

A proximity effect in adults' contamination intuitions

Laura R. Kim*

Nancy S. Kim†

Abstract

Magical beliefs about contagion via contact (Rozin, Nemeroff, Wane, & Sherrod, 1989) may emerge when people overgeneralize real-world mechanisms of contamination beyond their appropriate boundaries (Lindeman & Aarnio, 2007). Do people similarly overextend knowledge of *airborne* contamination mechanisms? Previous work has shown that very young children believe merely being close to a contamination source can contaminate an item (Springer & Belk 1994); we asked whether this same hyper-avoidant intuition is also reflected in adults' judgments. In two studies, we measured adults' ratings of the desirability of an object that had made contact with a source of contamination, an object nearby that had made no contact with the contaminant, and an object far away that had also made no contact. Adults showed a clear *proximity effect*, wherein objects near the contamination source were perceived to be less desirable than those far away, even though a separate group of adults unanimously acknowledged that contaminants could not possibly have made contact with either the nearby or far-away object (Study 1). The proximity effect also remained robust when a third group of adults was explicitly told that no contaminating particles had made contact with the objects at any time (Study 2). We discuss implications of our findings for extending the scope of magical contagion effects beyond the contact principle, for understanding the persistence of intuitive theories despite broad acceptance of science-based theories, and for constraining interpretations of the developmental work on proximity beliefs.

Keywords: reasoning; beliefs; health; contamination; proximity.

1 Introduction

People often resist reconciling their intuitive beliefs about the world with more recently learned theories uncovered by science. For example, people may intuitively cling to the belief that catching a cold is directly caused by exposure to cold temperatures. Although scientific research has revealed alternative mechanisms (e.g., rhinovirus transmission) that have come to be broadly accepted by the lay public, people may nonetheless behave in accordance with their initial belief. From a real-world perspective, our intuitive theories are critical to examine because although they can often be irrational and unsupported by science, they can still strongly influence our behaviors (Leventhal, Brissette, & Leventhal, 2003). For instance, people's excessive avoidance of AIDS patients, despite explicit knowledge that HIV cannot be

transmitted via casual contact, is partially fueled by non-scientific, intuitive theories of contamination (Connors & Heaven, 1990; Furnham & Proctor, 1992).

In general, such irrational or magical beliefs may emerge when people's core intuitive knowledge and assumptions about major domains (i.e., intuitive biology, intuitive physics, and intuitive psychology; Carey & Spelke, 1994; Wellman & Gelman, 1992) are inappropriately overgeneralized to other domains or situations (Lindeman & Aarnio, 2007; White, 2009). For example, beliefs about contamination that are correct within the biological domain can be overextended to the psychological domain, yielding behaviors consistent with the belief that a socially disliked person can somehow transmit undesirable properties onto objects he or she touches (Hirschfeld, 2002; Rozin, Nemeroff, Wane, & Sherrod, 1989).

Perhaps the most well-known of such overextensions of domain knowledge is the *magical contagion effect* in adults, wherein people permanently reject objects that had come into even brief, innocuous contact with an aversive source (Nemeroff & Rozin, 2004). For example, adults rejected a thoroughly washed sweater worn by a homeless person (Rozin et al., 1989) and juice touched by a sterilized cockroach (Rozin, Millman, & Nemeroff, 1986). In these instances, there is no real danger of contamination (Nemeroff & Rozin, 2004), yet even when any physical justification for rejection is removed (e.g., via washing or sterilization), people continue to reject the contacted object.

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*Department of Psychology, Northeastern University

†Corresponding author: Department of Psychology, 125 Nightingale Hall, Northeastern University, 360 Huntington Avenue, Boston, MA 02115, USA. E-mail: n.kim@neu.edu.

In studies such as these, Rozin and colleagues demonstrated modern adults' adherence to several key features of the anthropologically and historically documented *magical law of contagion* (e.g., Tylor, 1871/1974), which fundamentally states that objects "once in contact are always in contact." First, people behave as though physical contact is critical for undesirable properties to be transmitted; second, the contagion is characterized by dose insensitivity, such that even the briefest and most negligible contact is believed to transmit a substantial amount of undesirable properties that can then be transmitted on to other objects; third, the contagion is characterized by relative permanence in that it is believed to persist for a long time after the contact has ceased and is impervious to washing or sterilization (Rozin, Markwith, & Nemeroff, 1992). Rozin and colleagues thereby clearly argued, and showed, that contact is the central characteristic of the magical contagion effect (e.g., Rozin et al., 1989).

In the current studies, we asked whether adults also adhere to magical beliefs about contamination from nearby sources even in the complete absence of contact (the *proximity effect*, henceforth). Given the absence of contact, the proximity effect is conceptually distinct from the magical law of contagion ("once in contact, always in contact"). In theory, the existence of a proximity effect is highly plausible if the classic magical contagion effect is driven by an overgeneralization of real-world contamination mechanisms, as previously argued (Lindeman & Aarnio, 2007). The proximity effect, if obtained, could readily be construed as an overextension of known mechanisms for *airborne* contamination to situations in which it is clearly impossible.

There is some prior evidence that very young children behave as though an item is contaminated just by being near a contaminant (Rosen & Rozin, 1983; Toyoma, 1999). In one developmental study, for example, Springer and Belk (1994) told children one of several stories about a boy who drank a glass of juice. In their "physical contact" story, a bug first fell into the juice and was removed; in their "proximity" story, the bug was near the juice but never made contact with it. Most 7–8-year-olds in their study rejected the juice only in the physical contact story. In contrast, a significant portion of the 3–4-year-olds in their study also rejected the juice in the proximity story, demonstrating the proximity effect.

Given this apparent developmental shift between age groups in showing the proximity effect, researchers have generally attributed the effect to insufficient knowledge and magical thinking in very young children, suggesting that it may reflect ignorance of real-world mechanisms of contamination (Rosen & Rozin, 1983; Springer & Belk, 1994). Indeed, there has been little or no evidence to suggest otherwise, as experiments on the proximity effect have rarely been attempted with adults, who presumably

know the correct mechanisms of contamination.

If even the most minimal contact with the source was clearly and completely eliminated, would adults still behave as though contamination occurs? Whether adults show such an overextension of knowledge about airborne contamination is an open question. One possibility is that by adulthood, such naïve, radically inaccurate theories of contamination have been edited or replaced by more scientifically grounded theories. Alternatively, such intuitions may run deeply and persistently, and only be overriden in specific, learned cases such as bug-and-juice scenarios. For example, older children and adults may have repeatedly encountered bug-and-juice scenarios in real life, and have explicitly learned to accept juice that is proximal to a contaminant, despite their intuitions. In our study, we used scenarios that even adults would not encounter frequently, thereby increasing our ability to measure their intuitive, unpracticed responses.

Previously, only Toyoma (1999) reported preliminary evidence for a proximity effect in both children and adults, using verbally described scenarios in which a child came upon a glass and found that it had a contaminant (e.g., a roach) either inside or next to the glass. However, in that study, it was very ambiguous as to whether contact with the contaminant had ever occurred before the child's encounter with them (e.g., a live roach could have crawled anywhere prior to that moment, making it perfectly reasonable to reject the glass). This is a critical problem, given that work on the dose insensitivity principle (e.g., Rozin et al., 1992) has repeatedly shown that even the briefest and tiniest point of contact is still treated as contact, following the magical law of contagion. Therefore, it remains unknown whether adults would show a true proximity effect, such that they reject an item *while believing* that its contamination was physically impossible.

Similarly, studies using "chain of contagion" tasks cannot be construed as definitive tests of the proximity effect. In such tasks, a clean pencil is touched to a contaminant, a second clean pencil is then touched to the first pencil, and so on for a total of 12 pencils, with contamination judgments made for each pencil in the chain (Cisler, Adams, Brady, Bridges, Lohr, & Olatunji, 2011; see also Tolin, Worhunsky, & Maltby, 2004). These studies showed that adults' judgments of contamination decrease moving down the chain, and never come close to zero. However, in this paradigm, contact clearly occurred at each point in the chain. Therefore, contamination beliefs about the second pencil can be explained in that the second pencil made physical contact with the now-contaminated first pencil, which, by the magical law of contagion, allowed the first pencil to transmit the contagion. Adults' judgments in this task thereby demonstrated adherence to the magical law of contagion and its principles (e.g., physical

contact, dose insensitivity, and permanence), but the task does not constitute a clear test of the proximity effect.

Finally, the well-known study wherein people rejected fudge shaped to look like feces (Rozin et al. 1986) cannot reasonably be reinterpreted as having shown the proximity effect. Although no contact with a contaminant was involved in that study paradigm, neither was the effect of proximity to a contaminant tested. That is, in that study, there was no contaminant to which an object could be proximal. Rozin et al. (1986) instead designed the fudge-resembling-feces study as a test of a conceptually distinct, anthropologically documented law of sympathetic magic known as the *law of similarity*, which holds that “appearance is reality” (e.g., if it looks like feces, it must also share some of the other properties of feces). Accordingly, this study demonstrates that modern adults adhere to the law of similarity, but it does not, and indeed was never intended to, address the magical law of contagion (“once in contact, always in contact”) or the possibility of a proximity effect.

Thus, a new investigation was needed to clearly test for the proximity effect. In the current studies, we used vignettes that we pre-tested to ensure it was clear that contact with contaminants had never occurred. We modified Rozin and colleagues’ well-known paradigm, in which they asked participants to rate the desirability of having contact with objects that had previously had contact with different sources. The current work departed clearly from Rozin and colleagues’ task in that participants rated the desirability of having contact with objects that had been in varying degrees of *proximity* with different sources. Contact with the aversive source was eliminated in the critical conditions to measure the effect of proximity.

2 Study 1

2.1 Material and methods

2.1.1 Participants

Forty Northeastern University undergraduate students participated. Thirty participated in the main study for introductory psychology course credit, and 10 completed a manipulation check task and received candy.

2.2 Materials and procedure

The 30 undergraduate participants in the main study read two vignettes (see Appendix for the full text). In one, the contaminant was vomit induced by motion sickness; in the other, it was gore from a murder scene. Three people were described in each vignette: an aversive *Source*; someone near the Source (*Near*, henceforth), and someone far from the Source (*Far*, henceforth). The mur-

der vignette involved two coworkers traveling to work, one by car (*Far*) and one by foot (*Near*). The *Near* coworker rested outside an abandoned building along the way. Neither the *Near* nor *Far* coworker realized that a third coworker (*Source*) was torturing and killing several people inside that building. In the vomit vignette, the *Far* coworker was in the back of a plane and the *Near* coworker was sitting in the row behind the *Source*, whose motion sickness caused him to vomit, cleanly, into a bag. Neither the *Far* nor *Near* coworker was aware of the vomiting incident.

Vignette order was counterbalanced between participants. For each, participants first paraphrased it aloud to confirm their comprehension, and were then told that all three coworkers were wearing sweaters that day (murder) or had received an apple for a snack, which they did not eat (vomit). All items had subsequently been thoroughly washed. Participants then rated the desirability of wearing each clean sweater (murder) or taking a bite of each clean apple (vomit). Ratings were made on a -100 to $+100$ scale, following Rozin et al. (1989), where -100 was the most unpleasant thing one could imagine and $+100$ was the most pleasant. All participants therefore made all 6 critical ratings in this within-subjects design.

2.2.1 Manipulation check

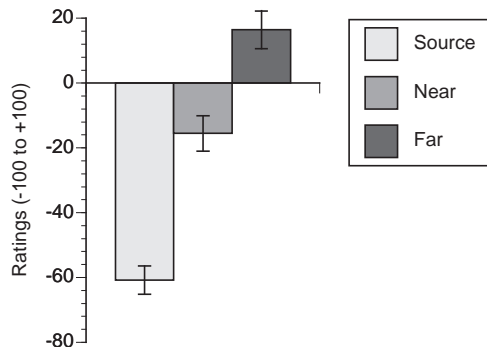
The separate group of 10 undergraduate participants in the manipulation check read both vignettes and judged whether the objects belonging to the *Near* and *Far* coworkers could have made contact with any contaminating particles. Importantly, the participants unanimously believed that no particles from the murder or the vomit had touched the sweaters or apples, respectively, of the *Near* or *Far* coworkers.

3 Results and discussion

3.1 Test for the proximity effect

A 2 (Vignette: Murder, Vomit) by 3 (Distance: Source, Near, Far) by 2 (Order: Murder first, Vomit first) mixed factor ANOVA revealed a significant main effect of Distance ($F[2,56] = 60.3$; $MSE = 1499.3$; $p < .001$; $\eta^2 = .68$). To test for the proximity effect, we compared ratings for *Near* versus *Far*. Although neither the objects belonging to the *Near* ($M = -15.6$, $SE = 5.3$) nor *Far* ($M = 16.5$, $SE = 5.7$) coworkers had made contact with any contaminants, the *Near* coworkers’ objects were considerably less desirable ($t[29] = 4.5$; $p < .001$; $\eta^2 = .41$; see Figure 1). This difference (difference in means = 32.1) showed that participants exhibited the proximity effect; that is, they preferred the object that had been farther from the aversive source, even though neither had touched it. Adults

Figure 1: Mean desirability ratings of objects of belonging to the Source, Near, and Far coworkers. Bars denote standard errors.



made their judgments as though contamination occurred via proximity, without a possible physical mechanism.

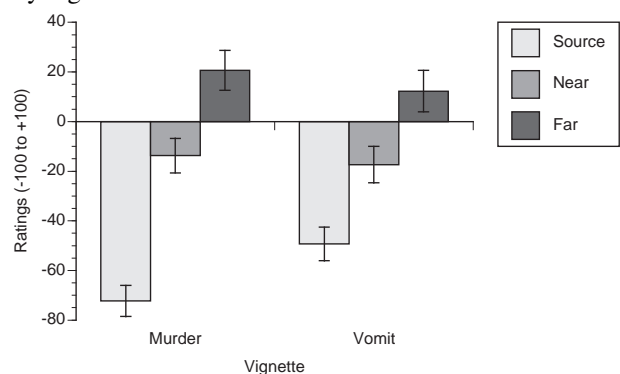
We also conducted separate ANOVAs for each vignette, and found main effects of Distance in both (murder: $F[2,56] = 49.7$; $MSE = 1331.5$; $p < .001$; $\eta^2 = .64$; vomit: $F[2,56] = 26.8$; $MSE = 1063.3$; $p < .001$; $\eta^2 = .49$). In the murder vignette, the sweater of the Near coworker ($M = -13.7$, $SE = 7.0$) was less desirable than that of the Far coworker ($M = 20.7$, $SE = 8.1$; difference in means = 34.4; $t[29] = 3.9$; $p < .001$; $\eta^2 = .34$). Similarly, in the vomit vignette, the apple of the Near coworker ($M = -17.3$, $SE = 7.4$) was less desirable than that of the Far coworker ($M = 12.3$, $SE = 8.3$; difference in means = 29.6; $t[29] = 3.4$; $p = .002$; $\eta^2 = .28$; see Figure 2). In other words, a strong proximity effect was found in both vignettes.

3.2 Secondary comparisons

Objects belonging to the Source ($M = -60.8$, $SE = 4.4$) were less desirable than objects belonging to the Near (difference in means = 45.2; $t[29] = 7.1$; $p < .001$; $\eta^2 = .64$) or Far (difference in means = 77.3; $t[29] = 10.1$; $p < .001$; $\eta^2 = .78$; see Figure 1) coworkers, ostensibly because the Source had generated the contaminant in each case.

The main ANOVA also revealed an interaction of Vignette and Distance ($F[2,56] = 4.8$; $MSE = 895.5$; $p = .012$; $\eta^2 = .15$; see Figure 2), which can be explained in that ratings for the murderer's sweater ($M = -72.3$, $SE = 6.3$) were lower than ratings for the apple belonging to the person who vomited ($M = -49.3$, $SE = 6.8$; difference in means = 23.0; $t[29] = 2.4$; $p = .025$; $\eta^2 = .16$; see Figure 2). No other effects or interactions were found (all p 's $> .394$; all $\eta^2 < .03$).

Figure 2: Mean desirability ratings of objects of belonging to the Source, Near, and Far coworkers, broken down by vignettes. Bars denote standard errors.



4 Study 2

In asking people to make all six judgments within-subject in Study 1, we essentially allowed them to deliberately take into consideration whether or not their judgments should be influenced by proximity. Presumably, they knew that doing so would violate known basic mechanisms of contamination, given that even airborne contamination was not possible in our scenarios. Systematic studies of similar within-subject designs have shown that people are perfectly willing to report when they believe the information manipulated between conditions does not make a difference to their judgments (e.g., Frisch, 1993), and furthermore are willing to report when information influenced their judgments even though they admitted it should not (e.g., Baron & Hershey, 1988). Thus, our study design should have been capable of showing a null effect of proximity if people believed that it did not matter to their judgments. Moreover, the separate group of people in the manipulation check acknowledged that no contaminating particles could possibly have made contact with any of the objects, and all of the objects were furthermore described as having been thoroughly washed before they were rated by people in the main study. Despite this, people still showed a clear proximity effect.

Nonetheless, we present Study 2 to address the possibility, however slim, that experimental demand to take proximity into account could have driven our results. In Study 2, we presented another group of people with the task from Study 1. This time, we explicitly stated that no actual physical contaminants had ever made any contact with the object. We added this text just prior to each one of the 6 ratings to ensure its salience. In doing so, we aimed to convey to participants that declining to differentiate between the Near and Far conditions would be a perfectly acceptable response. This statement had the additional benefit of ensuring that the same participants

who knew for certain that no contact with contaminants had occurred would also be the participants judging the desirability of the objects. We thereby eliminated any possible effects of some subset of participants wondering whether particles could have made contact with the objects via airborne transmission; the explicit statement simply makes it clear that this did not occur.

4.1 Material and methods

4.1.1 Participants

A separate group of 40 Northeastern undergraduates participated for partial introductory psychology course credit.

4.1.2 Materials and procedure

We used the same vignettes and rating questions used in Study 1, with added text immediately prior to each rating explicitly stating that the sweater or apple in question never came into direct contact with any particles of contaminant. Just as in Study 1, the object was also described as having been thoroughly washed. The remainder of the procedure was exactly the same as in Study 1.

4.2 Results and discussion

4.2.1 Test for the proximity effect

The main effect of Distance was replicated in Study 2 ($F[2,76] = 86.9$; $MSE = 1407.7$; $p < .001$; $\eta^2 = .70$). Critically, objects belonging to the Near coworker ($M = 13.1$, $SE = 5.2$) were much less desirable than those belonging to the Far coworker (difference in means = 16.4; $M = 29.5$, $SE = 5.8$; $t[39] = 3.9$; $p < .001$; $\eta^2 = .28$). Despite explicitly informing participants that no contact with contaminants had occurred, we again obtained a clear proximity effect. Within each vignette, the data showed the same pattern. In the murder vignette, the sweater of the Near coworker ($M = 8.0$, $SE = 8.4$) was less desirable than that of the Far coworker ($M = 26.4$, $SE = 7.4$; $t[39] = 3.5$; $p = .002$; $\eta^2 = .23$). In the vomit vignette, the apple of the Near coworker ($M = 18.2$, $SE = 7.0$) was less desirable than that of the Far coworker ($M = 32.7$, $SE = 6.7$; $t[39] = 2.3$; $p = .026$; $\eta^2 = .12$).

A 2 (Study: 1, 2) by 2 (Distance: Near, Far) mixed factor ANOVA revealed a marginally significant interaction of Study and Distance ($F[1,68] = 3.9$; $MSE = 532.0$; $p = .052$; $\eta^2 = .05$). The explicit reminder therefore marginally reduced the magnitude of the proximity effect in Study 2 relative to that found in Study 1; again, it should have created experimental demand in the opposite direction. Despite this, as the primary analyses above

showed, people persisted in producing a strong proximity effect ($p < .001$).

4.2.2 Secondary comparisons

As in Study 1, objects belonging to the Source ($M = -44.9$, $SE = 5.8$) were less desirable than objects belonging to the Near (difference in means = 58.0; $t[39] = 10.1$; $p < .001$; $\eta^2 = .72$) and Far coworkers (difference in means = 74.4; $t[39] = 10.0$; $p < .001$; $\eta^2 = .72$). Thus, contact with a contaminating Source further increases aversion to an object above and beyond the effect of proximity.

There was also an interaction of Vignette and Distance ($F[1,38] = 16.0$; $MSE = 1172.5$; $p < .001$; $\eta^2 = .30$), which can again be explained in that the murderer's sweater ($M = -69.7$, $SE = 6.3$) was less desirable than the apple belonging to the person who vomited ($M = -20.1$, $SE = 8.1$; $t[39] = -5.6$; $p < .001$; $\eta^2 = .45$).

5 General discussion

We found that adults show a strong aversion to objects they believe to have been close to a contaminating source, even though they are certain that no contact with the source or any contaminants occurred. For example, the sweater of the Near coworker in the murder vignette was outside the building the entire time, and the Near coworker never even realized that anything had happened. There was no chance of contact with the killer, the victims, or gore from the killings. Moreover, all of the participants in the Study 1 manipulation check believed that no contact with any contaminants had occurred in either vignette, and in Study 2, participants were explicitly told that no contaminants had ever made contact with the objects. Our main findings thereby demonstrate a clear proximity effect; to our knowledge, this is the first demonstration of the proximity effect in adults with materials clearly indicating the absence of contact with a contaminant. As we have suggested, adults seem to inappropriately overextend their beliefs about airborne contamination beyond rational physical boundaries. Magical contagion beliefs are therefore not restricted to situations adhering to the contact principle. At the same time, our secondary findings corroborate Rozin and colleagues' assertion about the relative importance of contact. In our study, people also clearly differentiated whether the object in question had been in contact with the Source versus merely being nearby, even though it was explicitly stated that the objects had been thoroughly washed in both cases.

Our finding that people are perfectly aware that contamination is not possible, yet simultaneously show relative aversion to the proximally Near objects, can be un-

derstood within the framework of dual-systems theories (e.g., Sloman, 1996; see Lindeman & Aarnio, 2007, for a previous application of these theories to the *magical contagion effect*). Such theories suggest that conflicting beliefs can be held simultaneously and relatively separately in two general cognitive systems; broadly speaking, the analytic system may include analytic processes operating over rational knowledge, whereas the intuitive system may include automatic processes operating over earlier, perhaps more intuitive knowledge (Lindeman & Aarnio, 2007). In this case, the analytic (rational) system knows the sweater or apple is clean, but the intuitive system nonetheless finds the object to be aversive. In the current studies, the within-subject design should have made this conflict especially salient to participants. Even so, people's intuitive feeling of aversion in the proximally Near cases was strong enough to override more concrete, factual beliefs about the object's cleanliness in making overall judgments of the object's desirability.

Our findings also suggest that greater caution is needed when interpreting the proximity effect in very young children from previous developmental work. Assuming that adult undergraduate students understand basic germ theory and the mechanisms of contamination, we cannot automatically presume that the youngest children in prior work did not. Rather, adults' intuitions seem to globally match the intuitions of young children, perhaps because of deeply engrained, visceral, and automatic reactions to aversive sources such as vomit and blood, or perhaps an intuitive hyper-avoidance strategy adopted in childhood that is never fully overridden by learned, science-based information in adulthood, but rather may be retained throughout.

5.1 Potential mechanisms and future directions

In keeping with the framework suggested by Lindeman and Aarnio (2007), we have suggested that the proximity effect may be driven by an overextension of knowledge about biological mechanisms of airborne contamination. Indeed, in reality, one's likelihood of contracting an infectious disease by airborne transmission is higher when one is closer to a contaminated person than when one is farther away. Making this assumption departs from rational judgment in cases wherein it is known for certain that no contaminating particles had come into contact with the objects being rated. It is in this latter sense that mechanisms of airborne transmission may have been overextended in our participants' reasoning.

This framework may also help to explain a wider range of phenomena in the literature. For example, in an investigation of the conceptually similar *group-contagion effect* in product selection, Mishra, Mishra, and

Nayakankuppam (2009) asked adults to choose a mug out of a group of mugs that were either placed far apart (10 inches) or closely together (1 inch). They found that people preferred to choose the mug out of the far-apart group if one mug was known to have a defective lid, whereas they preferred to choose a mug out of the close-together group if one mug was known to contain a small gift coupon. Mishra et al. (2009) suggested that adults' product preferences are consistent with the use of a heuristic wherein proximity systematically increases subjective estimates of probability. The application of this general heuristic seems rather illogical in the context of product selection, but once again, it would make sense within the domain of biological reasoning about airborne contamination. Thus, a speculative possibility is that the group-contagion effect reflects an even more dramatic overextension of reasoning beyond appropriate domains than that obtained in the current studies.

Several additional potential mechanisms and the conditions under which they might be engaged remain to be examined more thoroughly. First, the proximity effect could be driven by evaluative conditioning (Walther, Nagen-gast, & Traselli, 2005), whereby a neutral stimulus (e.g., apple) comes to be disliked merely after co-occurring with a negatively valenced stimulus (e.g., vomit). Second, an underlying belief in moral contagion (e.g., from the murderer to his sweater) rather than biological contagion could potentially explain our results from the murder vignette. Although this mechanism cannot explain all of our results, given that there is nothing immoral per se about vomiting due to motion sickness, there could be a subset of proximity effects driven or partially driven by beliefs about moral contagion.

Relatedly, it could be argued that the proximity effect we found was generally driven by an overextension of social, rather than biological, domain knowledge. There are well-known findings demonstrating adults' stigmatization of those who are socially aversive or have associated with aversive people. For example, a form of "social proximity effect" has been shown for traits such as obesity, such that people who are depicted alongside obese persons are stigmatized relative to those shown next to average-weight persons (Hebl & Mannix, 2003). The sources of contamination in our studies were both socially and physically aversive, and it is possible that some transfer of socioculturally-based reasoning was overextended to the reasoning about objects in our study. However, it is also possible that some social proximity effects in stigmatization could conversely be driven by an overextension of reasoning from the biological domain to the social domain, in keeping with the framework we have presented, and in concert with prior accounts of the magical contagion effect (Lindeman & Aarnio, 2007; White, 2009; see also Rozin, Haidt, & Fincher, 2009). It

furthermore remains possible that the conceptual structures underlying social and biological contamination beliefs may not be fully separable from one another; this is an important independent question for future study. Future work will be needed to more clearly delineate the conceptual commonalities and distinctions between socially and biologically based aversion, and the degree to which one is derived from the other.

Regardless of mechanism, people's tendency to show the proximity effect may have important implications for real-world health behaviors. An awareness of the proximity effect may be critical for physicians when communicating with their patients and the general public. Much of the large body of research on health literacy has focused on basic skills such as reading comprehension (Williams, Baker, Parker, & Nurss, 1998). However, our findings suggest that understanding intuitive lay perceptions of disease and contamination is also necessary, as such perceptions may be incorrect and sharply contradict scientifically-derived information, even for cases in which the scientifically accurate answer is widely accepted by lay people. For example, a general, persistent intuitive belief in proximity as a mechanism of contamination may lead to hyper-avoidance and stigmatization of patients having cancer, AIDS, and mental disorders. Translational work may ultimately examine the appearance, strength, and pervasiveness of the proximity effect in real-world contexts.

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Appendix: Vignettes

Murder

On a normal morning, two coworkers were leaving for work. One decided to drive, and the other decided to walk. On the way to work, the coworker who was walking took a shortcut by an abandoned building on the outskirts of town. He had plenty of time before work, so he decided to rest for a while in the shade of the building and listen to some music on his headphones. Because of his headphones, he did not realize that there was a third coworker of theirs inside the building. The third coworker was in the middle of torturing and killing several unknown people.

Vomit

On a normal morning, two coworkers were leaving for a business trip. One sat in the back of the plane, and the other sat near the front. During the flight, all passengers received an apple for a snack. There was plenty of time left on the flight, so the coworker in the front of the plane decided to take a nap. Because he was sleeping, he did not realize that there was a third coworker of theirs in the seat in front of him. The third coworker was in the middle of vomiting into a bag due to motion sickness brought on by turbulence.