Cultural Differences in Expectations of a Correspondence in Magnitude between Events and their Causes

by

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Abstract

Based on previous research on cultural differences in analytic and holistic reasoning, I hypothesized that when explaining events, North Americans would be more likely than East Asians to expect causes to resemble events with respect to magnitude (i.e., big events stem from big causes and small events stem from small causes). In addition, I hypothesized that these differences would be explained by cultural differences in the tendency to reason analytically or holistically. In a series of studies, Canadian and Chinese participants judged the likelihood that high or low magnitude events were caused by high or low magnitude causes. Events included a disease outbreak, a delay in a business negotiation, and damage caused by a tornado moving through a city. In two studies, participants from both cultural groups expected events and their causes to correspond in magnitude. More importantly, as hypothesized, Canadians expected events and their causes to correspond in magnitude to a greater degree than did Chinese. In a third study, I ruled out a potential alternative explanation that Chinese may have simply been exhibiting a response bias. In a fourth study, in support of my hypothesis that these cultural differences were due to differences in the reasoning styles of Canadians and Chinese, I found that Canadians primed to reason holistically expected less cause-effect magnitude correspondence than did those primed to reason analytically. These findings have important theoretical implications for the research literature on attributions and on cultural and social cognition, as well as practical implications in the context of judgment and decision making.

Co-Authorship

Li-Jun Ji provided feedback on the design, analysis, and writing for each of the studies. Zhiyong Zhang and Li Ye were responsible for the data collection in China for each of the studies. Leandre Fabrigar provided feedback on the design and writing for each of the studies. Roy R. Spina, as first-author for each of the studies, was responsible for their conception, design, data collection, analysis, and write-up.

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Chapter 1

Introduction

Millions of years ago, giant lizard-like creatures called dinosaurs dominated the earth until one day when an enormous meteor crashed to the planet's surface. The impact of the meteor caused permanent global changes in weather patterns that soon rendered this entire collection of colossal creatures extinct. Most of you have heard this explanation for the disappearance of the dinosaurs, and although you probably had little training in the natural sciences at the time, the explanation seemed plausible. One reason this explanation appealed to your senses was that the magnitude of the cause, a giant meteor that changed global weather patterns, and the magnitude of the effect, the extinction of a populous set of gargantuan reptiles, correspond with one another. Had you been told that a small mouse-sized meteor tumbled to the surface and wiped out this abundant assortment of gigantic creatures, you probably would have considered this explanation less plausible. Although the meteor explanation for the disappearance of the dinosaurs is not without controversy, other plausible explanations tend to conform to the same pattern; that is, they are large in magnitude.

But do causes and effects always correspond in magnitude? In the 1960s, American mathematician and meteorologist Edward Lorenz created a computer simulation of hydrodynamic flow (Lorenz, 1963). Allegedly, while using the computer simulation to model weather patterns, Lorenz entered the value .506 rather than the actual value .506127. He noticed that the outcomes stemming from the two ostensibly similar initial values varied substantially. Upon publishing his findings, one meteorologist remarked that if the theory was correct, one flap of a seagull's wings could change global

weather patterns forever. Over time, through some form of cultural metamorphosis, the ungainly seagull transformed into a delicate butterfly, and the term 'butterfly effect' was born. Many variants of the butterfly effect have since emerged predicting, for example, that the flap of a butterfly's wings in Beijing can alter the path of a tornado in Oklahoma. Regardless of whether or not this amusing anecdote is true, Lorenz found that seemingly negligible variations in initial conditions led to dramatic divergences in outcome patterns. Furthermore, Lorenz's 1963 article had a major impact on the atmospheric sciences and eventually played a part in the development of Chaos Theory.

Lorenz's finding has been surprising to many of us because it violated our expectations of cause-effect magnitude correspondence. Why do we expect big causes to lead to big effects and small causes to lead to small effects? Is it simply because we seldom observe violations of this association and thus have developed a heuristic that serves us well most of the time? The present research indicates that the explanation is far more interesting and complex.

The Representativeness Heuristic

As an example, let us take a moment to think about Tom, a high school senior who is intelligent and has a high need for order and clarity but lacks creativity. He tends to write in a dull and mechanical fashion and feels little sympathy for other people. Given a list of academic disciplines such as engineering, computer science, law, humanities, education, and social work, what discipline would you predict Tom to have entered in university? Kahneman and Tversky (1973) found that when forming such predictions, people relied mostly on the degree of similarity between Tom and a prototypical member of each academic discipline. Furthermore, the authors demonstrated that this strong

tendency to rely on the degree of similarity caused errors in judgment because participants ignored the percentages of students enrolled in each discipline, or the base rates. Kahneman and Tversky (1972) referred to this type of judgment as the representativeness heuristic.

Most of the research conducted on the representativeness heuristic has focused on errors in judgments people make when categorizing targets into groups on the basis of similarity (Gilovitch & Savitsky, 2002), such as the study described in the previous paragraph. However, the representativeness heuristic is not limited to categorization. People also use this heuristic when making causal judgments, such as when searching for causes that are similar to an effect. Gilovitch and Savitsky reasoned that relatively little research has been conducted on the representativeness heuristic in the domain of causal judgments because unlike Kahneman and Tversky's paradigm, establishing that an error in judgment has been made is difficult to determine. Nonetheless, across a variety of domains including medicine, pseudoscientific systems, and psychoanalysis, anecdotal evidence suggests that people appear to employ the representativeness heuristic when making causal judgments by relying on similarities between causes and effects (Gilovitch & Savitsky, 2002).

Einhorn and Hogarth (1986) divided such similarities into two categories, physical resemblance and congruity of strength. Throughout history, we see numerous examples of causal reasoning that most likely stemmed from a search for causes that physically resembled effects. For example, the Azande believed that the burnt skull of the red bush-monkey could treat epilepsy (Nisbett & Ross, 1980). Red bush-monkeys move in a chaotic and frenzied manner. The Azande most likely adopted the treatment after

observing that the movements of red bush-monkeys resembled those of people experiencing epileptic seizures. Einhorn and Hogarth's second category, the tendency to search for causes that resemble effects in congruity of strength is often reinforced by daily experience. In the physical world, numerous examples exist where causes and effects resemble one another in strength. For example, a large stone falling to the ground would create a larger impact than a small stone. However, we also see examples where the heuristic fails us. Contrary to our intuition, Galileo demonstrated that large stones do not fall faster than small stones, but rather they fall at the same rate.

Similar to Einhorn and Hogarth, Nisbett and Ross (1980) proposed that people may seek causes that correspond in magnitude with events they are trying to explain. For example, an editorial in an early twentieth century Washington newspaper mocked the suggestion by Walter Reed that yellow fever, with all of its devastating effects, was caused by the tiny mosquito. Likewise, many people would agree that it seems "outrageous that a single, pathetic, weak figure like Lee Harvey Oswald should alter world history" (Nisbett & Wilson, 1977, p. 252).

Apart from conjecture by Einhorn and Hogarth, Nisbett and Ross, and a few interesting and supporting anecdotes, however, there is little research evidence that people do indeed expect causes and effects to correspond in magnitude. Only a relatively small number of empirical studies have provided supporting evidence consistent with such speculation.

Empirical Research on Expectations of Cause-Effect Magnitude Correspondence

In one of the first studies that indirectly provided supporting evidence that people expect cause-effect magnitude correspondence, Shultz and Ravinsky (1977)

demonstrated that French-Canadian schoolchildren from kindergarten to the sixth grade typically chose causes that were similar to effects. For example, in one scenario, they attributed a loud noise to a heavy rather than a delicate lever. This particular scenario is consistent with the proposal that people choose causes that correspond in magnitude with effects. However, the other scenarios used would fall under Einhorn and Hogarth's physical resemblance category. For example, after watching a short video clip of a child engaging in either physical or verbal retaliation against a bully, children attributed physical retaliation to physical rather than verbal aggression.

McCauley and Jacques (1979) also provided indirect supporting evidence of an expectation of cause-effect magnitude correspondence. In their study, American participants read one of two headlines, "A man shoots at the president and misses" or "A man shoots at the president and kills him." Participants then estimated the probability that the man was acting alone and the probability that he was acting as a member of a group. The authors found that participants tended to attribute the more consequential effect, the successful assassination, to the group and the less consequential effect, the unsuccessful assassination, to the individual. However, this study does not provide strong evidence supporting an expectation of cause-effect magnitude correspondence because participants could be attributing the more consequential effect to a conjunction of causes, a group, more than a single cause, a lone gunman. In addition, the two outcomes differ in an important way other than magnitude. Missing, versus hitting, the president suggests incompetence on the part of the shooter, and thus the magnitude of the outcome is confounded with the content of the outcome. Describing a scenario whereby a shooter

hits the president who then either becomes incapacitated versus recovers, would provide a more systematic manipulation of magnitude.

McClure, Lalljee, and Jaspars (1991) examined if people explained extreme and moderate effects by using a conjunction of causes or a single cause. For example, British students visiting Oxford University on an open day read that, "Roger Peterson murdered seven people, mutilated their bodies, and buried them in a field near his home" (extreme crime), and that, "John Reid hit a number of people with a bottle at a football match" (moderate crime). Participants explained the effects, and each response was coded as a single cause or a conjunction of causes. Participants subsequently chose between a single explanation and a conjunction provided to them by the researchers. McClure et al. found that the majority of participants preferred single-cause explanations to conjunctions of causes. More importantly, for some scenarios describing extreme outcomes, participants generated single extreme causal explanations. However, this pattern of results did not emerge across all outcomes, and the authors were unable to identify a moderating factor that might account for such inconsistencies.

A recent set of studies by Ebel-Lam, Fabrigar, MacDonald, and Jones (2008) provided more direct support for an expectation of cause-effect magnitude correspondence. Canadian university students read a scenario describing either a high or moderate magnitude effect. For example, participants read that either a plane crashed killing everybody onboard (high magnitude) or that with difficulty the pilot successfully landed the plane (moderate magnitude). Participants estimated the likelihood that a number of high and moderate magnitude causes had led to the effect. Participants

attributed high magnitude effects to high magnitude causes and low magnitude effects to low magnitude causes.

Either directly or indirectly, the aforementioned studies provided consistent evidence that people (at least, Americans, British, and Canadians) typically expect a correspondence in magnitude between an effect and its cause. Why is this so and is it true across cultures? Research from the cultural psychology literature should provide some clues.

Cultural Differences in Analytic and Holistic Reasoning

Contrary to the Washington newspaper article mocking Walter Reed's suggestion that yellow fever was caused by a tiny mosquito, Asian folk wisdom states, "One tiny insect may be enough to destroy a nation." Research indicates that compared with North Americans (including Americans and Canadians), East Asians (including Chinese, Japanese, and Koreans) differ in their reasoning about cause-and-effect relationships (Choi, Dalal, Kim-Prieto, & Park, 2003; Maddux & Yuki, 2006; Nisbett, Peng, Choi, & Norenzayan, 2001). That is, East Asians tend to reason holistically; whereas North Americans tend to reason analytically (Nisbett et al., 2001).

Based on the work of Nisbett and colleagues (2001), holistic and analytic thought can be contrasted on a few essential cognitive tendencies. First, holistic thinkers attend to the entire field, whereas analytic thinkers attend to focal or central objects. As a result, holistic thinkers attend to relationships among objects within the field and attribute causality to the field, whereas analytic thinkers attend primarily to central of focal objects in the field, categorize these objects, and assign causality to them.

It is important to note that holism does not appear to be a simple uniform construct determined by a single cognitive mechanism. For example, researchers have focused on at least four factors under the umbrella term holism: causality (Choi et al., 2003), attitude toward contradiction (e.g., Peng & Nisbett, 1999), perception of change (Ji, Nisbett, & Su, 2001), and locus of attention (e.g., Masuda & Nisbett, 2001; see also Nisbett et al., 2001). The present research focused on the causality factor. Let us examine the relevant research more closely.

Across a variety of domains, East Asians attend to situational factors or contexts more than North Americans do, and North Americans attend to focal people or objects more than East Asians do (Miller, 1984; Morris & Peng, 1994). For example, one set of studies found that when describing an underwater scene, the first element Americans typically mentioned was a focal element, such as a large fish in the center of the picture. In contrast, the first element Japanese typically mentioned was a contextual element, such as seaweed (Masuda & Nisbett, 2001). In addition, Japanese focused on the entire scene as a unit, and their ability to recall a focal object from the scene was impaired when the background was altered. Alternatively, Americans focused on the focal objects independent of the background, and changing the background had little or no effect on their ability to recall a focal object.

Focusing relatively different amounts of attention on focal objects and contexts has implications for other aspects of cognition, such as the ability to detect covariation among stimuli. People who focus on focal objects more than contexts should be less likely to detect covariation between elements in a scene compared with people who attend to both focal objects and contexts. Ji, Peng, and Nisbett (2000) asked participants

to estimate the degree of covariation between images on a computer screen, and this is exactly what they found. That is, compared with American estimates, Chinese estimates were better calibrated with actual levels of covariation.

If Easterners attend more to contextual elements and notice a greater degree of covariation between elements than do North Americans, then they should explain effects differently. This pattern has been found when people make attributions. When people observe a person's behavior in a social situation, a number of elements are present other than the person. That is, other people are often involved and the person is acting in a surrounding context or situation. If an observer focuses relatively more attention on the situation, then the observer should be more likely to attribute causality to that situation. Alternatively, if an observer focuses relatively more attention on the focal person, then the observer should attribute causality to that person. Consistent with this reasoning, past research has shown that Asians tend to make more situational attributions; whereas Americans tend to make more dispositional attributions (e.g., Miller, 1984 with Indian participants; Morris & Peng, 1994 with Chinese participants).

Choi et al. (2003) further explicated the cultural differences in reasoning by demonstrating that Easterners typically have more complex causal theories and, therefore, consider more causal factors in their attributions than do Westerners, who typically have relatively simple causal theories. For example, in Choi et al., American and Korean participants read that, "A graduate student killed his or her advisor." Participants then judged the causal relevance of each of 97 pieces of information. Sample items included, "The graduate student's history of mental disorders" and "Whether the professor ever sexually harassed the graduate student." Participants were instructed to choose only items

that were relevant to establishing a motive for the graduate student to have murdered his or her advisor. Koreans considered a greater number of items to be relevant in establishing a motive than did Americans. Additionally, Choi et al. developed and included a 10-item measure of holistic tendency. The measure included statements such as, "Any phenomenon has numerous numbers of causes, although some of the causes are not known." Higher levels of agreement with these statements indicated a relatively more holistic thinking style. Koreans were more holistic than were Americans, and within each culture, individual differences in holism were related to the number of relevant items included. That is, the higher a participant's holistic tendency, the greater the number of items considered relevant to establishing a motive.

Present Research

To summarize the cross-cultural literature, East Asians reason holistically; whereas North Americans reason analytically. Notably, holism does not appear to be a simple uniform construct determined by a single cognitive mechanism. For example, researchers have focused on at least four factors under the umbrella term holism: causality, attitude toward contradiction, perception of change, and locus of attention (Choi et al., 2003; Nisbett et al., 2001). The present research focused on the causality factor. With respect to causality, East Asians reason holistically by focusing on many causes; whereas North Americans reason analytically by focusing on relatively fewer causes (Choi, et al., 2003).

If an observer tends to focus on one or a few causes only when explaining an effect, then the observer will expect a greater correspondence in magnitude between cause and effect. For example, imagine being shown pictures of two buildings and asked

how likely one sold for a higher price. The two buildings look very similar except that one is larger than the other. If all else were equal, one would expect the larger building to sell for more because size is one factor that determines the value of a building. However, a number of other factors also determine the value of a building, such as location and interior condition to name a few. If an observer tends to focus on only one cause, such as the magnitude of the size of the building in this case, when trying to understand a high magnitude effect, such as a higher selling price, then that person should expect a high magnitude cause, such as the larger building to be far more likely than a low magnitude cause, such as the smaller building (see Figure 1).

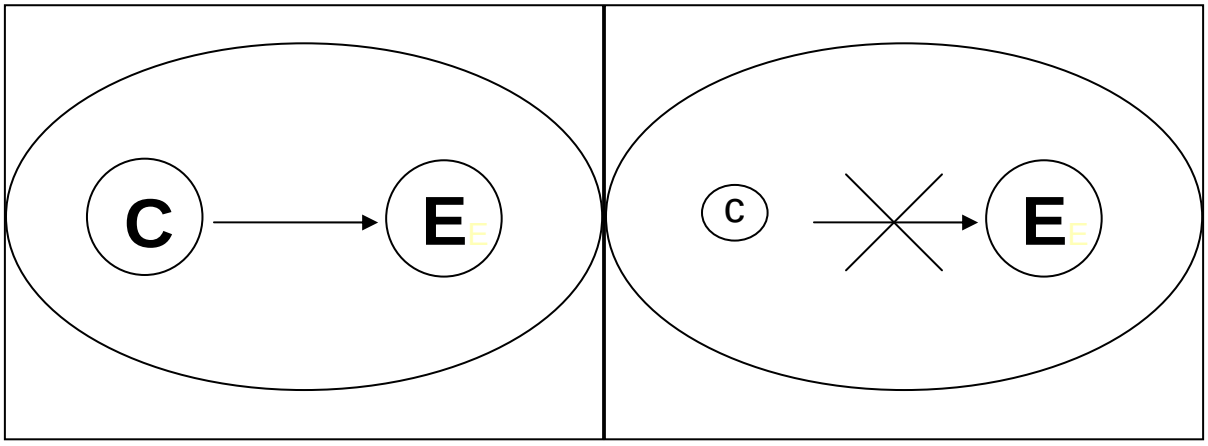

Figure 1: Single-cause model of an effect (the size of each letter and circle represents the magnitude of the cause (C) and the effect (E)).

Alternatively, if an observer tends to focus on many factors when explaining an effect, then the observer will expect a lesser correspondence in magnitude between cause and effect. Considering the previous example, if an observer tends to focus on numerous

factors, including size, location of the building, and other factors, when trying to understand a high magnitude effect, such as a higher selling price, then a high magnitude cause, the larger building, is not as necessary. Although both people may reason that the larger building would still likely sell for more than the smaller building, the larger building would seem more likely to have sold for a low price to someone with a multiple-cause focus than someone with a single-cause focus. The lesser correspondence between the magnitudes of cause and effect make sense because one of the other factors, such as location, could be working against the larger building and in favor of the smaller building when it comes to selling price (see Figure 2).

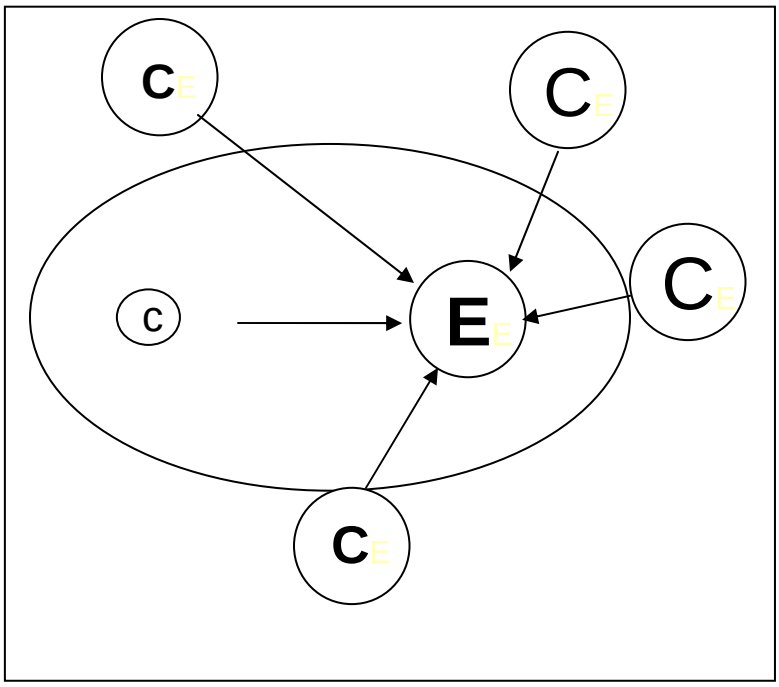

Figure 2: Multiple-cause model of an effect (the size of each letter and circle represents the magnitude of the cause (C) and the effect (E) and the direction of each arrow represents the directionality of the cause).

Therefore, based on previous research on cultural differences in analytic and holistic reasoning, specifically regarding differences in perceptions of causal complexity, I hypothesized that expectations of a correspondence in magnitude between effects and their causes would be stronger among North Americans than among East Asians. Specifically, I hypothesized that when explaining an effect, North Americans would tend to look for causes that correspond in magnitude with the effect. High or low magnitude effects should instigate a search for correspondingly high or low magnitude causes. In contrast, East Asians would be less likely than North Americans to expect such a correspondence in magnitude between effects and their causes. Lastly, I predicted that the cultural differences in the tendency to look for causes that correspond in magnitude with effects would be explained by differences in analytic and holistic reasoning. I conducted a series of studies to test these hypotheses.

Chapter 2

Study 1

The purpose of Study 1 was to test the hypothesis that Canadians would expect a greater correspondence in magnitude between effects and their causes than would Chinese. Participants read hypothetical scenarios with consequences of high or low magnitude and indicated how likely the effect was due to causes that were high or low in magnitude. I used two different versions of scenarios with two different samples, one in Study 1a and the other in Study 1b.

Study 1a

Method

Participants

Fifty-nine European-Canadians (45 women and 14 men) were recruited from Queen's University, and 60 Chinese (30 women and 30 men) were recruited from Beijing University. In all of the studies in this paper, Canadian participants were Caucasians of European descent and Chinese were Chinese nationals, mostly of Han descent. Canadian participants received course credit or $5 for their participation, and Chinese participants received a small gift.

Materials and Procedure (see Appendix A for all experimental materials)

Participants read a questionnaire describing a disease outbreak that either killed some people (high magnitude effect) or hospitalized them (low magnitude effect). The effect was followed by two potential causes, a highly infectious strain of bacteria (high magnitude cause) or a standard strain of bacteria (low magnitude cause). Participants rated the likelihood that each of the two causes had led to the effect on a 9-point scale (1

= *not likely at all*, 9 = *extremely likely*). In summary, Study 1a had a 2 (culture: Canadians vs. Chinese) by 2 (effect magnitude: high vs. low) by 2 (cause magnitude: high vs. low) design. The cause magnitude factor varied within-participants, and the other factors varied between-participants.

The study materials were generated by two Canadian and two Chinese researchers to ensure they were familiar and realistic to both cultures. Pilot testing indicated that Chinese and Canadians perceived the magnitudes and independent likelihoods of effects and causes to be equivalent. All materials were first developed in English and then translated into Chinese. The Chinese and English versions were then compared by two Chinese researchers who had lived in North America for at least four years. Additionally, a back-translation procedure was used to check consistency of meaning, and finally the translations were checked by at least three Chinese researchers in China to ensure they were free of error and that they sounded natural. The same procedure for generating and translating study materials was followed in all the studies reported in this paper.

Results and Discussion

Test of Cause-Effect Magnitude Correspondence

Preliminary analyses indicated no significant gender effects, Fs > 1, as was true for all studies reported in this paper. Thus gender will not be discussed further.

A 2 (culture) X 2 (effect magnitude) X 2 (cause magnitude) mixed-design analysis of variance (ANOVA) revealed a significant main effect of effect magnitude, $F(1, 115) = 13.55$, $p < .001$, $\eta_p^2 = .11$, such that participants in the high magnitude effect condition gave higher likelihood ratings for the causes ($M = 5.89$, $SD = .91$) in comparison with those in the low magnitude effect condition ($M = 5.27$, $SD = .92$). This

pattern indicated a stronger reaction to the high magnitude effect compared with the low magnitude effect. The effect magnitude by cause magnitude interaction also was significant, $F(1, 115) = 160.18$, $p < .001$, $\eta_p^2 = .58$. Overall, participants tended to associate the high magnitude effect with the high magnitude cause ($M = 7.73$, $SD = 1.40$) more than with the low magnitude cause ($M = 4.05$, $SD = 1.77$), $t(115) = 11.07$, $p < .001$, and the low magnitude effect with the low magnitude cause ($M = 6.82$, $SD = 1.67$) more than with the high magnitude cause ($M = 3.72$, $SD = 2.21$), $t(115) = 9.40$, $p < .001$.

More importantly, the culture by effect magnitude by cause magnitude interaction was significant, $F(1, 115) = 13.80$, $p < .001$, $\eta_p^2 = .11$. Follow-up mixed-model t tests on the interaction indicated that to account for the high magnitude event, Canadians rated the high magnitude cause as more likely than did Chinese and rated the low magnitude cause as less likely than did Chinese, ts$(115) > 1.65$, ps $< .05$. For the low magnitude event, Canadians rated the high magnitude cause as less likely than did Chinese and rated the low magnitude cause as more likely than did Chinese, ts$(115) > 2.20$, ps $< .02$. Therefore, as hypothesized, Canadians tended to exhibit a stronger cause-effect magnitude correspondence than Chinese (see Figure 3).

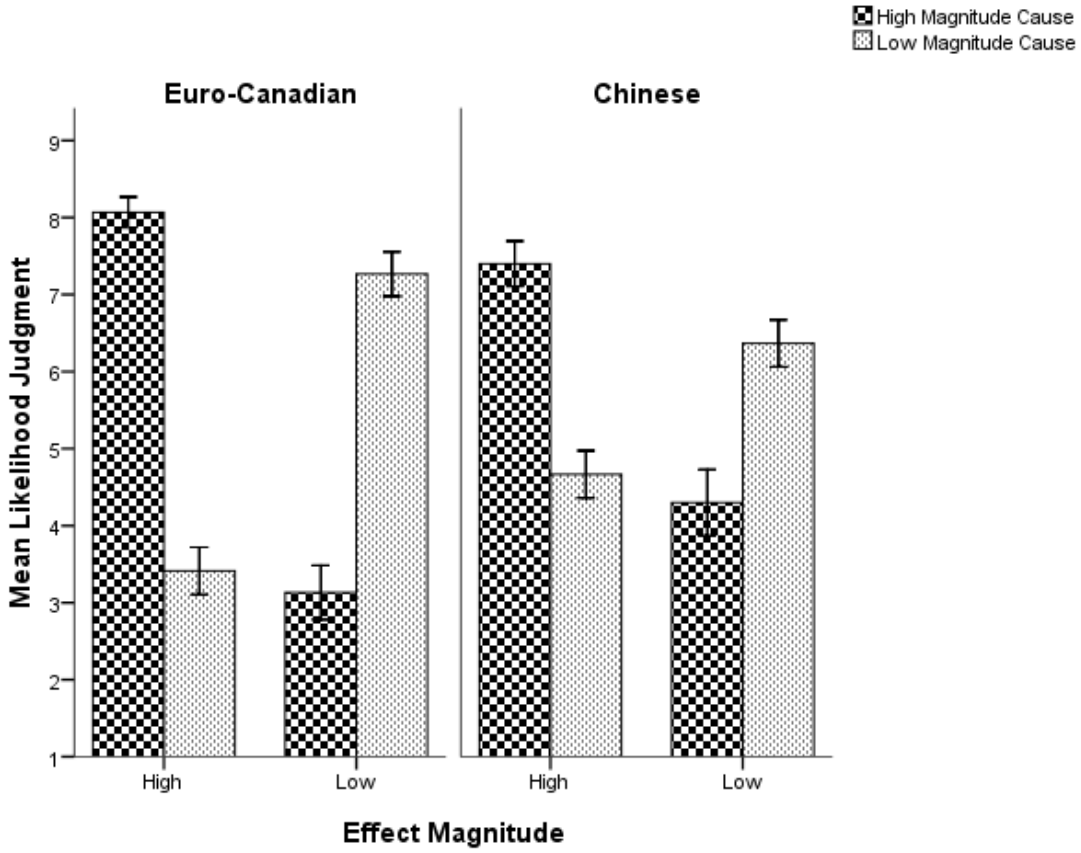

Figure 3. **Canadian and Chinese likelihood estimates (+ SE) of high and low magnitude causes leading to high and low magnitude effects**

Note. SE = Standard Error.

Study 1b

Method

Participants

Eighty-four European-Canadians (57 women and 27 men) were recruited from Queen's University, and 60 Chinese (33 women and 27 men) were recruited from Beijing University. Canadian participants received course credit or $5 for their participation, and Chinese participants received a small gift.

Materials and Procedure (See Appendix B for all experimental materials)

Study 1b followed a similar design and procedure to Study 1a but had a different scenario. The scenario described either a long negotiation delay (high magnitude effect) or a brief negotiation delay (low magnitude effect). The causes were a major disagreement (high magnitude cause) or a minor one (low magnitude cause). In summary, Study 1b had a 2 (culture: Canadians vs. Chinese) by 2 (effect magnitude: high vs. low) by 2 (cause magnitude: high vs. low) design with the cause magnitude varying within-participants, and the other factors varying between-participants.

Results and Discussion

Test of Cause-Effect Magnitude Correspondence

The results were similar to those obtained in Study 1a. A 2 (culture) X 2 (effect magnitude) X 2 (cause magnitude) mixed-design ANOVA revealed a significant main effect of effect magnitude, $F(1, 140) = 4.12$, $p = .04$, $\eta_p^2 = .06$, such that the likelihood ratings for causes were higher in the high magnitude effect condition ($M = 5.53$, $SD = .81$) than in the low magnitude effect condition ($M = 5.25$, $SD = .82$). The effect magnitude by cause magnitude interaction was significant, $F(1, 140) = 133.36$, $p < .001$, $\eta_p^2 = .49$. Overall, participants tended to associate high magnitude effects with high magnitude causes ($M = 7.10$, $SD = 1.63$) more than low magnitude causes ($M = 3.96$, $SD = 1.87$), $t(140) = 10.48$, $p < .001$, and low magnitude effects with low magnitude causes ($M = 6.75$, $SD = 1.81$) more than high magnitude causes ($M = 3.74$, $SD = 1.77$), $t(140) = 10.18$, $p < .001$.

More importantly, the culture by effect magnitude by cause magnitude interaction was significant, $F(1, 140) = 20.68$, $p < .001$, $\eta_p^2 = .13$. Follow-up mixed-model t tests on

the interaction indicated that to account for the high magnitude event, Canadians rated the high magnitude cause as more likely than did Chinese and rated the low magnitude cause as less likely than did Chinese, *t*s(140) > 2.44, *p*s < .01. For the low magnitude event, Canadians rated the high magnitude cause as less likely than did Chinese and rated the low magnitude cause as more likely than did Chinese, *t*s(140) > 3.08, *p*s < .005. Therefore, Canadians tended to exhibit a stronger cause-effect magnitude correspondence than Chinese (see Figure 4).

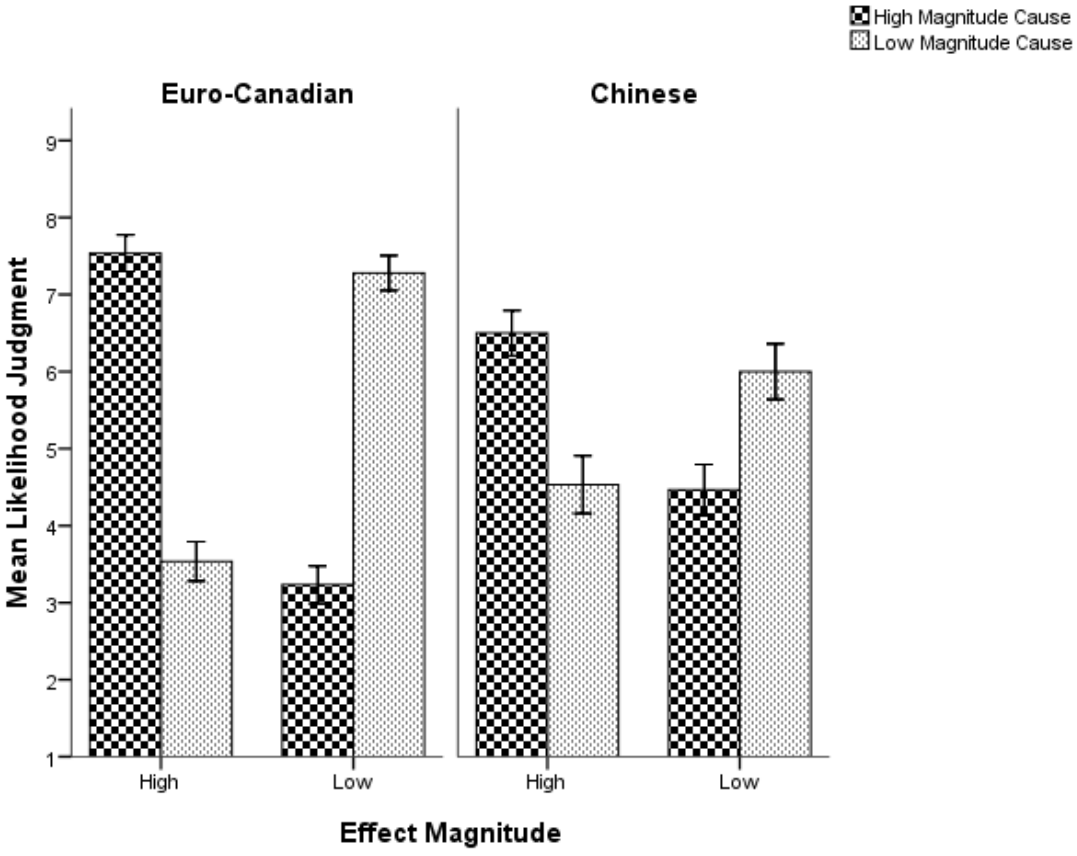

***Figure 4*. Canadian and Chinese likelihood estimates (+ SE) of high and low magnitude causes leading to high and low magnitude effects**

Thus, for both the disease (Study 1a) and the negotiation (Study 1b) scenarios, Canadians associated high magnitude effects with high magnitude causes more than low magnitude causes and low magnitude effects with low magnitude causes more than high magnitude causes. And in both scenarios, Chinese exhibited this pattern to a significantly lesser degree.

Chapter 3

Study 2

One potential limitation of Study 1a is that the scenario is related to medicine, a domain in which East Asians tend to be especially holistic (Choi, Koo, & Choi, 2007). For Study 1b, cultural differences in negotiation styles might lead Chinese to expect, relative to Canadians, that small disagreements could likely lead to long negotiation delays. Lastly, for both studies, the results could be a product of the methods that were used, for example if the two cultural groups attend to the information in the scenarios differently.

Although I could find no research evidence that would strongly and specifically support any of these alternative explanations, I felt it would be important to demonstrate the generalizability my findings across different scenarios and methods. Thus, the purpose of Study 2 was to replicate the results from Study 1 using different scenarios and a different format. Study 1 manipulated the magnitudes of causes and effects in detailed scenarios. In Study 2, I used simple scenarios that were described using pictures of common effects. Again, participants read hypothetical scenarios with consequences of high or low magnitude and indicated how likely the effect was due to causes that were high or low in magnitude.

Method

Participants

Seventy-eight European-Canadians (46 women and 32 men) were recruited from Queen's University, and 60 Chinese (27 women and 33 men) were recruited from Beijing

University. Canadian participants received course credit or $5 for their participation, and Chinese participants received a small gift.

Materials and Procedure (See Appendix C for all experimental materials)

Participants were randomly assigned to a high or low effect magnitude condition. In each condition, they were presented first with a picture of two basketball players, one tall (high magnitude cause) and one short (low magnitude cause), and they indicated the likelihood that each of the two players had scored the most points (high magnitude effect) or the least points (low magnitude effect) in a game. Next, participants were presented with a picture of two tornadoes that had traveled through a city, one wide (high magnitude cause) and one narrow (low magnitude cause), and they indicated the likelihood that each tornado had caused extensive damage (high magnitude effect) or no damage (low magnitude effect). The likelihood judgments were made on a 9-point scale (1 = *not likely at all*, 9 = *extremely likely*). In summary, Study 2 had a 2 (culture: Canadians vs. Chinese) by 2 (effect magnitude: high vs. low) by 2 (cause magnitude: high vs. low) design. The cause magnitude factor varied within-participants, and the other factors varied between-participants.

Results and Discussion

Likelihood Estimate Computation

Each participant completed both scenarios (basketball game and tornadoes). For each scenario, participants gave two likelihood estimates, one for a high-magnitude cause and one for a low magnitude cause. The pattern of the results was the same for each of the two scenarios. Therefore, I combined the scenarios by averaging the two likelihood estimates for the high magnitude causes and by averaging the two likelihood estimates

for the low magnitude causes. These two averages were then treated as repeated-measures variables.

Test of Cause-Effect Magnitude Correspondence

A 2 (culture) X 2 (effect magnitude) X 2 (cause magnitude) mixed-design ANOVA revealed a significant main effect of effect magnitude, $F(1, 134) = 23.72$, $p < .001$, $\eta_p^2 = .15$, such that participants in the high magnitude effect condition gave higher likelihood ratings for the causes ($M = 5.72$, $SD = .67$) in comparison with those in the low magnitude effect condition ($M = 5.22$, $SD = .45$). The effect magnitude by cause magnitude interaction was significant, $F(1, 134) = 50.20$, $p < .001$, $\eta_p^2 = .27$. Overall, participants tended to associate high magnitude effects with high magnitude causes ($M = 6.80$, $SD = 1.28$) more than with low magnitude causes ($M = 4.63$, $SD = 1.30$), $t(134) = 8.32$, $p < .001$, and low magnitude effects with low magnitude causes ($M = 5.91$, $SD = 1.71$) more than high magnitude causes ($M = 4.54$, $SD = 1.73$) , $t(134) = 5.21$, $p = .001$.

Similar to Study 1, the culture by effect magnitude by cause magnitude interaction was significant, $F(1, 134) = 7.48$, $p = .007$, $\eta_p^2 = .05$. Follow-up mixed-model *t* tests on the interaction indicated that to account for the high magnitude event, Canadians rated the high magnitude cause as more likely than did Chinese and rated the low magnitude cause as marginally less likely than did Chinese, $ts(134) > 1.65$, $ps < .07$. For the low magnitude event, Canadians rated the high magnitude cause as less likely than did Chinese and rated the low magnitude cause as marginally more likely than did Chinese, $ts(134) > 1.73$, $ps < .09$. Therefore, Canadians exhibited a stronger cause-effect magnitude correspondence than Chinese (see Figure 5).

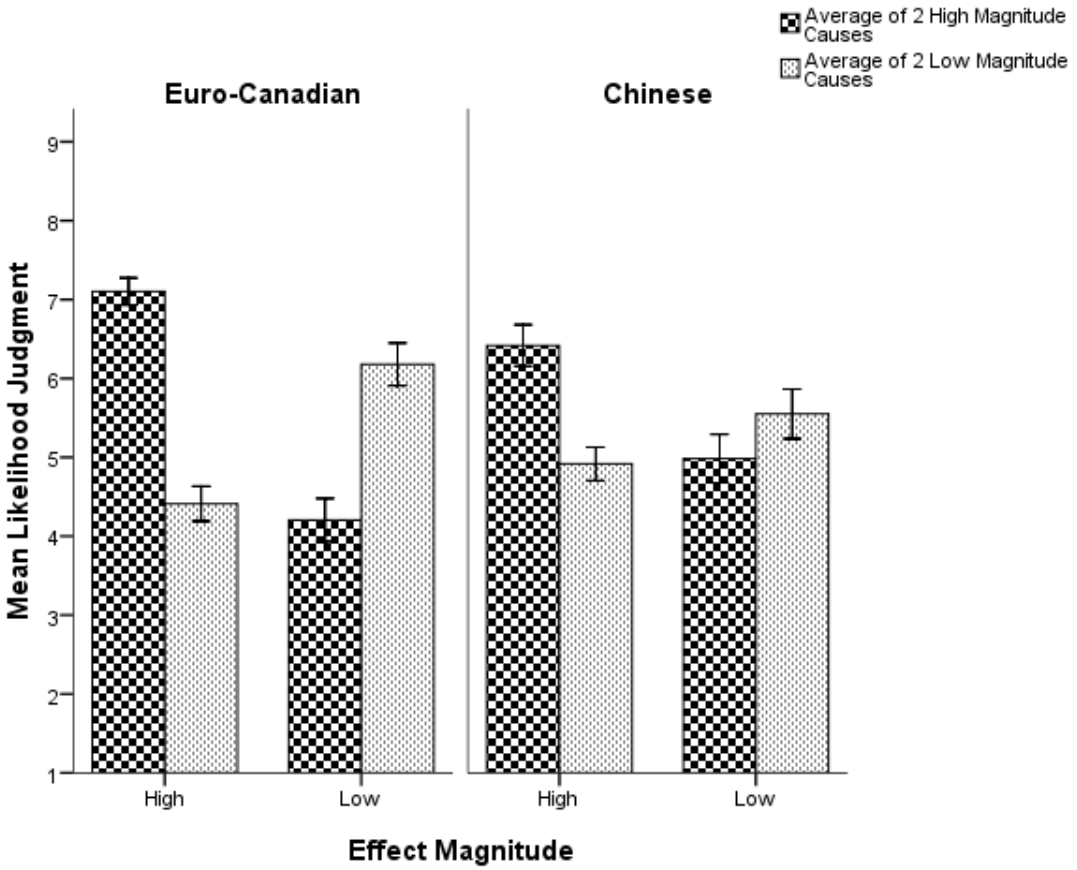

***Figure 5*. Canadian and Chinese likelihood estimates (+ SE) of high and low magnitude causes leading to high and low magnitude effects**

Thus, in two detailed scenarios represented by words in Study 1 and two simple scenarios represented by pictures in Study 2, Canadians associated high magnitude effects with high magnitude causes more than low magnitude causes and low magnitude effects with low magnitude causes more than high magnitude causes. Furthermore, for all four scenarios, Chinese exhibited this pattern to at least a marginally lesser degree (in Studies 1a, 1b, and 2).

Chapter 4

Study 3

In Studies 1 and 2, I found that compared with Chinese, Canadians expect effects and their causes to correspond in magnitude to a greater degree. I argue that the pattern of results is caused by cultural differences in holistic reasoning. However, a simple alternative explanation exists: The results from Studies 1 and 2 could be explained by a stronger preference to choose midpoints on scales by Chinese than by Canadians. In both studies, participants rated their likelihood judgments on a Likert-type scale. Chen, Lee, and Stevenson (1995) found evidence that East Asians typically prefer points closer to the midpoints of such scales even though the degree of midpoint-response bias in their study was weak, especially comparing Chinese and Canadians. Furthermore, other studies have found no such tendency (e.g., Ji, Schwarz, & Nisbett, 2000).

Nonetheless, I designed Study 3 to rule out the possibility that Chinese were engaging in such a moderacy-response bias. Instead of rating the likelihoods of causes on a scale, participants chose the cause they perceived to have most likely led to the effect. If the same pattern of results as in Studies 1 and 2 emerged regarding participants' choices, then these results would provide strong evidence against the alternative explanation.

Method

Participants

Sixty-three European-Canadians (48 women and 15 men) and 63 Chinese nationals living in Canada (44 women and 19 men) were recruited from Queen's University. Participants received course credit or $5 for their participation. At the time of

the study, the Chinese nationals had lived in Canada for an average of 28.83 months (*SD* = 13.54).

Materials and Procedure (See Appendix D for all experimental materials)

Participants were randomly assigned to either the high or the low effect magnitude condition. Within each condition, participants read three scenarios. A scenario was used from Study 1a (disease outbreak described in words) and both scenarios were used from Study 2 (basketball game and tornadoes depicted in pictures). In the high magnitude effect condition, all three scenarios described high magnitude effects, and likewise in the low magnitude effect condition, all three scenarios described low magnitude effects. For each scenario, participants chose the more likely cause of the effect between the high and the low magnitude causes. Additionally, participants indicated their confidence in each choice on an 8-point scale (1 = *not at all confident*, 8 = *extremely confident*). In summary, Study 3 had a 2 (culture: Canadians vs. Chinese) by 2 (effect magnitude: high vs. low) by 2 (cause magnitude: high vs. low) design. The cause magnitude factor varied within-participants, and the other factors varied between-participants.

Results and Discussion

Test of Cause-Effect Magnitude Correspondence

Each participant chose three causes, one for each scenario. Each choice was analyzed separately by conducting a 2 (culture) by 2 (effect magnitude) by 2 (cause magnitude) log-linear analysis. For all three scenarios, the analyses revealed significant interactions between effect magnitude and cause magnitude, all G^2s > 25.72, all *df* = 1, all *p*s < .001, indicating that for each scenario, participants were more likely to associate

high magnitude effects with high magnitude causes than with low magnitude causes, and low magnitude effects with low magnitude causes than with high magnitude causes, χ^2s > 8.41, *p*s < .004. More importantly, for all three scenarios, the analyses revealed significant culture by effect magnitude by cause magnitude interactions, all G^2s > 13.58, all *df* = 1, all *p*s < .001. For all three scenarios, Canadians were more likely to exhibit the magnitude matching pattern than were Chinese, χ^2s > 6.34, *p*s < .01 (see Table 1 for frequency counts). Thus, I successfully replicated the results from Studies 1 and 2 using a method that did not rely on a Likert-type scale, suggesting that a midpoint preference by Chinese was unlikely to account for the results obtained in Studies 1 and 2.

Table 1. ***Frequencies of Canadian and Chinese cause magnitude choices (and percentages within each culture)***

		Disease Outbreak Causes		Basketball Game Causes		Tornado Damage Causes	
Effect	Culture	High	Low	High	Low	High	Low
High	Canadian	29 (90.6%)	3 (9.4%)	30 (93.8%)	2 (6.2%)	28 (87.5%)	4 (12.5%)
	Chinese	18 (56.2%)	14 (43.8%)	20 (62.5%)	12 (37.5%)	19 (59.4%)	13 (40.6%)
Low	Canadian	4 (12.9%)	27 (87.1%)	3 (9.7%)	28 (90.3%)	4 (12.9%)	27 (87.1%)
	Chinese	14 (45.2%)	17 (54.8%)	13 (41.9%)	18 (58.1%)	13 (41.9%)	18 (58.1%)

Confidence Ratings

A 2 (culture) by 2 (effect magnitude) by 3 (scenario) mixed-design ANOVA indicated no significant interactions, all *p*s > .79. The effect magnitude main effect was significant, $F(1, 122) = 5.94$, $p = .02$, $\eta_p^2 = .05$, indicating that participants were more

confident in their choices in the low magnitude condition (M = 6.25, SD = .99) than in the high magnitude condition (M = 5.80, SD = 1.15). In addition, the culture main effect was significant, $F(1, 122) = 11.20$, $p < .001$, $\eta_p^2 = .08$, such that Chinese were more confident of their choices overall (M = 6.33, SD = .82) than were Canadians (M = 5.71, SD = 1.24). Therefore, on this scale as well, Chinese were not more likely than Canadians to prefer responses near the midpoint of the scale, thus providing further evidence that a midpoint preference by Chinese was unlikely to account for the results obtained in Studies 1 and 2.

Therefore, Study 3 replicated the results of Studies 1 and 2 using a different method and ruled out the potential alternative explanation that Chinese were engaging in a moderacy-response bias. In fact, Chinese responded significantly farther from the midpoint than did Canadians on confidence ratings of their likelihood judgments.

Chapter 5

Study 4

The purpose of Study 4 was to directly test the hypothesis that analytic and holistic reasoning was responsible for the cultural differences in the tendency to expect a correspondence in magnitude between cause and effect. I developed an exercise to prime either analytic or holistic reasoning in Canadian participants. Participants completed the exercise, then read a scenario describing a high or low magnitude effect and rated the likelihood that high or low magnitude causes had led to that effect. I used two different versions of scenarios with two separate samples, one in Study 4a and the other in Study 4b.

Study 4a

Participants

Sixty-seven European-Canadians (49 women and 18 men) were recruited from Queen's University. Participants received course credit or $5 for their participation.

Materials and Procedure (See Appendixes E and F for all experimental materials)

Analytic versus Holistic Prime. One important aspect of analytic versus holistic thinking that has been identified in past research is the tendency for analytic thinkers to have simple causal theories and for holistic thinkers to have complex causal theories (Choi et al., 2003). Therefore, I decided to prime analytic and holistic thinking by focusing participants' attention on either a simple or a complex causal field, respectively.

For the prime, participants completed an exercise ostensibly unrelated to the rest of the study. All participants read that "Getting into a competitive university such as Queen's University is a major achievement. The majority of high school students do not

make it into any university at all, and a large number of applicants to Queen's are turned away every year." In the analytic prime condition, participants then listed the most significant event in their life that had enabled them to get into Queen's and described how it had done so. Lastly, they completed a diagram consisting of two ellipses, one labeled "Event" and the other "Getting into Queen's" by writing the significant event in the event ellipse and by drawing an arrow between it and the getting into Queen's ellipse. The exercise was designed to focus each participant's attention on a single cause that had led to a major event in his or her life. The holistic prime was identical to the analytic prime except that participants listed the three most significant events. Holistic reasoning not only involves focusing on numerous causes but also focusing on the interactions between such causes. Therefore, participants also described how the three events had influenced each other. The diagram consisted of four ellipses, three on the periphery labeled "Event" and one in the center labeled "Getting into Queen's." After writing the three events in the event ellipses, participants drew arrows from each one to the Queen's ellipse. Lastly, they drew arrows connecting the three events to describe how these events had influenced or interacted with each other. The holistic prime was designed to focus participants' attention on a larger causal field and on the connectedness of causes within that field.

Magnitude Manipulations. After the prime, participants read the disease scenario from Study 1 and rated the likelihood that each of the two causes had led to the effect on a 9-point scale (1 = *not likely at all*, 9 = *extremely likely*). In summary, Study 4a had a 2 (prime: analytic vs. holistic) by 2 (effect magnitude: high vs. low) by 2 (cause magnitude:

high vs. low) design. The causal magnitude factor varied within-participants, and the other factors varied between-participants.

Results and Discussion

Test of Cause-Effect Magnitude Correspondence

A 2 (prime: analytic versus holistic) X 2 (effect magnitude) X 2 (cause magnitude) mixed-design ANOVA revealed a significant main effect of effect magnitude, $F(1, 63) = 12.47$, $p < .001$, $\eta_p^2 = .13$, such that participants in the high magnitude effect condition gave higher likelihood ratings for the causes ($M = 5.97$, $SD = .94$), in comparison with those in the low magnitude effect condition ($M = 5.35$, $SD = .92$). The effect magnitude by cause magnitude interaction was significant, $F(1, 63) = 78.92$, $p < .001$, $\eta_p^2 = .56$. Overall, participants tended to associate high magnitude effects with high magnitude causes ($M = 7.17$, $SD = 1.56$) more than low magnitude causes ($M = 4.51$, $SD = 1.98$), $t(63) = 6.55$, $p < .001$, and low magnitude effects with low magnitude causes ($M = 7.00$, $SD = 1.30$) more than high magnitude causes ($M = 4.44$, $SD = 1.76$), $t(63) = 6.03$, $p < .001$.

More importantly, the prime by effect magnitude by cause magnitude interaction was significant, $F(1, 63) = 12.02$, $p < .001$, $\eta_p^2 = .16$. Follow-up mixed-model t tests on the interaction indicated that to account for the high magnitude event, analytically-primed Canadians rated the high magnitude cause as more likely than did holistically-primed Canadians and rated the low magnitude cause as marginally less likely than did holistically-primed Canadians, $ts(63) > 1.94$, $ps < .07$. For the low magnitude event, analytically-primed Canadians rated the high magnitude cause as less likely than did holistically-primed Canadians and rated the low magnitude cause as marginally more

likely than did holistically-primed Canadians, *t*s(63) > 1.67, *p*s < .09. Therefore, Canadians primed to reason analytically exhibited at least a marginally stronger cause-effect magnitude correspondence than Canadians primed to reason holistically (see Figure 6).

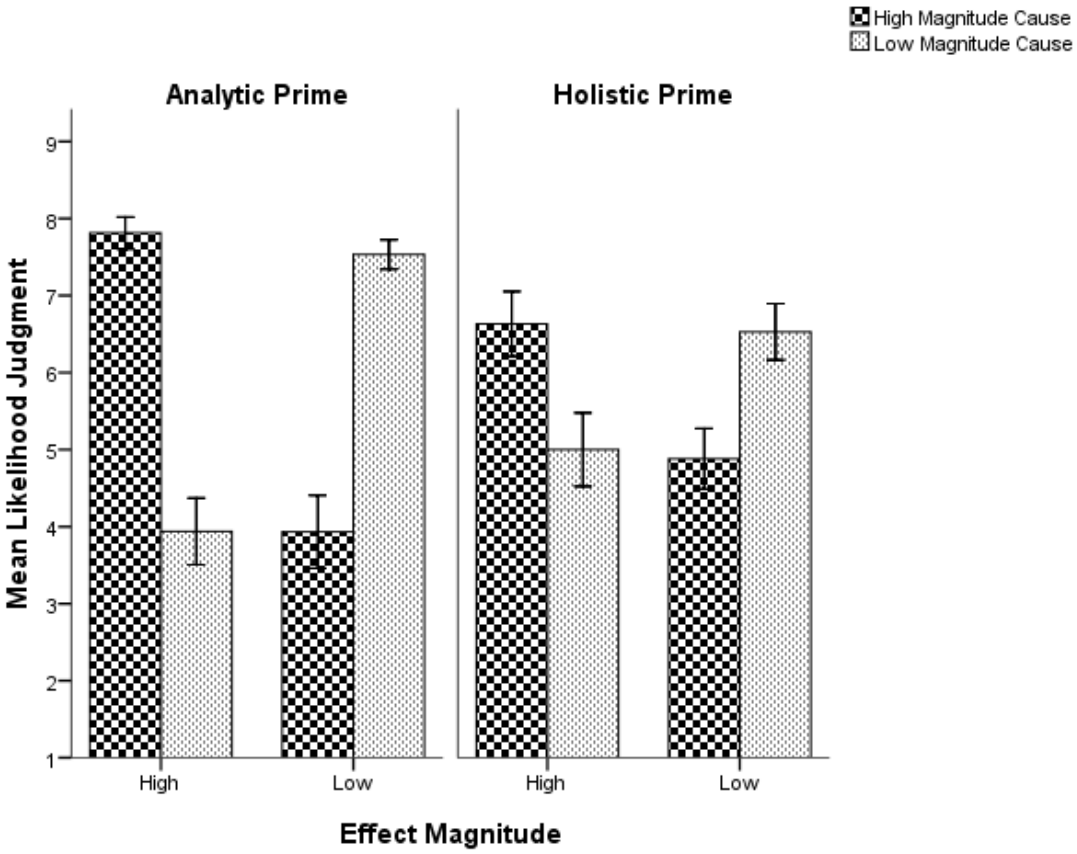

***Figure 6*. Analytically primed and holistically primed Canadian likelihood estimates (+ SE) of high and low magnitude causes leading to high and low magnitude effects**

Comparison with Non-Primed Participants from Study 1a

Participants in Study 1a completed the identical disease scenario but without any prime. Therefore, we compared participants from Study 4a with those from Study 1a to determine more specifically what effect the analytic and holistic primes had on participants. First, we compared analytically primed Canadians with those who received no prime. The prime by effect magnitude by cause magnitude interaction was not significant, $F(1, 86) = 1.36$, $p = .25$, revealing that Canadians primed to reason analytically did not differ from those who received no prime. Next we compared holistically primed Canadians with those who received no prime. The prime by effect magnitude by cause magnitude interaction was significant, $F(1, 91) = 21.39$, $p < .001$, $\eta_p^2 = .19$, revealing that it was the holism prime, rather than the analytic prime, that was responsible for the effects. Lastly, we compared holistically primed Canadians with Chinese from Study 1a who received no prime. The culture by effect magnitude by cause magnitude interaction was not significant, $F(1, 91) = 1.47$, $p = .23$, revealing that Canadians primed to reason holistically did not differ from Chinese who received no prime.

Study 4b

Participants

One hundred twenty-one European-Canadians (75 women and 46 men) were recruited from Queen's University. Participants received course credit or $5 for their participation.

Materials and Procedure (See Appendix G for all experimental materials)

The procedure was identical to Study 4a except that participants read a money scenario after the prime. I also included a control condition in which participants did not receive any prime. The money scenario described a Canadian individual who had either accumulated greater than average savings (high magnitude effect) or lesser than average savings (low magnitude effect). The scenario was followed by two potential causes, one of high magnitude (the individual had a higher than average income) and one of low magnitude (the individual had a lower than average income). In summary, Study 4b had a 3 (prime: none, analytic, or holistic) by 2 (effect magnitude: high vs. low) by 2 (cause magnitude: high vs. low) design. The causal magnitude factor varied within-participants, and the other factors varied between-participants.

Results and Discussion

Test of Cause-Effect Magnitude Correspondence

A 3 (prime) X 2 (effect magnitude) X 2 (cause magnitude) mixed-design ANOVA revealed a significant main effect of effect magnitude, $F(1, 115) = 8.72$, $p = .004$, $\eta_p^2 = .07$, such that participants in the high magnitude effect condition gave higher likelihood ratings for the causes ($M = 5.52$, $SD = .97$), in comparison with those in the low magnitude effect condition ($M = 4.77$, $SD = .98$). The effect magnitude by cause magnitude interaction was significant, $F(1, 115) = 239.66$, $p < .001$, $\eta_p^2 = .68$. Overall, participants tended to associate high magnitude effects with high magnitude causes ($M = 6.97$, $SD = 1.53$) more than low magnitude causes ($M = 3.43$, $SD = 2.01$), $t(115) = 11.88$, $p < .001$, and low magnitude effects with low magnitude causes ($M = 6.57$, $SD = 1.51$) more than high magnitude causes ($M = 3.07$, $SD = 1.64$), $t(115) = 11.65$, $p < .001$.

More importantly, the prime by effect magnitude by cause magnitude interaction was significant, $F(2, 115) = 6.81$, $p = .002$, $\eta_p^2 = .11$. We conducted follow-up 2 (prime) by 2 (effect magnitude) X 2 (cause magnitude) mixed-design ANOVAs to determine more specifically the effects of the primes. Canadians primed to reason analytically did not differ in the tendency to match cause and effect magnitudes compared with Canadians who received no prime, $F(1, 87) = .22$, $p = .64$. As hypothesized, Canadians primed to reason analytically exhibited a stronger cause-effect magnitude correspondence than Canadians primed to reason holistically, $F(1, 61) = 10.16$, $p = .002$, $\eta_p^2 = .14$. In addition, Canadians who received no prime tended to exhibit a stronger cause-effect magnitude correspondence than did Canadians primed to reason holistically, $F(1, 82) = 10.26$, $p = .002$, $\eta_p^2 = .11$.

Because analytically-primed Canadians did not differ from those receiving no prime, we collapsed the two groups together, referred to them as analytic-Canadians, and compared them with holistically-primed Canadians. Analytic-Canadians expected more cause-effect magnitude correspondence than did holistically primed Canadians, $F(1, 115) = 13.55$, $p < .001$, $\eta_p^2 = .10$. Follow-up mixed-model t tests on the interaction indicated that to account for the high magnitude event, analytic-Canadians rated the high magnitude cause as more likely than did holistically-primed Canadians and rated the low magnitude cause as less likely than did holistically-primed Canadians, ts(115) > 2.10, ps < .05. For the low magnitude event, analytic-Canadians rated the high magnitude cause as less likely ($M = 2.78$, $SD = 1.16$) than did holistically-primed Canadians ($M = 3.50$, $SD = 1.28$), $t(115) = 1.74$, $p < .05$, and rated the low magnitude cause as marginally more likely than did holistically-primed Canadians, $t(115) = 1.54$, $p = .09$ (see Figure 7).

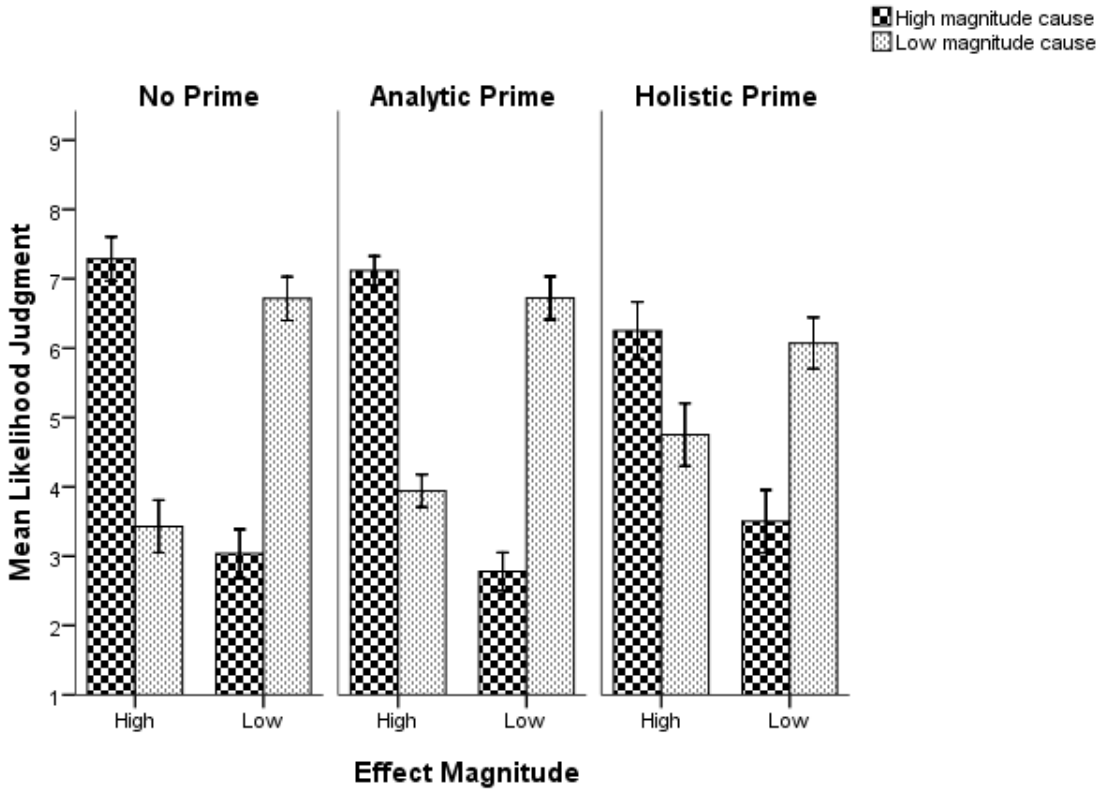

***Figure 7*. No prime, analytically primed, and holistically primed Canadian likelihood estimates (+ SE) of high and low magnitude causes leading to high and low magnitude effects**

Therefore, for both the disease (Study 4a) and the money (Study 4b) scenarios, analytically primed Canadians associated high magnitude effects with high magnitude causes more than low magnitude causes, and low magnitude effects with low magnitude causes marginally more than high magnitude causes. And in both scenarios, holistically primed Canadians exhibited this pattern to at least a marginally lesser degree. Additionally, comparing participants from Study 4a with participants from Study 1a who

completed the same materials without any prime revealed that the analytic prime had no effect. Instead, the holistic prime was the one that caused Canadians to expect less cause-effect magnitude correspondence. This pattern of results was replicated in Study 4b by comparing the participants who received either the analytic prime or the holistic prime with participants in a control condition who received no prime. Lastly, comparing holistically primed Canadians in Study 4a with Chinese in Study 1a who received no prime revealed no cultural differences in the tendency to expect a cause-effect magnitude correspondence.

Chapter 6

General Discussion

Across three studies, using various methods and scenarios, Canadians expected a greater correspondence in magnitude between effects and their causes than did Chinese. In a fourth study, both analytically primed Canadians and Canadians who received no prime were more likely to expect the correspondence in magnitude between cause and effect than were holistically primed Canadians; whereas the holistically primed Canadians showed similar responses to Chinese participants. The results not only demonstrated cultural differences in the extent to which people expect a correspondence in magnitude between cause and effect, but they also demonstrated the underlying factor responsible for such cultural differences, namely analytic or holistic reasoning.

It is important to note that although the cultural interactions were clearly significant for all studies, not all of the follow-up tests reached significance. For the high magnitude effect condition, the follow-up *t* tests were significant; whereas for the low magnitude effects, many of the follow-up *t* tests were marginally significant. Looking at the pattern of results across studies, the pattern is clear and consistent. Canadians do indeed expect stronger cause-effect magnitude correspondence than do Chinese. The marginally significant results most likely signal boundary conditions in which the effects are weaker. The fact that the effects were weaker in the low magnitude effect condition could be explained by participants being more engaged by high than low magnitude events. It would be interesting to explore such explanations in future research.

Alternative Explanations and Potential Limitations

One alternative explanation for the findings is that Chinese tend to prefer the midpoints of scales and, therefore, responded more moderately. In the first two studies, participants selected values on a Likert-type scale to judge the likelihood that high and low magnitude causes enabled high and low magnitude events. However, Study 3 provided strong evidence against this alternative explanation. When asked to choose the more likely cause, rather than to estimate the likelihood on a scale, the same pattern of results emerged across three scenarios, suggesting that the cultural differences obtained in our studies were not due to a response bias in Chinese participants. Furthermore, when asked to indicate their confidence in their choices using a Likert-type scale, Chinese were more confident than Canadians. Therefore, Chinese responded more extremely than Canadians, rather than more moderately on this scale.

Another alternative explanation for the results is that Chinese may be less familiar with the scenarios than are Canadians. If people are reasoning about the cause of an effect in a context where causes and effects do tend to correspond in magnitude in the real world, then the tendency to predict such an association would be prudent. Therefore, if Canadians are more familiar than Chinese are with a scenario, and thus the underlying causes of the effect in that scenario, then Canadians should expect a greater degree of correspondence between cause and effect.

This potential alternative explanation has at least three problems. First, when choosing and designing my scenarios, I was very careful to generate scenarios that were familiar and understandable to both cultural groups. In direct collaboration with two Chinese nationals who were born, raised, and spent most of their lives in China, I generated a number of potential scenarios. I then refined the final set of scenarios from

the much larger initial set by endeavoring to ensure the events and causes were both culturally appropriate and perceived to be equivalently likely and plausible across both cultures. These final scenarios were then carefully checked by our Chinese collaborators in Beijing and Wuhan, along with a number of their Chinese graduate students. After numerous revisions I chose a set of events and causes that were perceived to be equally likely to occur across cultures. A second problem with the alternative explanation is that Chinese indicated higher confidence levels in their judgments than did Canadians, thus providing evidence against the conjecture that Chinese were responding more moderately due to unfamiliarity with the scenarios. A third problem is that even if all my efforts at ensuring equivalent levels of familiarity with the scenarios failed, and Chinese indicated higher levels of confidence for some alternative reason, the familiarity explanation would not fit with the pattern of results in Studies 4a and 4b. One would have difficulty explaining, based on familiarity with the scenarios, why priming Canadians to think holistically would cause them to respond similar to Chinese, namely by expecting a lesser degree of cause-effect magnitude correspondence.

One potential limitation of this research stems from the way magnitude was manipulated in the events and the causes presented. In order to rule out the potential problems with previous research, whereby the magnitude of causes and effects was confounded with other factors, such as the content, I simplified the scenarios, so that magnitude was the most salient factor. As a result, one might argue that the scenarios were relatively simplistic compared to the types of information people might encounter in the everyday world. Making magnitude the most salient feature of the scenarios may have caused analytic Canadians to focus most of their attention on that feature, relative to

Chinese who attend to the world more holistically. One could then argue that there is nothing special about magnitude, and that we would find a similar pattern of results for whatever feature was made salient to Canadians. As a simple example, if the damage caused by a tornado was green in colour, and we included a green and a blue tornado as potential causes, Canadians might lock onto the colour due to their analytic style of thinking; whereas Chinese might consider other factors, such as magnitude, and the opposite pattern of results might emerge. Chinese would then expect more cause-effect magnitude correspondence than Canadians.

However, research indicates that there is something special about magnitude; it is not an arbitrary feature in terms of its importance to our field of attention. Osgood sought to determine the dimensions by which people categorize objects by factor analyzing adjectives and found that three meaningful factors emerged. He identified magnitude as one of the fundamental dimensions people naturally focus on and use when judging entities (Osgood, 1957; referred to as potency and characterized by adjective pairs such as large-small and strong-weak). As a result, he demonstrated that magnitude is an inherently salient and fundamentally meaningful dimension. In order of importance, magnitude came right after evaluation (good-bad) and before action (active-passive). In addition, Osgood, May, and Miron (1975) demonstrated the potential universality of the importance of these three dimensions by conducting numerous investigations in over 29 cultures, including North Americans and Chinese.

It is important to note another limitation of this research. It is important to note that holism does not appear to be a simple uniform construct determined by a single cognitive mechanism. For example, researchers have focused on at least four factors

under the umbrella term holism: causality (Choi et al., 2003), attitude toward contradiction (e.g., Peng & Nisbett, 1999), perception of change (Ji, Nisbett, & Su, 2001), and locus of attention (e.g., Masuda & Nisbett, 2001; see also Nisbett et al., 2001). The present research focused on the causality factor. Our prime was specifically developed to affect analytic and holistic reasoning patterns related to causality. We have no research evidence regarding how the present research relates to the other three factors. One other limitation of this research is that all four studies asked participants to explain events by judging the likelihood of causes. We do not know whether the reverse pattern of results would be similar, when given causes and asked to judge the likelihood that they enabled certain events. Based on the present literature, we have no reason to expect any differences.

Another alternative explanation hinges upon potential cultural differences in conversational norms, especially the norm of relevance (Grice, 1975). If Canadians believe that information provided by others is relevant to the task at hand to a greater extent than Chinese, then Canadians may have made greater use of the magnitude information in the scenarios than Chinese. As a result, Canadians likelihood judgments would have been influenced by the magnitude information more so than Chinese judgments. Ji, Schwarz, and Nisbett (2000) found evidence that Chinese and Americans equally relied on response scales as a frame of reference for behaviour frequency estimates when they had little episodic knowledge about the behaviours, suggesting that the norm of relevance may apply in the Chinese context as well. Thus, conversational norms may not be a valid alternative explanation, although additional research will be useful to address this issue.

Theoretical Contributions

Culture and Attributions. Gilovich and Savitsky (2002, p. 618) defined the representativeness heuristic as the tendency to process information "on the basis of one overarching rule: 'Like goes with like.'" Most of the research on this heuristic has been conducted in the context of categorization; whereas little research has explored the representativeness heuristic in the context of attributions. The tendency to expect causes and effects to correspond in magnitude is a species of this heuristic. Although some have speculated on the tendency to expect cause-effect magnitude correspondence when making attributions (Einhorn & Hogarth, 1986; Nisbett, 1980), little research has systematically investigated such speculation. Our studies demonstrated that people from two different cultures, Canada and China, indeed tend to expect cause and effect to correspond in magnitude. As a result, I have made a significant contribution to the attribution literature by providing strong and consistent empirical support that people tend to explain events in a manner consistent with what one would expect if relying on the representativeness heuristic.

In addition, my studies offer a significant contribution to both the attribution literature and the cultural psychology literature by demonstrating that the degree to which people expect cause-effect magnitude correspondence differs across cultures. The fact that Canadians expected a greater degree of correspondence in magnitude when making causal judgments indicates that they exhibit a more extreme form of the representativeness heuristic in this context, compared with Chinese. My study is the first that I am aware of to demonstrate cultural differences in the degree to which people employ the representativeness heuristic in the context of attributions.

Most importantly, my finding that the degree to which people expect cause-effect magnitude correspondence is in part determined by whether or not they reason analytically or holistically enhances our understanding of the cognitive underpinnings of the representativeness heuristic in the context of attributions. My studies provide the first evidence that the representativeness heuristic is, at least in part, caused by the degree of complexity one attends to in a causal field. Furthermore, the fact that this tendency differs across cultures signals the need to investigate whether or not cultural differences would emerge for other heuristics.

Cultural Universals. Notably, within the domain of my scenarios and designs, participants from both cultures expected a cause-effect magnitude correspondence. What differed across cultures was the degree to which people expected this correspondence. Norenzayan and Heine (2005) outlined a taxonomy of cultural universals, defined as core mental attributes shared by people everywhere. The taxonomy consists of four levels of cultural universality: accessibility, functional, existential, and nonuniversality. Accessibility universals, the most stringent level of universality, are psychological processes that are available to all people, used for the same function, and accessed to the same degree. Functional universals, the second most stringent level of universality, are cognitively available to all people, used for the same function, but accessed to different degrees. Existential universals, the third most stringent level of universality, are cognitively available to all people, but they may be used in markedly different ways and are accessed to different degrees. Nonuniversals are those processes that are not cognitively available to all people.

Although I only sampled people from two cultures, my pattern of results demonstrating that participants from both cultures expected cause-effect magnitude correspondence, but to different degrees, would potentially qualify as a functional universal. My studies provide the first evidence that I am aware of regarding the universality and cultural variability of the representativeness heuristic. What appears on the surface to be a simple heuristic, the tendency to associate high magnitude effects with high magnitude causes and low magnitude effects with low magnitude causes, is applied to different degrees depending on how our host culture has shaped our minds to process information.

Practical Implications

The pattern of results could also have important practical implications. One potential application is in the domain of behavioral decision making. According to the U.S. Federal Reserve, per capita personal debt in the United States has increased by at least a factor of 10 between 1945 and 2005, reaching unprecedented levels (Massey, 2008). The causes of this trend are surely complex, and I do not intend to oversimplify them or claim that my research has solved this problem. However, my results could potentially contribute to better understanding and ameliorating the situation. For example, North Americans may be more likely to believe that in order to accumulate wealth or to resolve their debt problems, they need to focus on cutting back on major costs and purchases. In doing so, they may pay little attention to the financial impact of minor routine expenses. Consistent with this possibility, financial experts are advising people to cut back on minor expenses, such as the purchase of a daily cup of coffee at a trendy café, because such purchases add up over time. Thus, for people who find themselves in debt,

realizing the importance of reducing minor routine expenses could enable them to more quickly and effectively ameliorate their financial hardship. In addition, the results from Study 4, demonstrating that the tendency to expect a magnitude correspondence is reduced when primed to think holistically, provides hope that people can reduce the degree to which they overlook minor expenses in such situations. I am investigating some of these implications in my ongoing research.

Meanwhile, this research could have mirror-image implications for East Asians. For example, research indicates that when people are aware that a certain behaviour, such as smoking, is detrimental to their health and yet the desire or craving to engage in the behaviour proves too difficult to resist, they may generate or utilize existing compensatory health beliefs to neutralize the cognitive dissonance aroused by the behaviour (Knäuper, Rabiau, Cohen, & Patriciu, 2004). Compensatory health beliefs (CHBs) are beliefs that the negative effects of an unhealthy behavior can be compensated for by engaging in healthy behaviors. For example, choosing to smoke because one believes that one eats well is an example of such a belief. Holding CHBs hinders people from making healthier lifestyle choices. One of the factors that may influence the efficacy of using such beliefs to deal with dissonance may be the degree of causal complexity one considers. If Person A believes that lung cancer is a product of smoking, air pollution, his diet, and his exercise routine, and Person B only considers smoking and exercise, than Person A should have a larger potential number of CHBs that he can generate. Thus, East Asians may be more likely to make use of CHBs. East Asians may underestimate the importance of major health-related behaviors because they believe that other minor health-related behaviors will compensate. For example, when told by a medical expert

that ceasing a pernicious behaviour, such as smoking, is essential for dealing with a major illness, such as lung cancer, Easterners may be more likely to believe that their other health-related behaviors, such as eating well, will compensate for the detrimental effects of smoking

The present research also has practical implications for problem solving and negotiation. The human world is becoming increasingly interconnected and many nations are becoming more ethnically diverse. People from different cultures are realizing the growing need to work together to solve problems, such as those currently undermining political and financial stability, as well as those plaguing our natural environment. When investigating the cause of a high magnitude effect, Westerners' tendency to expect high magnitude causes may lead them to overlook relatively lower magnitude causes that might have played a key role. On the other hand, Chinese might overemphasize factors that played a minor role at the expense of those that played a major role. These different tendencies to emphasize high versus low magnitude causes could potentially lead to disagreement or international conflict. In a world in which cross-cultural interaction is crucial, further understanding cultural differences in reasoning about cause and effect relationships could prove important both for finding solutions to the problems and for negotiating diplomatic resolutions to the inevitable disagreements that will arise between nations.

This research also has important implications for other areas of research, such as persuasion. People who expect a correspondence in magnitude between effects and their causes may find arguments consistent with such expectations highly persuasive compared with arguments that are not. A message attempting to persuade people to purchase a

major costly product because it is the only solution to their major problems may be more effective for North Americans than East Asians. Alternatively, a message attempting to persuade people that a minor inexpensive product is important may be more effective for East Asians than North Americans. Additionally, a prime similar to mine embedded within the message may increase its effectiveness in both cases.

People associate big causes with big effects and small causes with small effects. However, the degree to which we make this association is at least partially determined by the reasoning processes we are imbued with from the culture in which our minds developed. Some physicists believe that our universe, created by the big bang, will end in a big crunch. Perhaps a more holistic interpretation of this scenario would result in the universe that began from the big bang ending in a small crunch.

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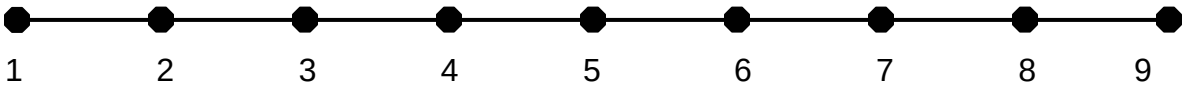
Appendix A: Questionnaires for Study 1a

High magnitude effect condition:

We are interested in people's intuitive predictions about events they may or may not be familiar with. Please read the following **incident**:

21 people at a major downtown company became ill. They were stricken with symptoms of nausea and vomiting. Within 3 days, 11 of these individuals had experienced a rapid but horrific death and the other 10 were still in hospital.

The two events below actually occurred, but at two separate companies. Only one event occurred at the company above and caused the incident. How likely do you think each of the two events below is to have caused the incident? Using the scale below, write the number for each event on the blank spaces.



1 2 3 4 5 6 7 8 9

Not Likely At All — Somewhat Likely — Extremely Likely

There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

Event A ___ An employee came into contact with a highly infectious type of super-bacteria, while on a business trip.

Event B ___ An employee came into contact with a standard type of bacteria, while on a business trip.

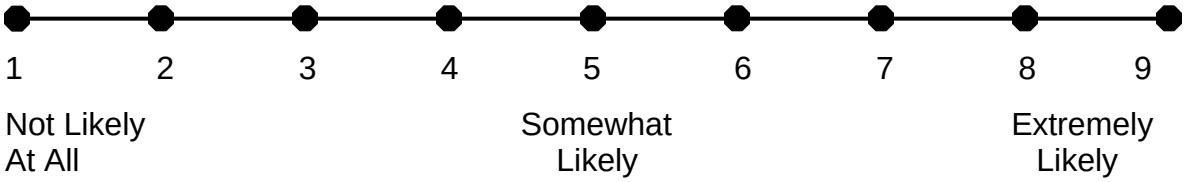
Questionnaires for Study 1a:

Low magnitude effect condition:

We are interested in people's intuitive predictions about events they may or may not be familiar with. Please read the following **incident**:

7 people at a major downtown company became ill. They were stricken with symptoms of nausea and vomiting. Within 3 days, 3 of these individuals had recovered and the other 4 were still experiencing minor symptoms.

<u>The two events below actually occurred, but at two separate companies. Only one event occurred at the company above and caused the incident.</u> How likely do you think each of the two events below is to have caused the incident? Using the scale below, write the number for each event on the blank spaces.



There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

Event A ___ An employee came into contact with a highly infectious type of super-bacteria, while on a business trip.

Event B ___ An employee came into contact with a standard type of bacteria, while on a business trip.

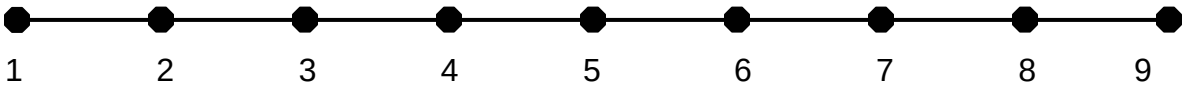
Appendix B: Questionnaires for Study 1b

High magnitude effect condition:

We are interested in people's intuitive predictions about events they may or may not be familiar with. Please read about the following negotiation:

Two parties are negotiating a new contract. This negotiation took over 31 weeks to reach an agreement, which is much longer than usual compared with other similar negotiations.

The two events below actually occurred, but during different negotiations. Only one event occurred during the negotiation described above. How likely do you think it is that each event occurred during the above negotiation? Using the scale below, write your estimate for each event on the 2 blank spaces.



1	2	3	4	5	6	7	8	9
Not Likely At All				Somewhat Likely				Extremely Likely

There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

Event A ___ Two negotiating parties could not agree on one major point, which amounted to 41% of the total contract.

Event B ___ Two negotiating parties could not agree on one minor point, which amounted to 10% of the total contract.

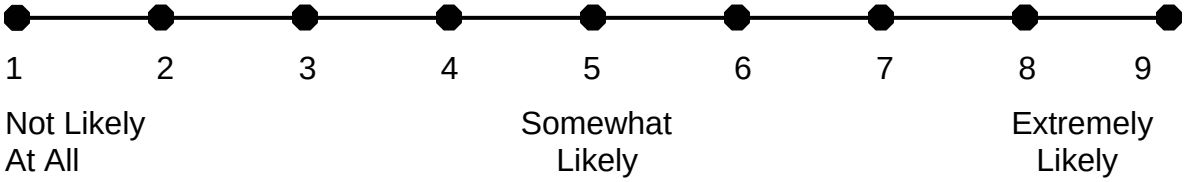
Questionnaires for Study 1b:

Low magnitude effect condition:

We are interested in people's intuitive predictions about events they may or may not be familiar with. Please read about the following negotiation:

Two parties are negotiating a new contract. This negotiation took only 2 weeks to reach an agreement, which is typical compared with other similar negotiations.

The two events below actually occurred, but during different negotiations. Only one event occurred during the negotiation described above. How likely do you think it is that each event occurred during the above negotiation? Using the scale below, write your estimate for each event on the 2 blank spaces.



There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

Event A ___ Two negotiating parties could not agree on one major point, which amounted to 41% of the total contract.

Event B ___ Two negotiating parties could not agree on one minor point, which amounted to 10% of the total contract.

Appendix C: Questionnaires for Study 2

High magnitude effect condition:

We are interested in people's intuitive likelihood estimates. Answer the following questions with your initial reaction. *There are no tricks, so do not spend too much time on each one.*

1. **One of the two players scored the most points in a professional basketball game. What is the likelihood that it was:**

Player X? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

Player Y? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

2. Both tornadoes went through a city. One of them caused severe damage. What is the likelihood that it was: (both pictures taken at same distance from center of tornado)

P

Q

Tornado P? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

Tornado Q? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

Questionnaires for Study 2:

Low magnitude effect condition:

We are interested in people's intuitive likelihood estimates. Answer the following questions with your initial reaction. *There are no tricks, so do not spend too much time on each one.*

1. One of the two players scored the least points in a professional basketball game. What is the likelihood that it was:

Player X? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

Player Y? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

2. Both tornadoes went through a city. One of them caused no damage at all. What is the likelihood that it was: (both pictures taken at same distance from center of tornado)

P

Q

Tornado P? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

Tornado Q? –

1 2 3 4 5 6 7 8 9

Extremely Unlikely — Extremely Likely

Appendix D: Questionnaires for Study 3

High magnitude effect condition:

We are interested in people's intuitive likelihood estimates. Answer the following questions with your initial reaction. *There are no tricks, so do not spend too much time on each one.*

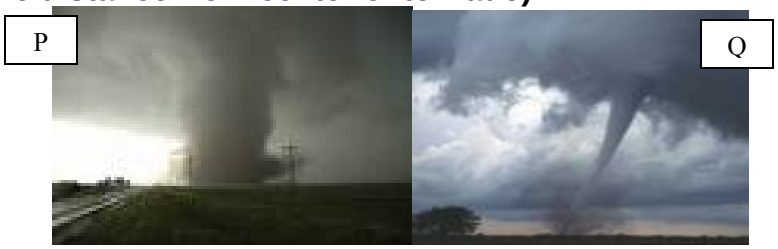
1. One of the two players scored the most points in a professional basketball game.

Who do you think it most likely was (circle one)? Man X Man Y

How confident are you about your above estimate? (Circle one number)

1	2	3	4	5	6	7	8
Not at all confident							Extremely confident

2. Both tornadoes went through a city. One of them caused severe damage (both pictures taken at same distance from center of tornado).



Which do you think it most likely was (circle one)? Tornado P Tornado Q

How confident are you about your above estimate? (Circle one number)

1	2	3	4	5	6	7	8
Not at all confident							Extremely confident

3. 21 people at a major downtown company became ill. They were stricken with symptoms of nausea and vomiting. Within 3 days, 11 of these individuals had experienced a rapid but horrific death and the other 10 were still in hospital.

The two events below actually occurred, but at two separate companies. Only one event occurred at the company above.

Event A - An employee came into contact with a highly infectious type of super-bacteria, while on a business trip.

Event B - An employee came into contact with a standard type of bacteria, while on a business trip.

Which event do you think most likely occurred at the company above? (Circle one)

Event A **Event B**

How confident are you about your above estimate? (Circle one number)

1	2	3	4	5	6	7	8
Not at all confident							Extremely confident

Questionnaires for Study 3:

Low magnitude effect condition:

We are interested in people's intuitive likelihood estimates. Answer the following questions with your initial reaction. *There are no tricks, so do not spend too much time on each one.*

1. One of the two players scored the least points in a professional basketball game.

Who do you think it most likely was (circle one)? Man X Man Y

How confident are you about your above estimate? (Circle one number)

1	2	3	4	5	6	7	8
Not at all confident							Extremely confident

2. Both tornadoes went through a city. One of them caused no damage at all (both pictures taken at same distance from center of tornado).

Which do you think it most likely was (circle one)? Tornado P Tornado Q

How confident are you about your above estimate? (Circle one number)

1	2	3	4	5	6	7	8
Not at all confident							Extremely confident

3. 7 people at a major downtown company became ill. They were stricken with symptoms of nausea and vomiting. Within 3 days, 3 of these individuals had recovered and the other 4 were still experiencing minor symptoms.

The two events below actually occurred, but at two separate companies. Only one event occurred at the company above.

Event A - An employee came into contact with a highly infectious type of super-bacteria, while on a business trip.

Event B - An employee came into contact with a standard type of bacteria, while on a business trip.

Which event do you think most likely occurred at the company above? (Circle one)

Event A **Event B**

How confident are you about your above estimate? (Circle one number)

1	2	3	4	5	6	7	8
Not at all confident							Extremely confident

Appendix E: Priming scenarios for Studies 4a and 4b

Analytic Prime:

Achievements

Getting into a competitive university such as Queen's University is a major achievement. The majority of high school students do not make it into any university at all, and a large number of applicants to Queen's are turned away every year.

Think of the most significant event in your life that enabled you to accomplish this major achievement. This event must have occurred within 10 years of getting accepted into Queen's. Briefly describe the event and explain how it enabled you to get into Queen's.

A) Briefly describe the event:

_____

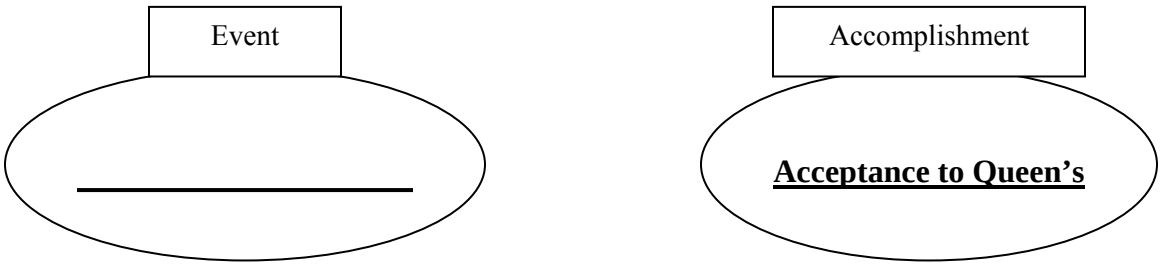
_____

B) Briefly explain how it enabled you to get into Queen's:

_____

_____

C) (i) Enter the event below in one or two words. (ii) Then draw an arrow connecting it to the accomplishment:



Priming scenarios for Studies 4a and 4b

Holistic Prime:

Achievements

Getting into a competitive university such as Queen's University is a major achievement. The majority of high school students do not make it into any university at all, and a large number of applicants to Queen's are turned away every year.

Think of the 3 most significant events in your life that enabled you to accomplish this major achievement. These events must have occurred within 10 years of getting accepted into Queen's, and they must have influenced each other somehow. Briefly describe the 3 events and explain how they enabled you to get into Queen's. Lastly, explain how the 3 events have influenced each other.

A) Briefly describe the events:

Event 1:

_____

_____

Event 2:

_____

_____

Event 3:

_____

_____

B) Briefly explain how each event enabled you to get into Queen's:

Event 1:

_____

_____

Event 2:

_____

_____

Event 3:

_____

_____

C) Briefly explain how the 3 events influenced each other:

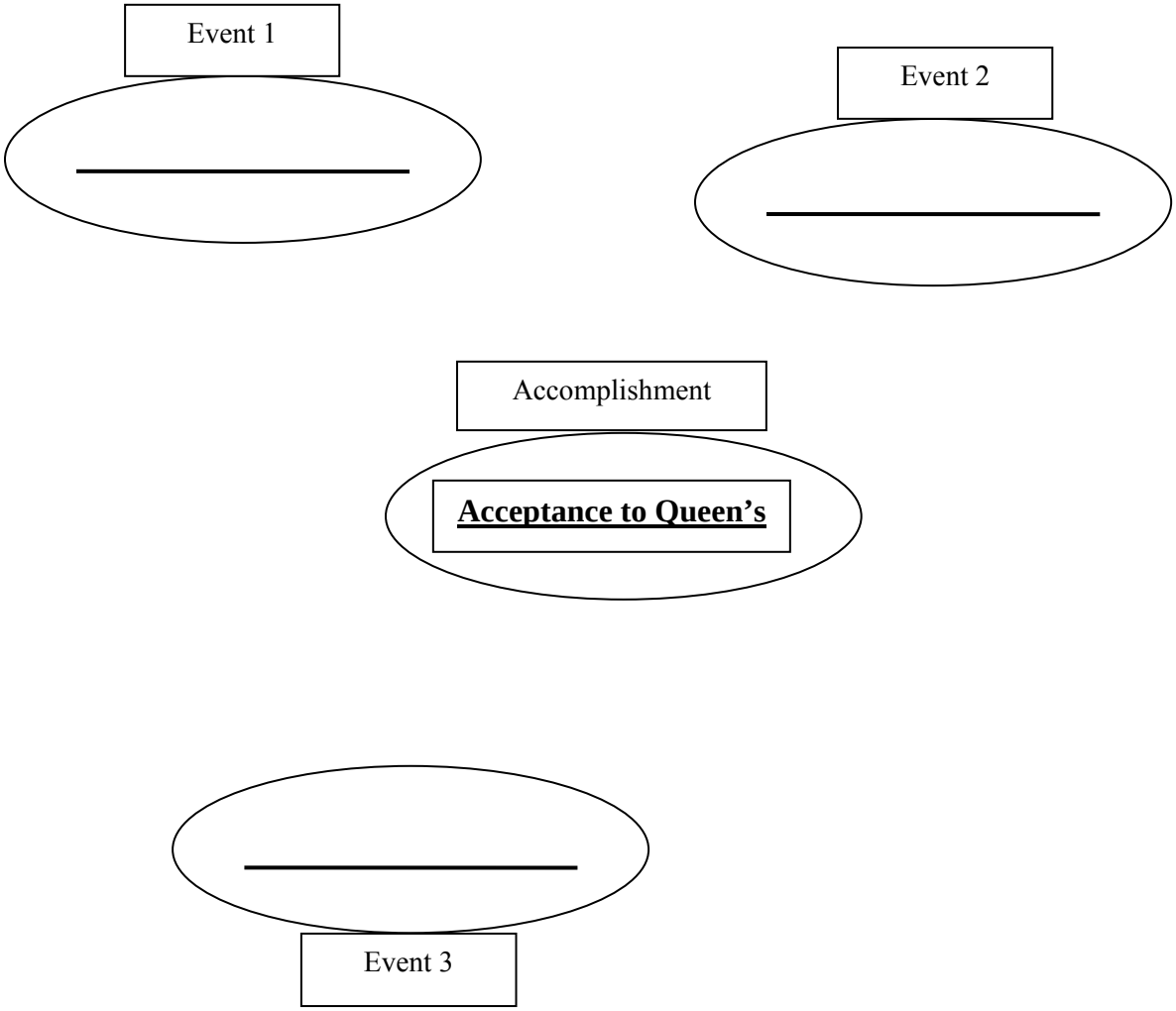
_____

_____

_____

_____

(D) (i) Enter each event below in one or two words. (ii) Then draw arrows connecting each event to the accomplishment. (iii) Lastly, draw arrows connecting the 3 events to each other to show how they influenced each other.



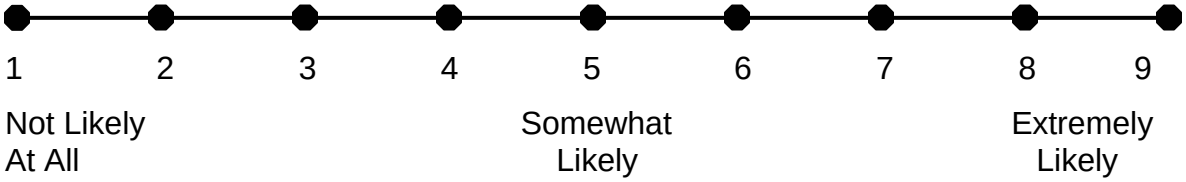
Appendix F: Questionnaires for Study 4a

High magnitude effect condition:

We are interested in people's intuitive predictions about events they may or may not be familiar with. Please read the following **incident**:

21 people at a major downtown company became ill. They were stricken with symptoms of nausea and vomiting. Within 3 days, 11 of these individuals had experienced a rapid but horrific death and the other 10 were still in hospital.

The two events below actually occurred, but at two separate companies. Only one event occurred at the company above and caused the incident. How likely do you think each of the two events below is to have caused the incident? Using the scale below, write the number for each event on the blank spaces.



There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

Event A ___ An employee came into contact with a highly infectious type of super-bacteria, while on a business trip.

Event B ___ An employee came into contact with a standard type of bacteria, while on a business trip.

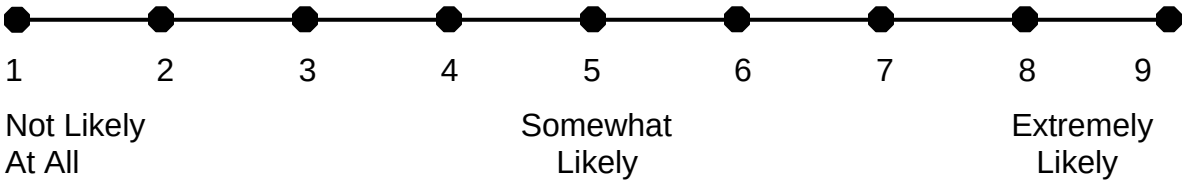
Questionnaires for Study 4a

Low magnitude effect condition:

We are interested in people's intuitive predictions about events they may or may not be familiar with. Please read the following **incident**:

7 people at a major downtown company became ill. They were stricken with symptoms of nausea and vomiting. Within 3 days, 3 of these individuals had recovered and the other 4 were still experiencing minor symptoms.

<u>The two events below actually occurred, but at two separate companies. Only one event occurred at the company above and caused the incident.</u> How likely do you think each of the two events below is to have caused the incident? Using the scale below, write the number for each event on the blank spaces.



There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

Event A ___ An employee came into contact with a highly infectious type of super-bacteria, while on a business trip.

Event B ___ An employee came into contact with a standard type of bacteria, while on a business trip.

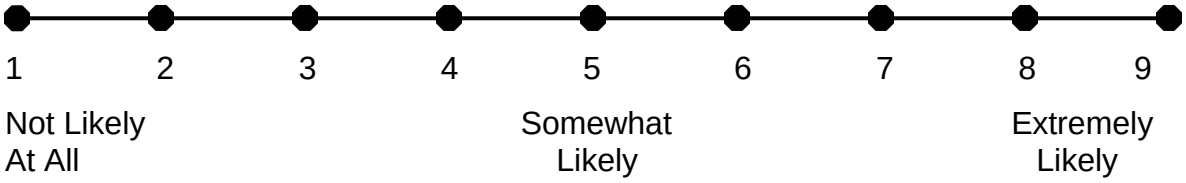
Appendix G: Questionnaires for Study 4b

High magnitude effect condition:

We are interested in people's intuitive predictions about scenarios they may or may not be familiar with. Please read the following scenario:

A person in Canada started with no savings whatsoever and has been working at a job for 25 years. During this time, this person has accumulated a substantial amount of savings. Compared to the total working population of Canada, this person's net worth is in the top 30%.

How likely do you think it is that each person below could be the person above? Using the scale below, write your estimate for each person on the blank space.



There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

1. ___ Person A has a much higher than average income.

2. ___ Person B has a slightly lower than average income.

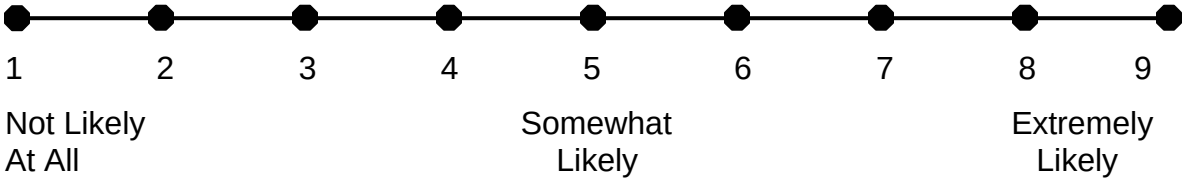
Questionnaires for Study 4b

Low magnitude effect condition:

We are interested in people's intuitive predictions about scenarios they may or may not be familiar with. Please read the following scenario:

A person in Canada started with no savings whatsoever and has been working at a job for 25 years. During this time, this person has accumulated a small amount of savings. Compared to the total working population of Canada, this person's net worth is in the bottom 30%.

How likely do you think it is that each person below could be the person above? Using the scale below, write your estimate for each person on the blank space.



There is no tricky information hidden in the scenario so do not spend too much time on each one – your initial reaction is best.

1. ___ Person A has a much higher than average income.

2. ___ Person B has a slightly lower than average income.