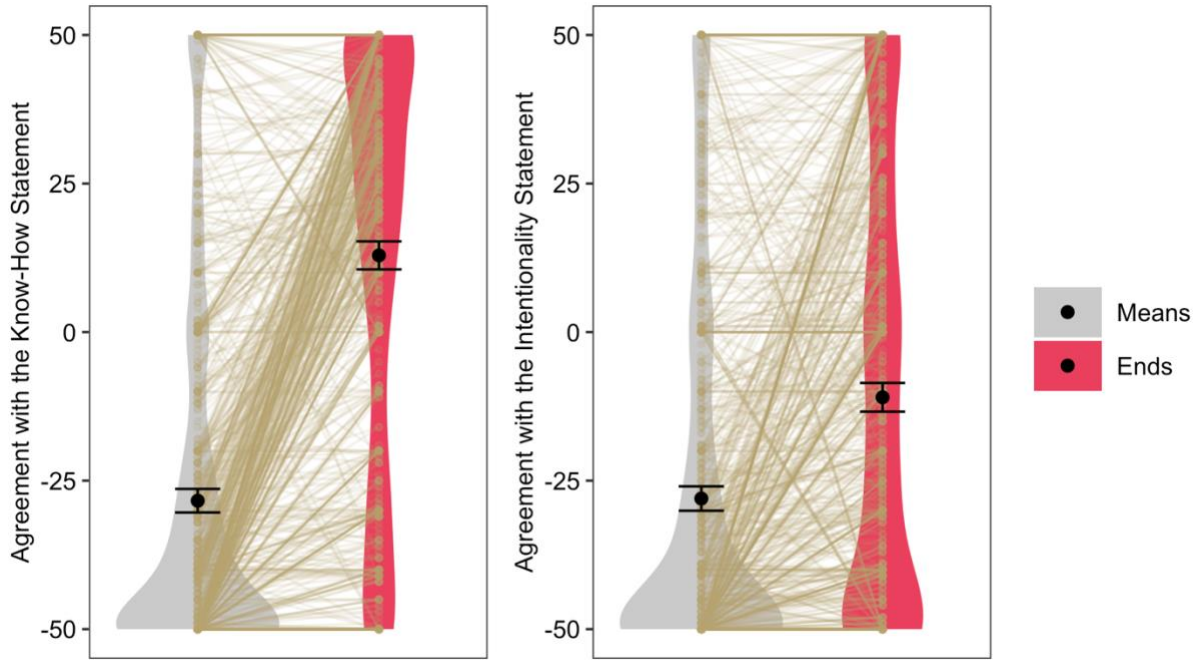

Figure 1. Mean agreement with the know-how and intentionality statements in Experiment 1. Error bars indicate 95% confidence intervals. Gold points and lines represent individual participant responses.

To investigate the relationship between know-how and intentionality judgments, we then conducted mixed-effects mediation analysis. The analysis examined the average causal mediation effect (ACME) of the agreement with knowledge-how statements and the average direct effect (ADE) of outcome on the intentionality judgments. There was a full mediation (ACME = -19.56, $p < .001$, CI [-21.71, -17.24]) such that the direct effect was no longer significant in the mediation model (ADE = 2.47, $p = .15$, CI [-0.71, 5.86]).

2.5 Discussion

In Experiment 1, we conceptually replicated the Kraemer effect using multiple morally-neutral vignettes and a continuous measure. As predicted by the Know-How Hypothesis, we also found a new effect—the know-how effect: people were more inclined to agree that the agent knew how to bring about the ends than the means. Moreover, we found that the Kraemer effect was fully mediated by the know-how effect, suggesting that judgments about intentional action in Kraemer's puzzle are explained by the corresponding judgments about know-how.

A reviewer noted that the fixed order of the statements might have affected the pattern judgments that we found. In order to investigate whether the fixed order of the statements or presenting participants with multiple statements affected participants' pattern of judgments in Experiment 1, we ran an additional experiment (see Supplemental Experiment 1). In this entirely between-participants experiment, participants read the carnival vignette from Experiment 1, and then they reported their level of agreement with only one statement that was displayed on the same page as the vignette. We found the same pattern of results that we see in Experiment 1. As such, we have no evidence that the fixed order or responding to multiple statements produced people's overall pattern of judgments in Experiment 1.

A reviewer also noted a potential concern about participants' overall denial of intentionality for both the ends and the means. In Experiment 1, the mean intentionality judgments for both the ends and means were below the midpoint of our scale. Given that participants' mean agreement was below the midpoint, one might reasonably wonder whether people judge the ends as intentional actions at all. Two observations mitigate the severity of this concern. First, it is reasonable to expect the mean agreement to vary considerably by vignette. In the carnival vignette, for instance, participants' mean agreement for the ends is above the midpoint (see Supplementary Materials). Moreover, in Supplemental Experiment 1—an entirely

between-participants experiment—mean agreement for intentionality judgments for the ends is above the midpoint. So, we are careful not to assume that people generally deny that ends are intentional in Kraemer-effect cases. Second, Nadelhoffer (2004: 279) found that in non-moral cases, the majority of subjects agree that the agent intentionally performed the ends. Crucially, Nadelhoffer's experiments used a dichotomous measure. By contrast, we used a graded scale, so we expected a degree of variation on the mean agreement. While it may be interesting that people's judgments are above or below the midpoint, it is not a relevant feature of our tested hypotheses; our interests are in the degrees of intentionality and know-how.[3]

Overall, these findings in Experiment 1 provide evidence against the Intentionality Hypothesis. Since the Intentionality Hypothesis does not hold that know-how plays a role in eliciting the Kraemer effect, this hypothesis does not predict a know-how effect or a mediation. Consider, for example, Cova and colleagues' (2012) ambiguity explanation for the Kraemer effect. While this ambiguity between the conative and control sense of 'intentional' is plausible for judgments of intentional action, the conative sense seems irrelevant for ascriptions of knowledge-how. After all, whether one knows how to perform a certain task is independent of whether one has the desire to perform it. So, Cova and colleagues' (2012) explanation for the Kraemer effect does not predict the know-how effect or the mediation that we find.

By contrast, the Know-How Hypothesis predicts all of these findings. According to the Know-How Hypothesis, in certain cases people judge that agents intentionally bring about the ends but not the means because they judge that those agents know how to bring about the ends

[3] One might, nonetheless, wonder why we observe a difference in the pattern of intentionality judgments and the pattern of knowledge-how judgments, which tend to be higher for the ends. We believe there is an explanation for this difference that fits naturally with some work in action theory. Although know-how is a necessary aspect of control—and indeed the aspect of control that explains the Kraemer effect—control in intentional action is not exhausted by know-how. So, chancy ends might not count as sufficiently under the control of an agent even though the agent has a reasonable degree of know-how. For a theory of control in action that integrates considerations of know-how with other considerations, see Pavese (2021) and Beddor and Pavese (2022).

but not the means. For example, people would judge that Brown intentionally won the game but not that he intentionally rolled a six because they judge that Brown knew how to win the game but also that he did not know how to roll a six. Experiment 1 confirmed the core predictions of this hypothesis.

The Know-How Hypothesis makes another prediction: if we modify the agent's know-how in the vignette so as to reduce or eliminate the know-how effect—specifically so that people judge that the agent knows how to bring about both the end and the means—the Kraemer effect should also dissipate. In order to test this prediction, we devised a second experiment that uses a modified vignette where the agent knows how to bring about the end and the means.

3 Experiment 2

In this experiment, we tested whether reducing the know-how effect also reduces the Kraemer effect. To do so, we used a vignette in which participants would think that the agent knows how to bring about both the ends and the means, and then we planned to measure whether that affected people's judgments of the agent's intentionality. To accomplish this task, we modified the game-show vignette from Experiment 1 and used the same measures.

3.1 Sample size

We kept sample size and the exclusion rate the same, so we aimed to recruit 212 participants.

3.2 Participants

A total of 212 participants completed the experiment. 1 participant reported not paying attention, so they were excluded. We analyzed data from the remaining 211 participants (M_{age} = 34, *SD* =

13.05, Range$_{age}$ = [19–78], 48% female). After completing the survey, we compensated participants $0.35.

3.3 Materials and Procedure

After they consented to participation, participants read a modified version of the game-show vignette, which was identical to the one used in Experiment 1 except the third paragraph was changed to:

> It turns out that the button is fixed so that door three will definitely open if it is pushed. Jane is aware of this, so she knows how to open door three.
>
> But she also knows that the brand-new car is behind door three. And Jane really wants to win that car.

Participants then responded to the same dependent measures in the same order as Experiment 1.

3.4 Results

There was no evidence that participants agreed to a greater degree that the agent knew how to perform the ends (M = 46.65, SD = 7.80, n = 211) than that the agent knew how to perform the means (M = 46.43, SD = 9.92, n = 211) (t(398.02) = 0.25, p = 0.79, d = .02, CI [-.16, .21]) (Figure 2). There was also no evidence that participants agreed to a greater degree that the agent intentionally performed the ends (M = 43.25, SD = 16.55, n = 211) than that the agent intentionally performed the means (M = 44.37, SD = 16.01, n = 211) (t(419.53) = -0.70, p = .47, d = -.06, CI [-.26, .12]).

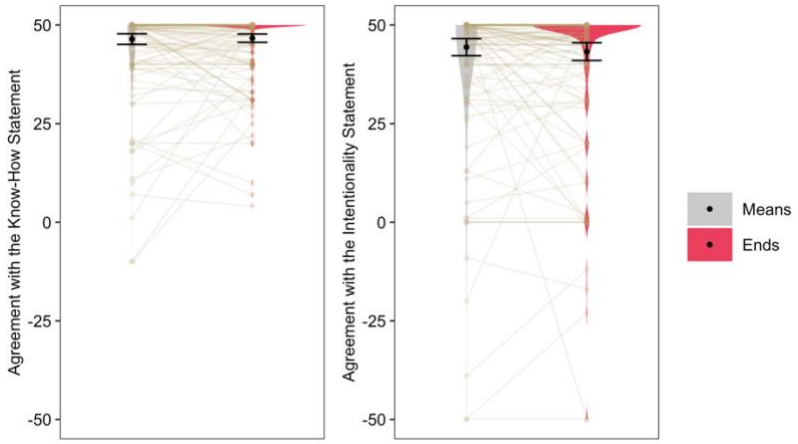

Figure 2. Mean agreement with the know-how and intentionality statements in Experiment 2. Error bars indicate 95% confidence intervals. Gold points and lines represent individual participant responses.

3.5 Discussion

In this experiment, we found no evidence for a know-how effect, so our intended modification of the vignette was successful. Critically, we also found no evidence for a Kraemer effect when people judged that the agent knew how to bring about both the end and the means. As predicted by the Know-How Hypothesis, eliminating the know-how effect also eliminated the Kraemer effect. This finding might also yield evidence against views that take the Kraemer effect to be due to the fact that the concept of intentional action asymmetrically tracks ends rather than means (see Nadelhoffer 2004: 279), for the Kraemer effect disappears when the agent knows how to bring about the ends and the means. Hence, a perceived difference in know-how—not an irreducible asymmetry in the concept of intentional action—seems to elicit the Kraemer effect.

These results, however, raise a further issue. In order to modify the vignette in Experiment 2 so as to present the agent as knowing how to bring about both the means and ends, we also modified the presence of a reliable way to bring about the means. In the vignette in

Experiment 2, the button is fixed, so pushing it is a reliable way to open door three. This difference could be a potential confound in Experiment 2: people's perception of the agent's know-how is not affecting their intentionality judgments—rather their perception of a reliable way to perform the action is. More generally, this could offer an alternative explanation for our findings in Experiment 1—a common-cause hypothesis. According to this hypothesis, what explains both the Kraemer effect and the know-how effect is whether there are reliable ways to bring about both the ends and the means, regardless of whether the agent knows how to bring about both the ends and the means. This common-cause hypothesis is incompatible with the Know-How Hypothesis, because it explains the Kraemer effect not in terms of know-how, but rather in terms of the presence or absence of reliable ways to bring about the action. In order to rule out the common-cause hypothesis as well as to determine whether the agent's knowledge about how to bring about the ends and the means is the difference maker in Kraemer effect, we devised a third experiment.

4 Experiment 3

This experiment aimed to determine whether the agent's knowledge about how to bring about the ends and the means is the difference maker in the Kraemer effect. To do that, we used a modified version of the game-show vignette from Experiment 1. In the modified vignette, there is a reliable way to bring about the ends and there is a reliable way to bring about the means: the agent can win the brand-new car by opening door three, and they can open door three by pushing the button, which—just like in Experiment 2—is fixed. However—just like in Experiment 1—the agent has no idea how to open door three, since they do not know that the button is fixed. This vignette differs from the one used in Experiment 2 only in the agent's lack of know-how. In

this experiment, participants are not told that the agent knows how to bring about the ends and the means; while we fixed a reliable way to bring about the ends and the means, we allowed participants' perception about the extent to which the agent knows how to bring about the ends and the means to vary for the ends and the means. In this setting, the Know-How Hypothesis predicts that there should be both the know-how effect and the Kraemer effect. By contrast, the common-cause hypothesis we mention above predicts that there should be no Kraemer effect.

4.1 Sample size

We kept sample size and the exclusion rate the same, so we aimed to recruit 212 participants.

4.2 Participants

A total of 213 participants completed the experiment. 0 participants reported not paying attention. We analyzed data from the 213 participants (M_{age} = 35, SD = 12.13, Range_{age} = [19–76], 48% female). After completing the survey, we compensated participants $0.35.

4.3 Materials and Procedure

After they consented to participation, participants read a modified version of the game-show vignette, which was identical to the one used in Experiment 1 except we added the following paragraph between the third and fourth paragraphs:

> Unbeknownst to Jane, the button is fixed, so door three will definitely open if the button is pushed.

Participants then responded to the same dependent measures in the same order as Experiment 1.

4.4 Results

Participants agreed to a greater degree that the agent knew how to perform the ends (M = 5.85, SD = 34.42, n = 213) than that the agent knew how to perform the means (M = -19.25, SD = 32.86, n = 213) (t(423.09) = 7.70, p < .001, d = .74, CI [.54, .94]). Participants also agreed to a greater degree that the agent intentionally performed the ends (M = -7.78, SD = 35.53, n = 213) than that the agent intentionally performed the means (M = -19.53, SD = 33.07, n = 217) (t(421.84) = 3.53, p < .001, d = .34, CI [.15, .53]) (Figure 3).

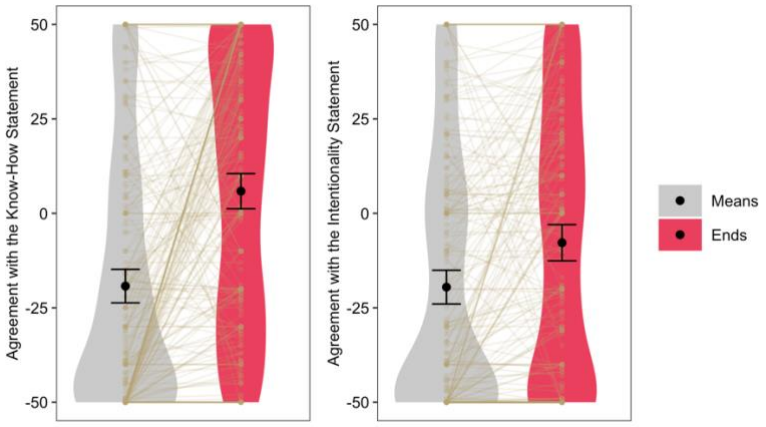

Figure 3. Mean agreement with the know-how and intentionality statements in Experiment 3. Error bars indicate 95% confidence intervals. Gold points and lines represent individual participant responses.

4.5 Discussion

Again, we found a know-how effect and a Kraemer effect, replicating our findings from Experiment 1. The Know-How Hypothesis predicted these results; the difference in the extent to which participants perceived the agent as knowing how to bring about the ends and the means elicits the Kraemer effect. In this experiment, we held fixed a reliable way to bring about the

ends and the means, but we allowed for variation in the agent's knowledge about how to bring about the means and the ends. As such, if the Kraemer effect is driven by know-how—as the Know-How Hypothesis predicts—we should observe the know-how effect and the Kramer effect in this case. We found just this, providing further support for the know-how hypothesis.

These results also rule out the common-cause hypothesis we mentioned above. On this view, people think that there is a reliable way for the agent to bring about the ends but not a reliable way to bring about the means, and this difference independently explains both the know-how effect and the Kraemer effect. This common-cause hypothesis predicts that if there is a reliable way to bring about both the ends and the means, then there should be neither a know-how effect nor a Kraemer effect. The Know-How hypothesis instead predicts that these effects should persist independently of the presence of a reliable way to perform the ends and the means when there is a perceived difference in the extent to which the agent knows how to bring about the ends relative to the means. Critically, the results in Experiment 3 are incompatible with this common-cause hypothesis, as we found a Kraemer effect. As such, we have no evidence that this common-cause hypothesis explains both the know-how effect and the Kraemer effect. But we have further evidence for the Know-How Hypothesis. We also have no evidence that the potential confound of introducing reliable ways to bring about both the end and the means produced our pattern of results in Experiment 2; rather, these findings all seem consistent with our Know-How Hypothesis.

Notably, it might seem that the effect sizes in this experiment are much smaller than those in Experiment 1, where responses for multiple vignettes are pooled together. However, the effect sizes that we see in Experiment 3 are similar to what we saw in our pilot experiment that used a variation of the game-show vignette—where we found $d = .61$ for the know-how effect

and d = .25 for the Kraemer effect—and what we see if we subset the data from Experiment 1 for just the game-show vignette—where we found d = .69 for the know-how effect and d = .17 (p = .07) for the Kraemer effect. Thus, these results are consistent with our other findings in this manuscript.

At this point, a reviewer suggested that we run an experiment where we manipulate the agents' knowledge of how to bring about the means.[4] If we manipulated the agents' knowledge of how to bring about the means, then we should find an interaction such that there is a Kraemer effect when the agents' know-how varies by the ends and the means and no Kraemer effect when the agent simply knows how to bring about the ends and the means. As such, we planned to run Experiment 4.

5 Experiment 4

In this experiment, we aimed to determine whether manipulating the agents' knowledge of how to bring about the means affected people's patterns of intentionality judgments that constitute the Kraemer effect. To that end, we manipulated the agent's knowledge of how to bring about the means between participants, and we had participants respond to all measures about the ends and the means for know-how and intentionality. If the Know-How Hypothesis is correct, we expected to detect an interaction between the agent's knowledge of how to bring about the means (Knowledge|No Knowledge) and the outcome (Means|Ends) for participants' intentionality judgments. The preregistration is available here: https://osf.io/wy7fm.

[4] We initially tried this experiment using variations of the game-show vignette from Experiment 1 (Supplemental Experiment 2). But we did not find the predicted interaction. We noticed, however, that some participants found that the vignettes were confusing (and some researchers we showed these vignettes to agreed). As such, we ran Supplemental Experiment 3 that used our vignette from Experiment 3, and we modified this vignette slightly in the knowledge conditions. Again, we failed to find the predicted interaction. We ran a simulation-based power analysis (see Supplemental Materials for details), and we found that we were underpowered to detect this interaction. Experiment 4 is a better-powered version of Supplemental Experiment 3.

5.1 Sample size

We ran a simulation-based power analysis based on our results from Supplemental Experiment 2 (see Supplemental Materials for details). 296 participants were required for each pair. With two conditions and expecting an exclusion rate of 1%, we aimed to recruit 600 participants.

5.2 Participants

A total of 601 participants completed the experiment. 3 participants reported not paying attention. So, we analyzed data from the remaining 598 participants (M_{age} = 40, SD = 13.19, Range_{age} = [18–78], 49% female). After completing the survey, we compensated participants $0.35.

5.3 Materials and Procedure

After they consented to participation, participants read a modified version of the game-show vignette from Experiment 3. In the No-Knowledge Condition, participants read the exact vignette from Experiment 3. In the Knowledge Condition, participants read the same vignette—only the fourth paragraph was changed to the following:

> Just before her turn, Jane is informed that the button is fixed, so door three will definitely open if the button is pushed.

Participants then responded to all four of the the same dependent measures about intentionality of know-how of the means or the ends that were used in Experiment 3. Each measure was displayed in randomized order on a new page with the vignette displayed again.

5.4 Results

For know-how, there was an interaction between Outcome and Knowledge ($F(1, 1192) = 43.41$, $p < .001$, $\eta^2_p = 0.04$, CI [0.02, 0.06]) (Figure 4). There was a main effect of Knowledge ($F(1, 1192) = 485.36$, $p < .001$, $\eta^2_p = 0.29$, CI [0.25, 0.33]), and there was a main effect of Outcome ($F(1, 1192) = 68.75$, $p < 0.001$, $\eta^2_p = 0.05$, CI [0.03, 0.08]).

To decompose the interaction for know-how, we investigated the simple main effects of Outcome at each level of the Knowledge factor. In the No-Knowledge Condition, participants agreed to a greater degree that the agent knew how to perform the ends ($M = 9.91$, $SD = 34.55$, $n = 296$) than that the agent knew how to perform the means ($M = -15.71$, $SD = 34.29$, $n = 296$) ($t(1192) = 10.51$, $p < .001$, $d = .86$, CI [.70, 1.02]). In the Knowledge Condition, there was no evidence that participants agreed to a greater degree that the agent knows how to perform the ends ($M = 36.40$, $SD = 22.41$, $n = 302$) than that the agent knows how to perform the means ($M = 33.36$, $SD = 25.63$, $n = 302$) ($t(1192) = 1.25$, $p = .20$, $d = .10$, CI [-.05, .26]).

For intentionality, there was no interaction between Outcome and Knowledge ($F(1, 1192) = 2.16$, $p = .14$, $\eta^2_p = 0.00$, CI [0.00, 0.01]) (Figure 4). There was a main effect of Knowledge ($F(1, 1192) = 418.28$, $p < .001$, $\eta^2_p = 0.26$, CI [0.22, 0.30]), and there was a main effect of Outcome ($F(1, 1192) = 15.47$, $p < 0.001$, $\eta^2_p = 0.01$, CI [0.00, 0.03]).

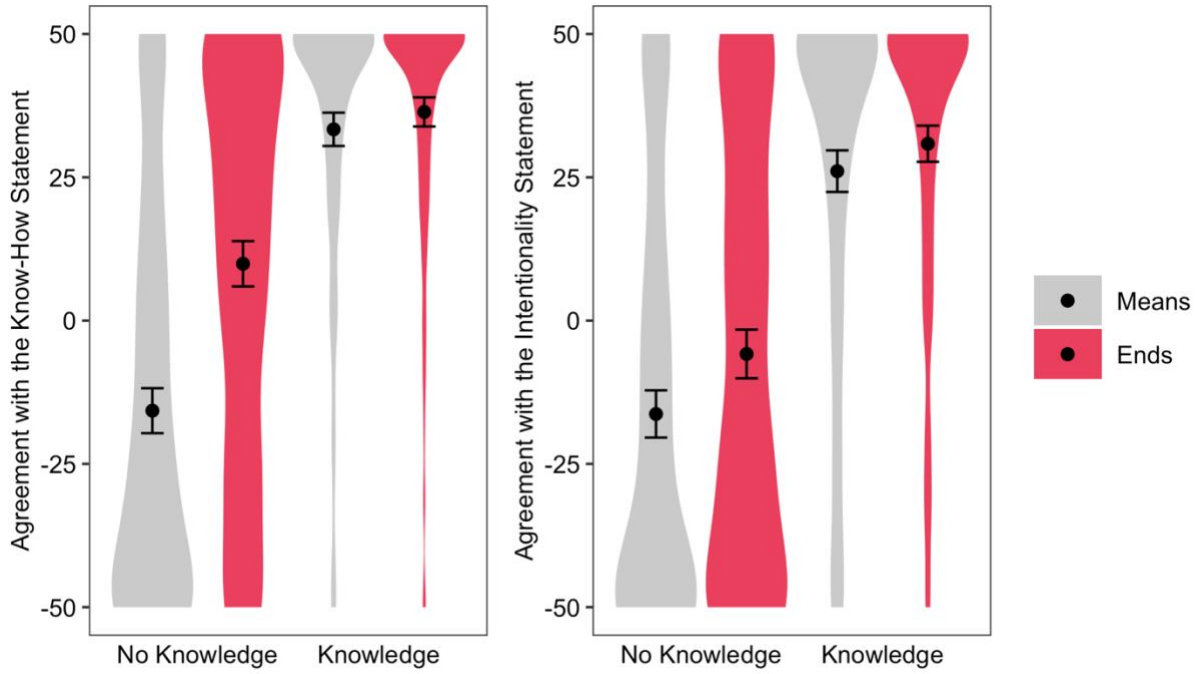

Figure 4. Mean agreement with the know-how and intentionality statements in Experiment 4. Error bars indicate 95% confidence intervals. Gold points and lines removed for figure clarity.

5.5 Discussion

In Experiment 4, we found an interaction between the agent's knowledge of how to bring about the means and the outcome for participants' know-how judgments. Specifically, we found a know-how effect when the agent did not know how to bring about the means, but we had no evidence for a know-how effect when the agent knew how to bring about the means. This pattern of know-how judgments was predicted by the know-how hypothesis. For intentionality judgments, however—although the superficial pattern of judgments is exactly as we predicted—we found no evidence that there was an interaction between the agent's knowledge of how to bring about the means and the outcome. For participants' intentionality judgments, we found

only an overall Kraemer effect and an overall effect of the agent's knowledge-how to bring about the means.

There could be a number of reasons for the lack of evidence for an interaction in this experiment. One reason for this is that we might still be underpowered to detect an ordinal interaction, as interactions are notoriously difficult to estimate (Gelman et al., 2020). We expected a smaller Kraemer effect in the knowledge condition, as we get in Experiment 3; this is the least likely case where we should find it. As such, the ability for us to find an ordinal interaction where we find the Kraemer Effect in the No-Knowledge conditions and where it disappears in the Knowledge conditions might require a very large sample.

Given this difficulty, we realized that there may still be a way for us to explore this interaction. If there are cases that elicit larger Kramer effects, then we might have a better chance of detecting an interaction using these cases. Luckily, there are some cases where we expect a larger Kraemer effect. While he used a dichotomous measure, Nadelhoffer's (2004; 2005) work on the Kraemer effect showed larger effects in moral scenarios than what we found in morally-neutral scenarios. These cases, we realized, might allow us to detect an interaction using an experimental design like that in Experiment 4. With this in mind, we first planned to run Experiment 5. In this experiment, we would first attempt to replicate the Kraemer effect in a moral scenario with a continuous measure. We would also test for a know-how effect and a mediation. Were we to find these results in a moral scenario, we would then plan to run a 2 x 2 experiment like Experiment 4 that used this moral scenario. If there were a larger Kramer effect using the moral scenario, we expected that we would be more likely to detect an interaction in this experiment. As we will see in Experiment 6, we found just this.

6 Experiment 5

This experiment aimed to test the predictions of the Know-How Hypothesis in a moral scenario. Moral versions of Kraemer's puzzle are an important motivation for the Intentionality Hypothesis. In cases where the end is morally wrong (such as killing Smith) but the means is morally neutral (such as pushing a button that randomly shoots an arrow down a path), people's judgments of intentional action show a large Kraemer effect (Nadelhoffer, 2004; 2005). As Nadelhoffer observes (2004: 283), finding the Kraemer effect in moral scenarios might suggest features of moral cognition produce this effect, rather than any differential perception of control. Indeed, Cova and colleagues (2012) developed an account on which intentional action ascriptions are ambiguous between different senses precisely in order to account for the ways in which moral considerations seem to affect people's tendency to ascribe intentional action in Kraemer's puzzle and in other contexts like Knobe's (2003a) side-effect effect.

In order to test whether the Know-How Hypothesis can explain the Kraemer effect in a moral scenario, we devised a fifth experiment, involving a version of our carnival vignette from Experiment 1 where the ends, but not the means, are morally wrong. We expected to replicate Nadelhoffer's (2004; 2005) results—i.e., a Kraemer effect in a moral scenario—using a continuous measure. The Know-How Hypothesis also predicts a corresponding know-how effect in this case—that people would be more inclined to judge that the agent knew how to bring about the ends relative to the means—and that the Kraemer effect would be mediated by people's judgments of know-how. We also expected a larger Kramer effect, which—if we found this—would allow us to be able to better detect the interaction we initially explored in Experiment 4.

6.1 Sample size

We kept the sample size the same as Experiments 1-3.

6.2 Participants

A total of 213 participants completed the experiment. 2 participants reported not paying attention. So, we analyzed data from the remaining 211 participants (M_{age} = 36, SD = 13.18, Range_{age} = [18–74], 47% female). After completing the survey, we compensated participants $0.35.

6.3 Materials and Procedure

After they consented to participation, participants read a moral version of the carnival vignette from Experiment 1:

> Joan has the opportunity to pull a lever that will randomly shoot a lethal arrow down exactly one of ten specified paths.
>
> A person named Bill is at the end of one of the ten paths. If Joan pulls the lever and the lethal arrow shoots down the path with Bill on it, then Bill will die.
>
> Joan has no idea which path the arrow will shoot down if she pulls the lever. But she does know that Bill is down path eight. And Joan really wants to kill Bill.
>
> Hoping to kill Bill, Joan pulls the lever. To her great satisfaction, the arrow shoots down path eight, and Bill is killed.

Participants then reported their agreement with the following statements on the same scale as all other experiments:

Joan knows how to kill Bill.

Joan knows how to make the arrow shoot down path eight.

Joan intentionally killed Bill.

Joan intentionally made the arrow shoot down path eight.

Statements were displayed in randomized order with the vignette displayed again on the same page.

6.4 Results

Participants agreed to a greater degree that the agent knew how to perform the ends (M = 17.69, SD = 30.52, n = 209) than that the agent knew how to perform the means (M = -30.12, SD = 28.60, n = 209) (t(414.27) = 16.52, p < 0.001, d = 1.61, CI [1.39, 1.83]). Participants agreed also to a greater degree that the agent intentionally performed the ends (M = 31.81, SD = 28.48, n = 211) than that the agent intentionally performed the means (M = -23.29, SD = 33.97, n = 211) (t(407.58) = 18.05, p < .001, d = 1.75, CI [1.53, 1.98]) (Figure 5).

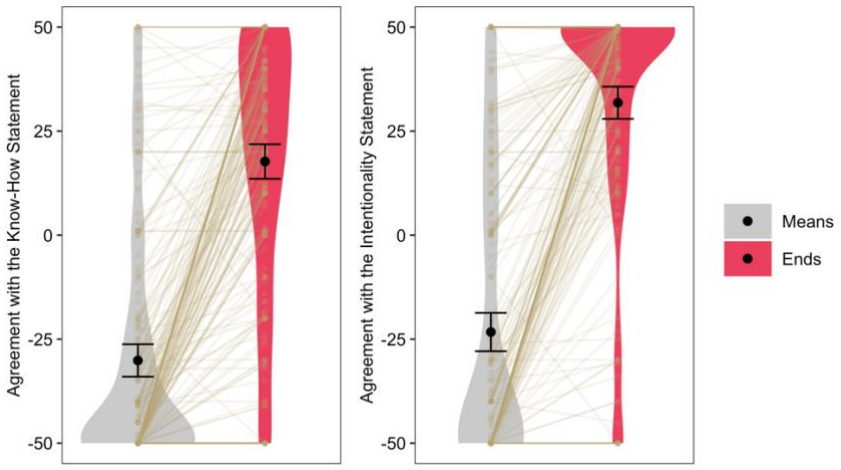

Figure 5. Mean agreement with the know-how and intentionality statements in Experiment 5. Error bars indicate 95% confidence intervals. Gold points and lines represent individual participant responses.

To investigate the relationship between know-how and intentionality judgments, we then conducted a mediation analysis. There was a partial mediation (ACME = -29.62, $p < .001$, CI [-35.04, -24.80]) such that the direct effect remained significant in the mediation model (ADE = -25.75, $p < .001$, CI [-32.23, -19.85]).

6.5 Discussion

We conceptually replicated the Kramer effect in a moral scenario (Nadelhoffer, 2004) with a continuous measure: people were more inclined to agree that the agent intentionally brought about the morally bad ends than that the agent intentionally brought about the means. As predicted, we also found a know-how effect in this moral scenario: people were more inclined to agree that the agent knew how to bring about the morally bad ends than that the agent knew how to bring about the means. We also found a partial mediation (proportion mediated = 0.53),

suggesting that—in accordance with the Know-How Hypothesis—a considerable part of the Kraemer effect observed in moral scenarios is indeed explained by know-how.

For this experiment using a moral case, however, we found only a partial mediation, whereas we found a full mediation in Experiment 1. This finding suggests that while know-how explains the Kraemer effect in morally-neutral cases, it is only part of the explanation for the larger Kraemer effect that we observe in moral scenarios. Moral aspects of the case seem to increase the size of the Kramer effect. We take this to indicate that previous work on these moral cases (Nadelhoffer, 2004; 2005) is right to identify other features of moral cognition as relevant to the explanation for the Kraemer effect in moral scenarios. We have shown, however, that judgments of know-how play a considerable role in explaining the Kraemer effect overall. Future work will have to further explore the role of other aspects of moral cognition in these cases.

7 Experiment 6

The aim of this experiment was to investigate the same kind of interaction we explored in Experiment 4 using a moral scenario. In Experiment 4, it seemed that the failure to detect an interaction between the agent's knowledge of how to bring about the means and the outcome was due to insufficient power given the small size of the Kraemer effect in morally-neutral scenarios. In Experiment 5, which used a moral scenario, we found a large Kraemer effect—qualitatively larger than those found in morally-neutral scenarios (see Experiment 1). As such, we thought that we might be better able to detect an interaction using this moral scenario.

Thus, we planned an experiment using a version of our moral scenario from Experiment 5. In this experiment, we ran a 2 (Knowledge|No Knowledge) x 2 (Means|Ends) x 2 (Intentionality Judgment|Know-How Judgment) mixed-design experiment, where we

manipulated the agents' knowledge of how to bring about the means between participants and where participants responded to all measures. We predicted that, by manipulating the agents' knowledge about how to bring about the means and nothing else, we would find an interaction between the agent's knowledge about how to bring about the means and the outcome and that both the Kraemer effect and the know-how effect would be significantly reduced in the knowledge condition.

7.1 Sample size

We used the same sample size as Supplementary Experiment 3. So, we planned to recruit 230 participants and then replicate the experiment if we were under-powered.

7.2 Participants

A total of 230 participants completed the experiment. 2 participants reported not paying attention. So, we analyzed data from the remaining 228 participants (M_{age} = 37, SD = 12.55, Range_{age} = [18–80], 47% female). After completing the survey, we compensated participants $0.35.

7.3 Materials and Procedure

After they consented to participation, participants read a modified version of the vignette from Experiment 5—the only difference was that we added a paragraph between what was the third and fourth paragraphs. In the No-Knowledge Condition, the new paragraph read:

> Unbeknownst to Joan, the lever is fixed, so the lethal arrow will definitely shoot down path eight if the lever is pulled.

In the Knowledge Condition, the new paragraph read:

> Just before her turn, Joan is informed that the lever is fixed, so the lethal arrow will definitely shoot down path eight if the lever is pulled.

Participants then responded to all four of the the same dependent measures about intentionality of know-how of the means or the ends that were used in Experiment 5. Each measure was displayed in randomized order on a new page with the vignette displayed again.

7.4 Results

For know-how, there was an interaction between Outcome and Knowledge ($F(1, 449) = 24.15$, $p < .001$, $\eta^2_p = 0.05$, CI [0.02, 0.10]) (Figure 6). There was a main effect of Knowledge ($F(1, 449) = 319.32$, $p < .001$, $\eta^2_p = 0.42$, CI [0.35, 0.47]), and there was a main effect of Outcome ($F(1, 449) = 160.50$, $p < 0.001$, $\eta^2_p = 0.26$, CI [0.20, 0.33]).

To decompose the interaction for know-how, we investigated the simple main effects of Outcome at each level of the Knowledge factor. In the No-Knowledge Condition, participants agreed to a greater degree that the agent knew how to perform the ends ($M = 8.79$, $SD = 31.47$, $n = 115$) than that the agent knew how to perform the means ($M = -35.82$, $SD = 24.31$, $n = 114$) ($t(449) = 12.43$, $p < .001$, $d = 1.64$, CI [1.37, 1.91]). In the Knowledge Condition, participants agreed to a greater degree that the agent knows how to perform the ends ($M = 41.92$, $SD = 14.23$, $n = 113$) than that the agent knows how to perform the means ($M = 22.38$, $SD = 34.18$, $n = 111$) ($t(449) = 5.38$, $p < .001$, $d = .72$, CI [.45, .98]).

For intentionality, there was an interaction between Outcome and Knowledge ($F(1, 450) = 43.46$, $p < .001$, $\eta^2_p = 0.09$, CI [0.04, 0.14]) (Figure 6). There was a main effect of Knowledge

(F(1, 450) = 160.70, $p < .001$, $\eta^2_p = 0.26$, CI [0.20, 0.33]), and there was a main effect of Outcome (F(1, 450) = 277.67, $p < 0.001$, $\eta^2_p = 0.38$, CI [0.32, 0.44]).

To decompose the interaction for intentionality, we investigated the simple main effects of Outcome at each level of the Knowledge factor. In the No-Knowledge Condition, participants agreed to a greater degree that the agent intentionally performed the ends (M = 29.52, SD = 26.91, n = 115) than that the agent intentionally performed the means (M = -28.67, SD = 27.54, n = 114) ($t(450) = 16.47$, $p < .001$, $d = 2.18$, CI [1.91, 2.44]). In the Knowledge Condition, participants agreed to a greater degree that the agent intentionally performed the ends (M = 44.85, SD = 12.80, n = 113) than that the agent intentionally performed the means (M = 19.74, SD = 34.84, n = 112) ($t(450) = 7.04$, $p < .001$, $d = .94$, CI [.67, 1.21]).

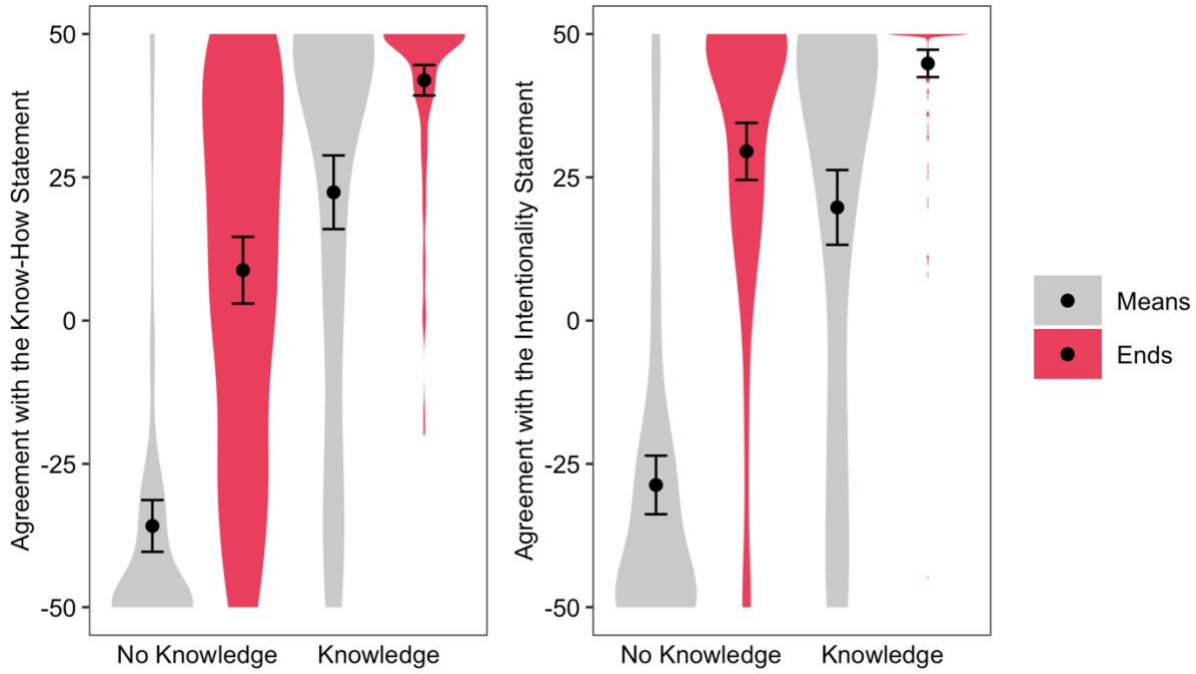

Figure 6. Mean agreement with the know-how and intentionality statements in Experiment 6. Error bars indicate 95% confidence intervals. Gold points and lines removed for figure clarity.

7.5 Discussion

In Experiment 6, we found an interaction between the agent's knowledge of how to bring about the means and the outcome for participants' know-how judgments. Specifically, we found a know-how effect when the agent did not know about how to bring about the means, and we found a smaller know-how effect when the agent knew about how to bring about the means. We also found an interaction between the agent's knowledge of the means and the outcome for intentionality judgments. Specifically, we found a Kraemer effect when the agent did not know about how to bring about the means, and we found a smaller Kraemer effect when the agent knew how to bring about the means.[5] These findings support our know-how hypothesis and suggest that our inability to detect an interaction in Experiment 4 might have been due to a lack of power.

While our manipulation reduced the Kraemer effect, it did not completely eliminate the Kraemer effect in the knowledge condition. The same holds, however, for the know-how effect, suggesting that the two effects occur together in accordance with the Know-How Hypothesis.

It is an interesting question, however, why the know-how effect persists in the knowledge-condition—that is, why people are less inclined to judge that the agent does not know how to bring about the means relative to the ends when the agent is informed that the means are fixed. There might be a simple explanation for this finding. In the knowledge condition, the agent, since they know that the lever is fixed, knows more about the means than they do in the no-knowledge condition. So, the know-how effect is considerably reduced. Nevertheless, the

[5] We initially planned to replicate this experiment with a larger sample if we were underpowered. A post-hoc power analysis suggested that we were not under-powered (see Supplementary Materials for details). So, we did not replicate this with a larger sample.

agent's acquisition of the relevant knowledge is much different than the ordinary acquisition of knowledge-how. In the knowledge condition, the agent came to know that pulling the level is a reliable way to bring about the ends by being told so—not by virtue of the agent's using it. By contrast, people come to know how to perform ordinary activities, like playing pickleball, by playing and practicing over time, not simply by being told how to do it. And people might be more resistant to attributing knowledge to the agent that acquires know-how simply by being told. We suspect this aspect of our manipulation might explain both the residual know-how effect and part of the Kraemer effect in the knowledge conditions.[6] Future work will have to investigate this issue further.

8. General Discussion

The Kraemer effect is mysterious: why is it that people judge that agents bring about ends intentionally but also that they do not bring about the means that brought about those ends intentionally, even though bringing about the means and the ends is just as likely? Researchers have primarily discussed Kraemer's puzzle as showing an asymmetry in our concept of intentionality or an ambiguity in the ascriptions of intentional action (e.g., Nadelhoffer, 2004; 2006; Cova et al., 2012). In this manuscript, we offer a new account: perceived differences in agents' know-how explain the Kraemer effect.

The results of six experiments support this hypothesis. In Experiment 1, we conceptually replicated the Kraemer effect in a variety of non-moral scenarios (Nadelhoffer, 2004; 2005), and

[6] It is important to note that in Experiment 2 a similar manipulation leads people to agree completely with the know-how judgment for both means and ends. There is, however, an important difference between the vignette in Experiment 2 and the knowledge condition in Experiment 6: only in the former is the agent explicitly described as knowing how to perform the means. Participants in Experiment 2 read the statement "Jane is aware of this, so she knows how to open door three." In Experiment 6, participants were not explicitly told that the agent knew how to bring about the means. This difference might explain why participants' responses are at ceiling in Experiment 2.

we found a new effect uniquely predicted by our new hypothesis: the know-how effect, where people are less inclined to judge that the agent knew how to bring about the means relative to the ends. We also found that people's intentionality judgments that give rise to the Kraemer effect are fully mediated by people's know-how judgments. In Experiment 2, we found that reducing the know-how effect reduces the Kraemer effect. In Experiment 3, we ruled out a common-cause hypothesis. In Experiment 4, we failed to find an interaction between the agent's knowledge about how to bring about the means and the outcome. Thinking that the lack of an interaction was due to power, we ran Experiment 5, where we found a large Kraemer effect in a moral scenario. We also found that know-how explains a considerable part of the Kraemer effect in moral scenarios. As expected, in Experiment 6, we found an interaction between the agent's knowledge of how to bring about the means and the outcome in a moral scenario. Together, these results support our Know-How hypothesis.

These results are also important for adjudicating between different views about the ordinary concept of know-how. On some accounts, there should not be a difference in people's judgments of know-how for the means and the ends (e.g., Ryle, 1949). Suppose one believes, for example, that having know-how is a matter of having a disposition to behavior (e.g., Ryle, 1949; Markie, 2015). On this view, knowing how to play tennis, for instance, is a matter of being disposed to play tennis when one wants to. On this kind of view, there should not be a know-how effect at all because there is no difference in an agent's disposition to bring about the means or the ends. Brown, for instance, is as disposed to winning a dice game as he is to rolling a six. But we do consistently find a know-how effect. So, some common views of know-how like this one do not accord with our findings. As such, these results present a major challenge to many of these philosophical accounts.

Other views of know-how, however, predict the know-how effect (Stanley & Williamson, 2001; Bengson & Moffett, 2011; Pavese, 2015; Levy, 2017). Specifically, a view on which know-how involves knowledge of reliable ways to perform an action predicts a know-how effect (Bengson & Moffett, 2011; Pavese, 2015; Levy, 2017). On these views, Brown, for instance, knows a reliable way to win the dice game (i.e., rolling a six), but he does not know any reliable way to roll a six. Indeed—as we have seen from Experiment 3 and Experiment 6—manipulating the agents' knowledge of reliable ways to bring about the means affects the size of both the Kraemer effect and the know-how effect. So, our work on Kraemer's puzzle and the know-how effect suggest that the ordinary concept of know-how is one on which, for one to know how to perform an action, one needs to know a reliable way to perform it. As such, it contributes to the recent discussion on the nature of the ordinary concept of know-how (Gonnerman et al., 2018; 2021; Pavese et al., 2023).

8.1 Objections to the Know-How Hypothesis

Some readers may have objections to the Know-How Hypothesis. As a first objection, one might wonder whether the Know-How Hypothesis makes the right predictions in all of the cases used to test the Kraemer effect. For example, Setiya (2012: 286-7) consider cases like the following:

> I am trying to defuse a bomb, staring with confusion at an array of colored wires. Which one to cut? In desperation, not having a clue what the wires do, whether they will trigger the bomb or not, I disconnect the red wire—and the timer stops. Even though I did not know how to defuse the bomb, and managed to do so through dumb luck, I count as having defused the bomb intentionally.

Here, it seems that I intentionally defused the bomb even though I did not intentionally cut the right wires. According to Setiya (2012), that is so even though I did not know how to defuse the bomb. As such, he argues that one might intentionally perform some end without knowing how

to perform it. Thus, Setiya concludes that the sort of examples giving rise to Kraemer's puzzle constitutes a direct counterexample to the view that intentional action requires know-how.

The Know-how Hypothesis, however, also accounts for the pattern of judgments in the cases that Setiya considers. Recall that the Know-How Hypothesis explains the Kraemer effect in terms of a perceived difference in the *degree to which* one knows how to perform the ends relative to the means. Know-how comes in degrees as it is shown by the fact that know-how ascriptions are gradable (Pavese, 2017). While in the defusing bomb example I have no clue about which wire to cut, there is, nonetheless, a difference in the degree to which I know how to cut the right wire and the degree to which I know how to defuse the bomb. I know more about how to defuse the bomb than I know about how to choose the right wire, since I know that I can defuse the bomb by cutting the right wire even though I know of no reliable way to choose the right wire. This perceived difference in the degree of know-how, according to the Know-How Hypothesis, accounts for our judgments in Setiya's bomb-defusing case.

Consider also the following difficult case from Nadelhoffer (2005: 349):

> Imagine that Fred is playing a new kind of lottery machine for $1,000,000. In order to win, he must type in the correct ten-digit code. Vividly aware that the odds against typing in the correct code are astronomical, Fred pays his $1 and decides to give it a try. He punches in the first ten digits that come into his head, in that order, believing of his doing so that it 'might thereby' win him the $1,000,000. Amazingly, he punches in the correct code and wins the lottery!

In this scenario, Nadelhoffer (2005) found no Kraemer effect: people tended to judge that Fred did not intentionally win the lottery and that Fred did not intentionally punch the correct ten-digit code. At first glance, it might seem that the Know-How Hypothesis fails to make this prediction. This pattern of judgments, however, is exactly what the Know-How Hypothesis predicts. As we mentioned in our introduction, Pavese and colleagues (2023) found that people are disinclined to

ascribe know-how and intentional action in lottery cases.[7] So, the Know-how Hypothesis predicts no Kraemer effect in this case, since it predicts no know-how effect.[8] While there might be further difficult cases and objections to our hypothesis, so far it handles the difficult cases and objections in the literature.

Finally—as a reviewer brought to our attention—one might reasonably wonder whether the findings in Experiment 5 and 6 provide evidence in support of the Intentionality Hypothesis. Compare the results for the non-moral cases in Experiment 1 to the results for the moral cases in Experiment 5. In the non-moral cases in Experiment 1, the mean rating for the claim that the agent intentionally brought about the end was -10.97 (slightly disagreeing), whereas in the moral cases in Experiment 5, the mean rating for the claim that the agent intentionally brought about the end was 31.81 (agreeing). One might object that this difference is not explained by know-how, since if one looks at the know-how judgments, one does not find the same difference between the two experiments (M = 17.69 in the moral case in Experiment 5 and M = 12.91 in the non-moral cases in Experiment 1).

We have two responses to this concern. First, as noted in Section 7.5, we did not develop the experiments to test for differences between the moral and the non-moral cases, so we are careful not to draw any definitive conclusions about quantitative differences across experiments between the moral and the non-moral cases. As noted in Section 2.5, we are also careful not to

[7] It is important to note that Nadelhoffer (2005) used a dichotomous measure for this study. As such, we cannot rule out *a priori* that if this experiment were replicated with a continuous measure, there would be a Kraemer effect such that people would be more inclined to disagree that the agent brought about the means intentionally relative to the ends. If an experiment found this result, the Know-How Hypothesis predicts that there should also be a corresponding know-how effect.

[8] It is an interesting question why people are so reliable in judging that an agent cannot know how to win a fair lottery. The answer to this question might be that winning a fair lottery is not an *action*—something that an agent does—rather it is something that *happens to* an agent. In this respect, it differs from engaging in other competitions and games. As such, it is not the sort of thing that an agent can intentionally perform or even know how to perform. Indeed, philosophers generally accept that only actions are the sort of things that an agent can know how to do (Ryle, 1949; Stanley & Williamson, 2001; Pavese, 2016).

assume that in the non-moral cases, people tend to slightly disagree with the intentionality statements about the ends, since we do not find this in a between-participants experiment (see Supplemental Materials). Moreover, although the difference between the know-how judgments in the moral (M = 17.69) and non-moral cases (M = 12.91) does not appear to be as large as what we find for intentionality judgments, it is not entirely negligible either. This suggests that moral considerations might also affect judgments of know-how. Future work should explore these comparisons in a controlled experiment.

Second, we do not think the relevance of moral considerations for judgments of intentional action supports the Intentionality Hypothesis as a better theory of the general Kraemer effect than the Know-How Hypothesis. As Experiments 1-4 indicate, we find the Kraemer effect in non-moral cases, and this difference is fully explained by know-how. As the mediation results in Experiment 6 suggest, moreover, even in the moral cases, a sizable portion of the Kraemer effect is explained by know-how judgments. We take this to indicate that although moral considerations are relevant to explaining the difference in judgments between the moral and non-moral cases—as the proponents of the Intentionality Hypothesis might emphasize—the further complexities invoked by the Intentionality Hypothesis are not needed to explain the general Kraemer effect that we observe in the non-moral cases. So, while we take these final set of results to provide further evidence that moral cognition is relevant to explaining the differences between the moral and non-moral cases, we also take it that the Know-How Hypothesis suffices to explain the general Kraemer effect we set out to explain.

8.2 Know-How, Skills, and Control

Our discussion of Kraemer's puzzle is also relevant for the question as to whether skill itself plays a role in the folk psychology of intentional action. Citing beginners' luck cases and lottery cases—where the agents lack the skill to perform the action and do not perform actions intentionally—many researchers have independently hypothesized that people's judgments about whether an agent acted intentionally depends on whether people think that the agent possess the skill to perform it (e.g., Ryle, 1949; Heider, 1958; Mele & Moser, 1994; Malle & Knobe, 1997; Malle, 2003; Guglielmo et al., 2009; Guglielmo & Malle, 2010; Setiya, 2012; Shepherd, 2021; Pavese & Beddor, 2022). On these views, one can only shoot an arrow at a target intentionally if one is skilled at archery. Traditionally, Kraemer's puzzle challenges this kind of view. For example, Nadelhoffer (2004: 283) so comments on his experimental results on moral versions of Kraemer's puzzle:

> It appears that when it comes to people's judgments of intentionality, considerations of luck and skill can sometimes be trumped by moral considerations – which spells bad news for any analysis of intentional action that has skill as a necessary condition.

The evidence we presented in this article suggests that perhaps Nadelhoffer's comment is worth revisiting, for the concept of know-how and that of skills are importantly related. Many philosophers argue that a person is skilled at an action when one knows how to perform it (e.g., Ryle, 1949; Setiya, 2012; Cath, 2015; Pavese, 2016; 2018). For example, one can only be skilled at archery if one knows how to shoot an arrow. Our work on judgments of know-how deepens the connection between skills and intentional action. Further work can explore this connection as it may resolve further issues in the folk psychology of intentional action (Setiya, 2012; Pavese, 2016; 2017; Shepherd, 2021; Pavese, 2021; Beddor & Pavese, 2022; Pavese & Beddor, 2022; Pavese et al., 2023).

The Know-How Hypothesis also comports well with—and indeed supplements—Kraemer's (1978) original explanation for the puzzle. As we discussed in our introduction, Kraemer (1978: 116-17) argued that the puzzle arises because of a fundamental difference in the amount of control that the agent has over the means relative to the end. While Kraemer's control explanation is plausible, the way Kraemer explained control—i.e., in terms of whether the agent is in position of opting out—did not seem to provide a satisfactory explanation for Kraemer's puzzle. After all, Brown seems to be in the position to opt out of winning the game just as he is in the position to opt out of rolling a six. As such, if control plays a role in explaining the Kraemer effect, it cannot be because of a perceived difference in the opportunity to opt out. But then how are we to think of control in such a way to overcome the puzzle?

Our account helps address this question. According to an increasingly popular theory of control in action theory (e.g., Wu, 2016; Shepherd, 2021; Beddor & Pavese, 2022), an agent's control over action requires the agent's know-how. According to this view, people should judge that Brown has control over winning the game since he knows how to win it but also that he does not have control over rolling a six since he does not know how to roll a six in a fair dice game. According to this approach, people's judgments of intentional action might well be affected by judgments of control—though control has less to do with whether the agent can opt out of the task, as Kraemer originally suggested, and more to do with whether the agent knows how to perform it. Thus, the Know-How Hypothesis captures the core insight of Kraemer's original solution, by supplementing it with a cognitive theory about control and knowledge-how in intentional action. Future work might further explore the implications of this insight (Pavese, 2018; 2020; 2021; Piñeros Glasscock, 2020; Beddor & Pavese, 2022; Pavese et al., 2023).

8.4 Conclusion

People's judgments of intentionality sometimes show the Kraemer effect: people judge that agents bring about ends intentionally but also that they do not bring about the means that brought about those ends intentionally—even though bringing about the ends and means is just as likely. In this article, we explored a new explanation for the Kraemer effect—the Know-How Hypothesis: a perceived difference in the extent to which agents know how to bring about the means and the ends explains the Kraemer effect. In six experiments, we find evidence that supports it. This work accords with a burgeoning area of action theory that identifies an important connection between know-how and intentionality (Ryle, 1949; Cath, 2015; Pavese, 2018; 2020; 2021; Beddor & Pavese, 2022; Pavese et al., 2023). We conclude that this understanding of the Kraemer effect in terms of know-how provides a satisfying solution to Kraemer's puzzle.

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