Beliefs about Change and Predicted Future Health Status

by

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ABSTRACT

Beliefs about change reflect how we understand phenomena and what kind of predictions we make for the future. Cyclical beliefs about change state that events are in a constant flux, and change is inevitable. Linear beliefs about change state that events happen in a non-fluctuating pattern and change is not commonplace. Cultural differences in beliefs about change have been documented across various domains, but research has yet to investigate how these differences may affect health status predictions. The present study addresses this gap by inducing different beliefs about change in a European-American college sample. Health status predictions were measured in terms of predicted likelihood of exposure to the flu virus, of contraction of the flu, and of receiving a flu vaccine. Most differences were observed among those who have a recent history of suffering from the flu. Among them, cyclical thinkers tended to rate their likelihood for exposure and contraction to be higher than linear thinkers. However, linear thinkers indicated that they were more likely to receive a flu vaccine. The different patterns suggest the possibility that cyclical beliefs may activate concepts related to cautionary behaviors or pessimistic biases, while linear beliefs may activate concepts related to taking action and exercising control over the environment. Future studies should examine the interplay between beliefs about change and the nature of the predicted outcome.

DEDICATION

I dedicate this thesis to my loving and supportive parents.

ACKNOWLEDGEMENTS

I thank my advisor, my committee, my friends in and outside of the social psychology program, and Kaiden.

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Chapter 1

INTRODUCTION

Cultural environments can influence people's cognitive processes, such as their thinking styles and worldviews. One distinction researchers have made between people's cognitions is holistic and analytic cognition (see Nisbett, Peng, Choi, & Norenzayan, 2001). Holistic thinkers tend to see that change happens in a cyclical fashion, where constant change and fluctuations are expected. On the other hand, analytic thinkers tend to view change in a linear fashion, where changes are rare occurrences, and if there is a change, they expect it to be in a similar pattern as in the past (Choi, Koo, & Choi, 2007; Ji, Nisbett, & Su, 2001; Peng & Nisbett, 1999).

Previous studies have examined the effects of beliefs about change on predictions of a variety of events (e.g., interpersonal relationships, socioeconomic status, competition outcomes, Ji et al., 2001; stock performance, Alter & Kwan, 2009; Ji, Zhang, & Guo, 2008), but researchers have yet to consider how these beliefs about change may influence predictions of an individual's health status. Health status predictions are an interesting domain to examine, as they provide a combination of factors regarding the person and the environment, as well as proactive, behavioral intentions such as health-promotive behaviors. Investigating predictions in this domain may further our understanding about whether the same prediction mechanism may be applied for events relating to one's own health status. The present research aims to understand the factors that comprise health status predictions, and how beliefs about change may lead to different patterns of predictions. In this thesis, I start by reviewing the literature on holistic versus analytic thinking, and factors that lead to different beliefs about change. Next, I discuss evidence for within-culture variations in thinking styles. Finally, I describe and report an experiment, which reveals different prediction patterns for future health status among European American college students who are primed with different beliefs about change.

Thinking Styles and Predictions

Arguably, many different sources can shape an individual's thinking style. One universal source that influences thinking styles is culture, although what form it takes varies. The differences manifest in such aspects as self-construals, cognition, attribution, emotion, motivation, and social explanation (see Markus & Kitayama, 1991; Heine, 2010; Nisbett, 2003). In this section, I focus my discussion on cross-cultural differences in cognition.

Holistic vs. Analytic Cognition

East Asians and North Americans employ different beliefs and thinking styles in their everyday processing of information (for reviews, see Kwan, Li, White, & Jacobson, in press; Nisbett, 2003; Nisbett, Peng, Choi, & Norenzayan, 2001). Nisbett and colleagues (2001) introduced *holistic vs. analytic cognition* as a framework to understand cross-cultural differences in how people think. Holistic cognition, which characterizes East Asian thinking, leads one to attend to the entire field when determining causality. Holistic thinkers rely on the so-called *dialectical thinking* rather than formal logic, and are much more concerned about being reasonable than being logically correct (see Peng & Nisbett, 1999). On the other hand, analytic cognition attends to the focal object and the categories to which it belongs in order to understand the object, and is predominant in Western cultures. Analytic cognition largely relies on logic and rules (Choi & Nisbett, 2000; Norenzayan, Smith, Kim, & Nisbett, 2002; Nisbett et al., 2001). Evidence for cultural differences is widely documented in such areas as beliefs about metaphysical systems, epistemology, and cognitive processes. These differences are thought to have originated from ancient philosophies of Greece (e.g., Aristotle) and China (e.g., Taoist beliefs), which emphasized different aspects of what it means to be human (Nisbett, 2003; Peng, Spencer-Rodgers, & Nian, 2006). This means that compared to Western cultures, Eastern cultures became more holistic; they pay attention to the field as a whole, have lower perceived control due to a lower belief in personal agency, and tend to explain things more in terms of the context or the situation rather than the attributes of the object itself. Westerners, on the other hand, are more analytic than Easterners, paying more attention to the focal object, displaying higher perceived control as a result of a higher belief in personal agency, and usually explaining phenomena more in terms of an object and its properties (i.e., more dispositional explanations).

Another explanation turns to ecological factors (see Nisbett, 2003). East Asian societies traditionally relied on agriculture, as their natural environment provided fertile grounds on which to farm. This lifestyle made it necessary to have harmonious relationships with neighbors, as it limits geographical mobility, and shared irrigation systems required that there be a ruler to provide strict guidelines in order to avoid conflict. As a result, Easterners have been living in a socially complex world with hierarchy where relationships are highly valued, and at any point in time, attention is given to a wide range of targets. In contrast, Greek societies were built on mountainous, seaside landscapes. Their main sources of income were hunting and herding, which, in comparison to agriculture, did not require much cooperation with others. Rather, it encouraged competition, and the development of the marketplace promoted seeking and acquiring one's own profit. Therefore, relatively less importance was given to maintaining long-term interpersonal relationships, and thus social dynamics were less complex.

To summarize, being able to focus on one object and the categories it belongs to (for example, for purposes of trade) gave the ancient Greeks a higher sense of control, and they were able to predict future events based on the present (i.e., in a linear fashion), since they attend to an object and its category memberships, which are usually stable. On the other hand, the traditional Chinese were geared toward paying attention to the whole field, and the field is a complex entity as it contains a huge number of components. As a result of tending to large fields, witnessing contradictory events was commonplace, and individuals were hence more likely to perceive the pattern of events to fluctuate. This led the Chinese to have a more cyclical belief about change; one that assumes fluctuations and sees change as constant.

Dialectical Thinking

A key component of holistic cognition is dialectical thinking (Peng & Nisbett, 1999). It is characterized as embracing apparent contradictions and inconsistencies. There are different ways of understanding events and arguments.

Dialectical thinkers, who are typically Easterners, tend to find truth in both sides of an argument and reach a “Middle Way” to resolve a conflict, whereas Westerners usually decide what is correct by rejecting one of the two opposing arguments. Additionally, Easterners believe that an object can only be understood within its context, whereas Westerners believe that objects can be understood on their own. To summarize these characteristics, researchers have identified principles that are central to dialectical and to formal logical thought (Peng & Nisbett, 1999; Nisbett et al., 2001). The three principles of dialectical thinking are the principle of change, the principle of contradiction, and the principle of relationship or holism. These principles themselves are intertwined, embodying the very idea of dialecticism – reality is dynamic and flexible, which means that change is constant; since change is constant, contradiction is also constant. Hence, when trying to understand a phenomenon, it makes sense to take into account external factors such as the relationships between the phenomenon and its environment.

Western thought also comprises three corresponding principles, or laws: the law of identity, the law of noncontradiction, and the law of the excluded middle. The law of identity states that everything is identical with itself. The law of noncontradiction holds that an event or an observation cannot be simultaneously true and false. Lastly, the law of the excluded middle states that a phenomenon can only be either true or false, and does not fall in-between. Previous research found a consistent pattern of cultural differences in proverb preference, resolution of social contradictions, preferences for style of formal argumentation, and judgments of contradictory information. A significantly higher preference for dialectical thinking in East Asian participants compared to North American participants provides strong evidence for East-West thinking style differences across domains (Peng & Nisbett, 1999).

Cross-Cultural Differences in Beliefs about Change

The Western thinking style, as mentioned in the above section, is characterized by the expectation of stability, and the endorsement of a *linear* belief about change. Should there be a change, linear thinkers would expect a stable pattern of change in change itself. Easterners (and Jews, who tend to be more dialectical than members of most other Western religions), on the other hand, often hold a *cyclical* belief about change: they expect constant change and fluctuations in events (Choi et al., 2007; Ji et al., 2001; Peng & Nisbett, 1999). These beliefs about change influence what predictions people make for the future. Linear thinkers are more likely to predict the same pattern of future events as they have seen in the past; on the other hand, cyclical thinkers would predict the reverse or an irregular pattern of future events. Empirical evidence (e.g., Ji et al., 2001) supports this reasoning. When asked to predict the future of the protagonists in a variety of scenarios (e.g., scenarios about the relationship between two fighting kindergarteners, a boy who grew up poor but managed to put himself through college), Easterners consistently predicted more change from the status quo compared to Westerners (Ji et al., 2001; Study 1). Similarly, Easterners were found to predict more reversed trends than Westerners, in such tasks as predicting the probabilities of a given trend (e.g., global economy growth rates) to increase, decrease, or remain the same. In these studies, the participants were presented with trends over a three-year span, and were asked to predict whether and how the pattern may change (Ji et al., 2001; Studies 2 and 3). The differences in thinking styles were exhibited in the finance domain as well: when asked to indicate which stock they would buy, Westerners indicated a greater likelihood of purchasing rising stock, whereas Easterners indicated that they would be more likely to buy falling stock (Ji et al., 2008). This is consistent with the premise that Westerners have linear beliefs about change and Easterners have cyclical beliefs. Westerners expected the rising stock to continue rising, and Easterners believed that the falling stock were going to rise because they believe that patterns of an event must constantly change. This contrast translated into different preferences for stock investment. Importantly, in the aforementioned study (Ji et al., 2001, Study 4) in which individuals were asked to predict the course of their life happiness, it should be noted that Easterners endorsed a U-shaped pattern of happiness such that they expected an actual reversal, not merely a lesser degree of linearity, of the pattern of events.

Within-Culture Variation in Beliefs about Change

Between-culture variations in beliefs about change are not always robust at every age; they increase as the mean age of the sample increases (Ji, 2008). The capacity to think both linearly and cyclically exists in people across cultures, but which style manifests more dominantly depends on people's age and other situational influences, such as life experiences. This suggests that one cultural group may be capable of employing another group's dominant style of thinking, when prompted to do so. Which factors may predict the style of thinking an individual is more likely to adopt?

Western dialecticism. Evidence for cross-cultural differences in tendencies for dialectical thinking is strong and pervasive across different domains. Developmental psychology literature provides insights for which conditions lead to a greater likelihood of dialectical thinking. Evidence shown by Baltes and Staudinger (1993) demonstrates that such factors as age and personality differences (e.g., openness to experience), as well as life experiences, are related to the extent to which individuals engage in dialectical thinking. More specifically, older adults and those in the helping professions (e.g., clinical psychologists, pastoral counselors, legal specialists in marriage and family matters) tend to think more dialectically, because they have had more experience with various facets of life. Having a broader knowledge base of human experience to draw from means that certain parts of this knowledge may contradict a different part of the information. Thus, levels of dialecticism are increased when one is more familiar with many different types of life experiences.

Individual differences within-culture. If different thinking styles and beliefs about change are available in both Easterners' and Westerners' mental toolbox, then it is possible that there are trait-level, individual differences in the extent of dialectical thinking. Indeed, researchers have been successful in capturing individual differences in beliefs about change. Choi et al. (2007) developed the Analysis-Holism Scale (AHS) in order to measure people's tendencies to prefer analytic vs. holistic styles of thinking. This scale consists of four subscales, each of which reflects a vital component of analytic vs. holistic cognition. The subscales represent beliefs about causality, attitudes toward contradictions, locus of attention, and perceptions of change. With their scale, Choi and colleagues were able to capture, in a Korean sample (of Western and Oriental medicine students), within-culture variation in the extent of analytic vs. holistic cognition. Additionally, they were also able to document differences in the responses to categorization tasks (measures preference for either family-resemblance-based judgment or rule-based judgment using Norenzayan et al.'s (2002) stimuli) and to causal complexity tasks (i.e., participants were given a list of evidence relevant to a scenario and were asked to eliminate irrelevant pieces of information from the list). The results of this research revealed the same pattern of differences in both tasks between analytic vs. holistic thinkers (i.e., students of Western medicine vs. students of Oriental medicine), as shown in cross-cultural samples from previous studies. More specifically, findings show that Western medicine students tended to be analytic thinkers, and Oriental medicine students tended to be holistic thinkers, even though both groups of students were Korean (generally more holistic than analytic).

Situational Factors that Influence Prediction

Certain cues in the environment also make a belief more salient or accessible. It is possible to experimentally manipulate the presence of these cues, with the help of priming techniques. Many prior studies have investigated the influence of situational cues on people's cognitive processes. Before we consider examples from the literature, it may be helpful to review what types of priming techniques are most commonly used.

Broadly speaking, there are two general categories of priming: conceptual priming and mindset priming (Bargh & Chartrand, 2000). Conceptual priming (also called semantic priming) refers to the activation of the concept of interest (what the researcher is trying to make salient) in an unrelated task, prior to the measurement of the outcome variable. This may be accomplished subliminally, meaning outside of the participant's awareness, or supraliminally, meaning that the participant is fully aware of the prime itself, but not aware of the concept it is aiming to make salient. An example of conceptual priming is Bargh, Chen, and Burrows's (1996) series of studies where they primed participants with concepts of rudeness and stereotypes about the elderly through scrambled-sentence tasks. The researchers found that individuals who were primed with rudeness were more quick and frequent in interrupting the experimenter compared to individuals who were primed with politeness, and individuals who were primed with elderly-related stimuli walked down the hallway more slowly when exiting from the experiment.

While conceptual priming is a valuable tool in its own right, there are instances in which mindset priming (otherwise known as procedural priming) is a more suitable method. Mindset priming procedures are characterized by actively engaging in a style of thinking in the first task, and then measuring the carry-over effect of that thinking style on the subsequent task (Bargh & Chartrand, 2000). For instance, inducing a deliberative or an implemental mindset leads individuals to employ these mindsets in a subsequent writing task (Gollwitzer, Heckhausen, & Steller, 1990).

Priming is a useful tool in making salient certain concepts and inducing certain mindsets. It has been frequently used in cultural psychological research where researchers are concerned with investigating the influence of culture on mental processes. Oyserman and Lee (2007) argue that cultural priming involving language may work as both a conceptual prime (if it affects values, self-concept, and relationality) and as a mindset prime (if it affects cognitive processes). Thus, previous research on cultural priming often used a combination of conceptual and mindset priming techniques. Regardless of the particular priming technique (i.e., whether it is semantic or procedural priming), cultural priming is shown to moderately affect both cognitive content and process.

Much of cultural priming research has studied bicultural samples (e.g., Hong, Morris, Chiu, & Benet-Martinez, 2000), because it is assumed that bicultural individuals have two equally accessible cultural systems in their cognition. However, if priming is the activation of a system that already exists in an individual, and there is reasonable evidence that multiple cultural systems may be present in individuals from a single culture, then we may be able to learn more about cultural influences on cognitive processes by increasing the salience of certain cultural constructs to monocultural samples.

Extracultural cognition. Most previous research examined bicultural individuals and cross-cultural samples to make comparisons concerning thinking styles. Little research has used single-culture samples in cultural priming, but one exception is Alter and Kwan's (2009) research on extracultural cognition. These researchers illustrated that monocultural individuals are able to adopt a predominantly foreign mindset, through cultural priming. In their series of studies, Westerners adopted more traditionally Eastern styles of thinking when Eastern culture was made salient. The researchers accomplished this by showing participants a culturally-laden East Asian symbol, and also by recruiting participants who were about to enter or were just leaving an Asian grocery store (the cultural venue was the prime). Differences in prediction were documented in various domains like stock investment and weather predictions, such that Westerners who were primed with Eastern culture were less likely to invest in appreciating stocks, and more likely to predict rainy weather after a chain of sunny weather (consistent with the Eastern sample's responses in studies examining cross-cultural differences).

Health Status Predictions and Health-Promotive Behaviors

While the different patterns of predictions of future events have been demonstrated in a number of domains (e.g., weather, stock market, relationship status, social status, performance), to date, there has not been research pertaining to predictions for future health status. This type of predictions has consequences for long-term health, in terms of whether an individual will engage in behaviors to protect and promote his or her health. There are several factors people may take into consideration when predicting their own future health status. For some diseases, genetic predisposition will largely determine one's susceptibility, but for others, lifestyle and other health-related behaviors likely predict whether or not one will contract the disease. One example of such disease is the seasonal influenza (flu). The flu is an acute, viral infection that is easily spread between people, and may pose serious health threats to individuals and especially to ones who have pre-existing conditions (for example, asthma; Centers for Disease Control and Prevention, 2010a). It is, however, easily preventable. Examples of these health-promotive behaviors include washing hands, using hand sanitizers, and avoiding contact with infected individuals (CDC, 2010b), with the most effective prevention strategy being vaccination (World Health Organization, 2009; CDC, 2010b). In addition to its high effectiveness, the flu vaccines are widely available and inexpensive. Yet, despite these conveniences, only 15-20% of adults between the age of 18 and 49 have received the vaccine during 2001 through 2008 (CDC, n.d.).

One possible reason for this low vaccination rate is that how people conceive of their chances of getting the flu may influence their participation in health-promotive behaviors. If an individual does not expect to get sick, then he or she might not particularly feel inclined to partake in health-promotive behaviors. Similarly, if one expects to contract a disease, he or she may take precaution to act in a health-promotive manner. One’s perceived susceptibility therefore influences the likelihood of engaging in health-promotive behaviors (see Aiken, Gerend, Jackson, & Ranby, 2012, for a review).

In the present study, I focused on people’s predictions for whether they will contract the seasonal flu, as influenced by beliefs about change. The flu recurs annually, so people may make predictions regarding it every year. It is possible for different beliefs about change to influence the direction of predicted health status (whether or not one will contract the flu), and those beliefs may have implications for people's intentions to engage in health-promotive behaviors. Stated differently, I expected individuals who report a higher likelihood of contracting the flu to also report greater intentions to engage in health-promotive behaviors. This hypothesis is supported by the Health Belief Model (HBM; Becker & Maiman, 1975; Rosenstock, 1966; Aiken et al., 2012). According to the HBM, there are six main constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy) that influence an individual's health-related decision-making process. Perceived susceptibility, or the belief that an individual thinks he or she is likely to contract or develop a condition, is particularly relevant to the current study. If people expect to get the flu, their perceived susceptibility is raised. Therefore, this increased susceptibility may lead to increased intentions for health-promotive behavior.

Another goal of this research is to examine the extent to which people's predictions differ for their future health and behavioral intentions as a result of the salience of a certain thinking style (linear or cyclical). For those primed with a linear belief, I expected individuals to make predictions consistent with their past health status, such that those who had the flu last year will expect to get it again this year, and those who did not, will expect not to get it this year. I expected individuals primed with a cyclical belief to predict the opposite future health compared to their past health, such that those who had the flu last year will expect not to get it this year, and those who did not have the flu last year will expect to get it this year (see Figure 1). However, it is possible that the belief about change is not the only predictor of future health status. Perceptions of vulnerability to diseases can also likely influence one's predictions for future health status. In the absence of perceived vulnerability, there is no reason to assume that an individual would engage in health-promotive behaviors. Similarly, if one does not feel susceptible toward a disease, the individual would not predict to suffer from it. In the meantime, if one has very high perceived levels of vulnerability toward a disease, he or she may predict to suffer from it and thus engage in many health-promotive behaviors regardless of situational factors. Because of these reasons, in the current study, I prescreened for levels of perceived vulnerability to diseases (PVD; Duncan, Schaller, & Park, 2009) in order to select only individuals who display moderate levels of PVD.

Overview of the Present Study

The present research aims to expand on previous research on beliefs about change and prediction of events by investigating the effects of a salient belief about change on future health prediction, in terms of exposure to the flu virus, flu contraction, and intentions to receive a flu vaccine. To understand the interplay of these three factors, I recruited a sample of European Americans with varied exposure to the flu during the last flu season. Participants were randomly assigned, by birth month, to be in either prime condition: linear or cyclical primes of beliefs about change. Participants were prescreened not to have extremely low or extremely high levels of perceived vulnerability to diseases.

I hypothesized that individuals would make varying predictions about their future health, depending on the prime and their past health history. In general, I expected individuals primed with a cyclical belief to make predictions that differed more from their past health status; I expected individuals primed with a linear belief to make predictions that were more similar to their past health status. That is,

a. in the cyclical prime condition, individuals who did not suffer from the flu last year would give higher likelihood ratings for each dependent variable. Those who suffered from the flu last year would report lower likelihood ratings.

b. in the linear prime condition, individuals who suffered from the flu last year would give higher likelihood ratings for each dependent variable. Those who did not suffer from the flu would report lower likelihood ratings.

I expected this pattern to emerge for likelihood ratings of being exposed to the flu virus, of contracting the flu, and of receiving a flu vaccine. Additionally, I expected my three dependent variables to positively correlate with each other within each level of the prime, such that individuals will report similar likelihood ratings across all dependent variables in each prime condition. However, I do not have a specific hypothesis about whether the patterns of these correlations will be different. The examination of responses to these different events and behaviors will allow me to identify differences in predictions about events largely external to one's control (exposure to the flu virus and contracting the flu), and behavioral intention (getting a flu vaccine), if any.

Insert Figure 1 here.

Chapter 2

METHODS

Eligibility

There were two stages in this study. In the first stage, I prescreened participants (n = 1522) for two characteristics: ethnicity and levels of PVD. Only participants who self-identified as European American, and among those, individuals who did not score on the extreme ends of the PVD scale, were invited to partake in the second stage of the study (the main study). Only European Americans were recruited because cultural influences may confound the prime, since research documents differences in thinking styles that are present between different ethnic groups as described above. Individuals who reported extremely high or extremely low levels of PVD were not invited to participate, for the following reasons. Individuals who think they are highly vulnerable to diseases (i.e., have very high PVD) will likely expect to contract a disease regardless of situational factors. Similarly, individuals who think they have very low vulnerability toward diseases will likely expect not to contract a disease regardless of situational factors. The major goal of this research is to investigate the effects of situational factors on health predictions. It is thus important that the participants are open to making alternative predictions. Therefore, only individuals who scored between one standard deviation above and below the mean on the PVD scale were recruited for the second stage of the study. Excluding those that are not European Americans, and those that scored outside the aforementioned range of PVD score, left 681 participants. Fourteen of them did not provide an email address, so the total number of potential participants was 667.

Participants

Participants were recruited via email, through which they were provided an invitation code to participate in the study for 0.5 research credits toward their PGS 101 course. Among the 667 invited participants, 194 accepted invitation and participated in the study, yielding a 29.09% acceptance rate. I excluded the responses of 23 participants prior to data analysis based on the following criteria. First, in terms of demographic information, four participants reported an ethnicity other than European American, including bi/multiracial individuals or individuals who did not report their ethnicity. Second, two participants did not provide any answers and three did not fill out the prime question (which means their answers would not reflect the intended effects of priming), and were thus removed prior to analyses. Third, two participants were excluded on the basis of random response patterns: following the recommendations by Gosling, Vazire, Srivastava, and John (2004), the random response patterns were detected by using the 15-item PVD scale as an indicator. Since the PVD scale contains reverse-coded items, if participants are conscientiously answering the items, variations in standard deviation is to be expected prior to reverse-coding the items. The two excluded participants showed a standard deviation of zero, which was indicative of their providing long strings of identical answers. Fourth, twelve individuals who took longer than a half hour to complete the study, and one who took less than five minutes, were also excluded. Since the current study uses priming as a tool, it is important that participants complete the study in a timely manner so that they are doing so while the prime still has an effect. The mean duration was 12 minutes and 53 seconds. After excluding the above cases, the final sample size included in the analyses was 170 (92 women, M_{age} = 19.38).

It should be noted that each dependent variable was checked for outliers by adding and subtracting three standard deviations from the mean and comparing the numbers against the minimum and maximum response value. No outliers were identified.

Design and Materials

Prescreening participants required the use of two surveys: the PVD scale, and the past health history survey. Potential participants provided their answers on the two questionnaires as part of their PGS 101 mass testing. The two questionnaires were always presented in the order listed above.

The main study employs a 2 (past health history: had the flu last year vs. did not have the flu last year) x 2 (prime: cyclical vs. linear belief about change) between-subjects factorial design.

Perceived vulnerability to diseases. In order to capture individual differences in the levels of PVD, I used Duncan, Schaller, and Park's (2009) perceived vulnerability to disease scale (see Appendix A for the complete PVD scale). This 15-item scale consists of two subscales: perceived infectability (seven items; Cronbach's α = .89), and germ aversion (eight items; Cronbach's α = .71). Answers are indicated on a 7-point scale, ranging from 1—Strongly Disagree to 7—Strongly Agree. This PVD scale has been validated in different samples (men, women, Dutch, Canadian, individuals of European ethnic heritage, individuals of East Asian ethnic heritage, and individuals of other ethnic heritage) to capture trait-level perceived vulnerability to diseases, and the scale means range from 3.01 to 4.02 with the standard deviation ranging from .98 to 1.20. The mean PVD score for my sample is similar to previous findings, at 3.59 as the mean and 0.72 as the standard deviation.

Past health history. This survey assessed participants' health status during the last flu season (November 2010 to February 2011). This section comprises three components: exposure to virus, contraction of the flu, and severity of symptoms. Participants were asked how likely they believe they had been exposed to the flu virus, and also whether they suffered from the flu last year. Symptom severity was measured because it may provide further insights to participants' past health status. More specifically, individuals who suffered from very severe symptoms may expect to continue to get the flu in the future, possibly because they find the disease traumatic or unconquerable, regardless of prime (see Appendix B for the complete health history questionnaire). Results of an independent samples *t*-test shows that those who had the flu last year reported more severe symptoms (for fever, dry cough, and sore throat, which were measured as continuous variables; $M = 3.24$, $SD = 0.63$) than those who did not have the flu last year ($M = 2.13$, $SD = 0.85$), $t\,(90.08) = 8.88$, $p <.001$.

Priming stimuli. The stimuli consist of two short essay-writing tasks. Two scenarios modified from a previous study on predictions of change (Ji et al., 2001) were used. Of the four original scenarios, I adopted two that seemed more relevant to the interests of college-aged individuals (romantic relationship and economic status). The original authors presented scenarios and asked their participants to rate the likelihood of change in the status quo in the future. I posed the scenarios in statements rather than in question form, and they reflect either a cyclical or a linear pattern of change. Participants read the beginning and the end of a story, and then were asked to write a story about life events that happened between the beginning and the end of the story. The following two scenarios were used (see Appendix C):

Cyclical Story 1: Lucia and Jeff are both seniors at the same university. They have been dating each other for two years. *Participants were prompted to fill in the story here.* Twenty years later, they are both married to someone else. Lucia and Jeff are no longer close to each other, and in fact, they have not kept in touch since university.

Cyclical Story 2: Richard grew up in a poor family. *Participants were prompted to fill in the story here.* Twenty years later, Richard is a successful business owner. He leads a wealthy lifestyle, unlike his childhood.

Linear Story 1: Lucia and Jeff are both seniors at the same university. They have been dating each other for two years. *Participants were prompted to fill in the story here.* Twenty years later, they are happily married and have children together.

Linear Story 2: Richard grew up in a poor family. *Participants were prompted to fill in the story here.* Twenty years later, he is still living in poverty.

His life is no different than how it was when he was a child, growing up in a poor family.

Future health status prediction. After reading the scenarios, participants were asked to rate their likelihood of (1) being exposed to the flu virus, (2) contracting the flu this year, and (3) receiving a flu vaccine. All three are single-item questions, with a 7-point scale as answer choices. The choices ranged from 1—Not at All Likely to 7—Definitely.

Intentions for health-promotive behaviors. Following the health status prediction questions was a list of health-promotive behaviors (see Appendix D). Participants were asked to rate how likely they are to participate in each of the behaviors listed, such as washing hands often and avoiding crowded places. All answer choices are indicated on a 7-point scale ranging from 1—Not at All Likely to 7—Definitely.

Perceptions of change. The perception of change subscale (six items; Cronbach's $\alpha = .68$) of Choi et al.'s (2007) analysis-holism scale was administered to see if prime had an effect. This scale contained six items. The scale was intended to be a trait-level measure, so it is possible that the temporary effects of the prime do not translate into differences in ratings on this scale. I added three additional items that more explicitly reflect different beliefs about change, to help supplement this section (see Appendix E for the items).

Demographic items. Each participant completed a short demographic questionnaire, which includes information about the participants' age, gender, ethnicity, socioeconomic background, and insurance status.

Procedure

Both parts of this study were conducted online, using Sona systems and the SurveyMonkey research software. The first part of the study was administered as a part of the ASU psychology department's mass testing. The second part of the study required participants to sign up through Sona systems, which subsequently led them to the study uploaded onto SurveyMonkey. The study was presented as a study about beliefs and predictions about health status. The prime task, to which participants were randomly assigned, was presented ostensibly as a request for help in generating future experimental materials for the research laboratory. Following the prime, participants read that they were going to answer a series of questions regarding health beliefs and health status predictions. The order in which the questionnaires were presented is as follows: prime, future health status prediction, intentions for health-promotive behavior, perceptions of change measures, the PVD measure, the past health history survey, and demographic information. Following completion of the questionnaires, participants were fully debriefed and granted research credit.

Chapter 3

RESULTS AND DISCUSSION

MANOVA

A two-way multivariate analysis of variance (MANOVA) was performed to examine the effects of the independent variables on the three dependent variables. Even though cell sizes were far from equal (see Table 1), Box's test of homogeneity of covariances shows that the homogeneity assumption is not violated, *Box's M* = 10.07, *F* (18, 13342.39) = 0.53, *p* = .945, indicating that equal variance was distributed for all three dependent variables across all level combinations of the independent variables. Therefore, I proceeded to address my research question using the MANOVA test.

Insert Table 1 here.

The omnibus MANOVA results (see Table 2) reveal a significant main effect of prime (*Wilks' Lambda* = .943, *F* (3, 164) = 3.30, *p* = .022, η^2_p = .057) and a significant past health history by prime interaction (*Wilks' Lambda* = .944, *F* (3, 164) = 3.21, *p* = .024, η^2_p = .056). There was a marginally significant main effect of past health status on predictions for future health status (*Wilks' Lambda* = .957, *F* (3, 164) = 2.48, *p* = .063, η^2_p = .043) overall, and a multivariate test of simple effects of past health status shows that it significantly affects those participants who were primed with a cyclical belief (*Wilks' Lambda* = .901, *F* (3, 164) = 6.00, *p* = .001, η^2_p = .099) but not those primed with a linear belief (*Wilks'*

Lambda = .982, *F* (3, 164) = 1.00, *p* = .393, η^2_p = .018). Another multivariate simple effects test reveals that the effect of prime was only found among participants who had the flu last year (*Wilks' Lambda* = .934, *F* (3, 164) = 3.87, *p* = .010, η^2_p = .066) but not among those who did not have the flu last year (*Wilks' Lambda* = .977, *F* (3, 164) = 1.30, *p* = .275, η^2_p = .023). These findings suggest that past health status and beliefs about change only influence responses on the DVs if the participants had had the flu last year, and are being primed with a cyclical belief. Indeed, that is what I found when I examined each dependent variable separately.

Insert Table 2 here.

ANOVAs

Since the overall MANOVA indicated a statistically significant main effect and an interaction effect, I conducted a series of univariate analyses of variance (ANOVAs) to examine the effects of the independent variables on each dependent variable. Levene's test of equality of variances is not significant for all three dependent variables (*F* (3, 166) = 0.50, *p* = .686 for exposure; *F* (3, 166) = 0.67, *p* = .573 for contraction; *F* (3, 166) = 0.67, *p* = .570 for vaccine), illustrating that the error variance of each of the dependent variables is equal across groups.

Predictions for exposure to the flu virus. There was a significant main effect of prime such that individuals primed with a cyclical belief predicted higher likelihoods of exposure for the upcoming flu season (*M* = 5.09, *SE* = 0.16) compared to individuals primed with a linear belief (*M* = 4.46, *SE* = 0.21), F (1, 166) = 5.65, p = .019, η^2_p = .033. This main effect was not predicted. I predicted that individuals primed with a cyclical belief would predict a higher likelihood of exposure only if they did not suffer from the flu last year; I expected that they would predict a lower likelihood of exposure if they had the flu last year. My findings differ from predictions in the following ways: (1) the cyclical prime did not result in lower likelihood ratings of exposure for those that had the flu last year; rather, it resulted in even higher likelihood ratings (*M* = 5.21, *SE* = 0.27) than the linear prime did (*M* = 4.40, *SE* = 0.37; *mean difference* = 0.81, *SE* = 0.46, p = .081), albeit this difference was statistically negligible, and (2) past health status did not influence exposure predictions, F (1, 166) = 0.08, p = .783, η^2_p < .001. There was no interaction between prime and past health status: individuals primed with a linear belief rated their exposure to the flu virus as less likely than did individuals primed with a cyclical belief *regardless* of their past health status, F (1, 166) = 0.47, p = .493, η^2_p = .003. Overall, results for this dependent variable did not support my hypotheses. Given that the cyclical prime participants rated their likelihood of flu exposure to be higher than linear prime participants, it seems possible that the cyclical prime activated constructs related to unexpected events (and possibly being cautious of such events) rather than a reversal of trends. The two cyclical primes have always been presented in the order listed in Appendix C, where the first scenario led from a positive present to a negative future. This may have activated constructs related to unexpected negative future states, and therefore primed the participants to prepare for a potential negative future. Although the second scenario led from a negative present to a positive future, I cannot rule out the possible confound that the order of the scenarios may have had an effect on the outcomes (i.e., primacy effect). Table 3 shows means and standard error for each condition.

Insert Figure 2 here.

Insert Table 3 here.

Predictions for contraction of the flu. The univariate test for predictions for flu contraction revealed significant main effects for both independent variables, as well as a significant interaction.

Insert Figure 3 here.

The results reveal a significant interaction between past health history and prime, F (1, 166) = 4.50, p = .035, η^2_p = .026, albeit in a different pattern from what I had predicted (see Table 4 for means and standard errors). Participants who had the flu last year reported a higher predicted likelihood of contracting the flu when they were primed with a cyclical belief (M = 4.21, SE = 0.22) than if they were primed with a linear belief (M = 3.27, SE = 0.30), which is the opposite of my predictions. This difference is significant, *mean difference* = 0.95, *SE* = 0.37, $p = .011$.

Participants who did not have the flu last year reported a greater likelihood of contracting it when they were primed with a cyclical belief (*M* = 3.24, *SE* = 0.14) than if they were primed with a linear belief (*M* = 3.18, *SE* = 0.16), which is in the predicted pattern, however this difference is not significant, *mean difference* = 0.05, *SE* = 0.21, $p = .792$. Similarly, differences in past health history also influence health status predictions, but only in the cyclical condition such that individuals who had the flu last year and were primed with a cyclical belief rated their likelihood of flu contraction to be higher (*M* = 4.21, *SE* = 0.22) than individuals who did not have the flu (*M* = 3.24, *SE* = 0.14), *mean difference* = 0.98, *SE* = 0.26, $p < .001$. Past health status did not influence predictions in the linear prime condition, *mean difference* = 0.09, *SE* = 0.33, $p = .800$.

To recapitulate, in addition to the interaction, each independent variable had significant main effects on the outcome. First, past health history had a significant main effect, such that those who had the flu last year predicted that they were more likely to contract the flu (*M* = 3.74, *SE* = 0.18) than participants who did not have the flu last year (*M* = 3.21, *SE* = 0.10), $F(1, 166) = 6.38$, $p = .013$, $\eta^2_p = .037$. Individuals who had the flu last year were more likely to predict that they would contract it again this year. Prime also had a significant main effect: individuals primed with a cyclical belief predicted that they were more likely to contract the flu (*M* = 3.73, *SE* = 0.13) than individuals primed with a linear belief (*M* = 3.22, *SE* = .17), *F* (1, 166) = 5.66, *p* = .018, η^2_p = .033. Table 4 displays means and standard errors for each condition.

Insert Table 4 here.

Predictions for receiving a flu vaccine. This dependent variable revealed effects in the hypothesized direction: there was a significant interaction, *F* (1, 166) = 4.47, *p* = .036, η^2_p = .026 (see Figure 4). More specifically, among individuals who had the flu last year, those primed with a cyclical belief predicted lower likelihoods of receiving a flu vaccine (*M* = 2.93, *SE* = 0.37) than those primed with a linear belief (*M* = 4.13, *SE* = 0.51), *mean difference* = -1.21, *SE* = 0.63, *p* = .059. Among individuals who did not have the flu last year, there was not a significant difference between the cyclical (*M* = 3.51, *SE* = 0.23) and the linear (*M* = 3.18, *SE* = 0.27) conditions, *mean difference* = 0.33, *SE* = 0.36, *p* = .351. While these comparisons are not statistically significant, they are nonetheless in the predicted direction. The comparisons between past health history at each level of prime were not statistically significant either, but they were also in the predicted direction: among those that were primed with a cyclical belief, individuals who had the flu last year (*M* = 2.93, *SE* = 0.37) rated their likelihoods of receiving a flu vaccine to be lower than those who did not have the flu last year (*M* = 3.51, *SE* = 0.23), *mean difference* = -0.59, *SE* = 0.44, *p* = .187. Among those who were primed with a linear belief, individuals who had the flu last year (*M* = 4.13, *SE* = 0.51) scored higher than individuals who did not have the flu last year (*M* = 3.18, *SE* = 0.27), *mean difference* = 0.95, *SE* = 0.58, *p* = .101.

Neither past health history (F (1, 166) = 0.25, p = .615, η^2_p = .002) nor the prime (F (1, 166) = 1.44, p = .231, η^2_p = .009) showed a significant main effect on predictions for getting vaccinated for the flu, but the pattern of the interaction reflected the hypothesized effects. Table 5 shows means and standard errors.

Insert Figure 4 here.

Insert Table 5 here.

Together, the univariate analyses reveal some interesting findings. First, individuals in the cyclical prime condition rated their likelihood of exposure to the flu to be higher than individuals in the linear prime condition. Second, the pattern of the interaction for the contraction variable shows that whether the prime had any effect in contraction predictions depended on an individual's past health history; only among those that had the flu last year did the prime have an effect. The direction of this effect was different from my predictions: among those who had the flu last year, cyclically primed individuals rated their contraction likelihood to be higher than linearly primed individuals.

The revealed patterns suggest a few possibilities. It may be the case that the cyclical prime activates concepts related to a pessimistic future, which may lead to fatalistic beliefs or a sense of helplessness regarding the flu. On the other hand, participants may be making predictions based on their health at the time of the survey, as opposed to during the last flu season. This may explain why those in the cyclical condition who had the flu last year predicted higher likelihoods of exposure and contraction; perhaps, they perceive the "cycle" of health as every flu season (i.e., sick during flu season and healthy during off-flu season is one cycle) as opposed to every other flu season (i.e., sick during one flu season but healthy during the next). I will elaborate more on these possibilities in the general discussion section.

Ancillary Analyses

There were many other variables for which I have collected data. Below is a series of analyses of the pertinent variables, to investigate whether and how they are related to the results reported above.

Perceptions of change. Perceptions of Change scale did not produce different patterns for the different prime groups, $F\ (1, 166) < 0.001$, $p = .985$. Neither did the additional measures, $F\ (1, 168) = 0.38$, $p = .536$, or the composite measure of perceptions about change, $F\ (1, 166) = 0.11$, $p = .741$. There were no differences between flu statuses, either. Flu statuses did not differ in their response patterns on the Perceptions of the Change scale, $F\ (1, 166) = 0.04$, $p = .835$, on the additional measures, $F\ (1, 168) = 2.03$, $p = .156$, nor on the composite measure, $F\ (1, 166) = 0.05$, $p = .832$.

Socioeconomic and insurance status. There were no socioeconomic status differences in the answer patterns, although there was an insurance status difference. A one-way ANOVA reveals that regardless of prime or past health history, individuals who did not have health insurance scored higher on likelihood ratings of predicted flu exposure ($n = 12$; $M = 5.58$, $SD = 1.44$) than insured individuals did ($n = 157$; $M = 4.73$, $SD = 1.45$), F (1, 167) = 3.86, $p = .051$. Uninsured individuals also scored higher on likelihood ratings of predicted flu contraction ($M = 4.33$, $SD = 0.99$) than insured individuals ($M = 3.30$, $SD = 1.18$), F (1, 167) = 8.75, $p = .004$.

Perhaps expectedly, the homogeneity assumption is violated for predictions for receiving a flu vaccine, and insured individuals reported higher likelihoods of receiving a vaccine ($M = 3.44$, $SD = 2.00$) than uninsured individuals did ($M = 2.17$, $SD = 1.47$), F (1, 167) = 4.68, $p = .032$. Excluding uninsured individuals produces the same pattern of results in the same directions. See Tables 6.1 and 6.2 for means, standard errors, and change in statistical significance for the MANOVA and the ANOVAs. See Table 7 for means and standard errors for insured individuals only.

Insert Tables 6.1, 6.2, and 7 here.

Insurance status differed by socioeconomic status, χ^2 (4, $N = 169$) = 22.43, $p < .001$, such that one out of seven working class, six out of 18 lower middle class, two out of 71 middle class, three out of 68 upper middle class, and zero out of five upper class individuals were uninsured (one case was missing insurance information). The difference in the insurance status does not seem to pose any threat to the interpretation of my findings. Without the uninsured participants, the pattern of results remains in the same direction (as shown in Table 6.2), and the results of the uninsured participants do not seem to represent a systematic difference (see Table 8 for means, standard error, and *n*s per cell). Additionally, levels of PVD did not differ by insurance status or by SES.

Insert Table 8 here.

Gender. Gender differences arose, not for flu exposure predictions and not for vaccine predictions but for flu contraction predictions. An independent samples *t*-test reveals that females (n = 92) tended to rate their likelihood of contracting the flu to be higher (M = 3.72, SD = 1.06) than males did (n = 78; M = 2.99, SD = 1.23), t (168) = -4.15, p <. 001. This difference may be attributed to differences in PVD: females (n = 88) scored higher on overall PVD (M = 3.72, SD = 0.68) than males (n = 74) did (M = 3.44, SD = 0.74), t (160) = -2.44, p = .016. However, overall response patterns by gender in each condition were similar to the general pattern of results (see Table 9 for means and standard error).

Insert Table 9 here.

Prescreening PVD. One might wonder whether pre-existing levels of PVD, as measured at prescreening, may have affected the results of this study, as it is quasi-experimental and therefore true random assignment was not possible. Indeed, it turns out that individuals who were assigned to the cyclical prime condition (n = 96) scored higher on the infectability subscale (M = 3.16, SD = 0.65) than did individuals assigned to the linear condition (n = 67; M = 2.97, SD = 0.63), t (161) = 2.28, p = .006, but scores did not differ on the germ aversion subscale (t (155.70) = 0.17, p = .908), or on the total PVD scale (t (156.45) = 1.53, p = .128). There was also a difference in the level of prescreening PVD by past health history, such that individuals who had the flu last year (n = 41) scored higher on the infectability subscale (M = 3.34, SD = 0.66) than did individuals who did not have the flu last year (n = 122; M = 3.07, SD = 0.64), t (161) = 3.47, p = .019, but this should not be surprising given that individuals who suffered from the flu probably feel that they are more susceptible to it than individuals who did not suffer from the flu. Scores on the germ aversion subscale and the total PVD scale did not differ by past health history, t (160) = -1.36, p = .175 and t (160) = 0.14, p = .890, respectively.

A closer look reveals that, among the cyclically primed individuals, those who had the flu last year reported significantly higher $PVD_{infectability}$ scores (M = 3.60, SE = 0.12) than did those who did not have the flu last year (M = 3.13, SE = .08), p = .001. The same individuals, i.e., those in the cyclical prime condition and had the flu last year, scored marginally higher on the $PVD_{infectability}$ scale than did those in the linear prime condition who had the flu last year (M = 2.90, SE = 0.16), p = .001. But, $PVD_{infectability}$ scores from the prescreening did not significantly moderate the effects, β = -.34, p = .738.

Main study PVD. Participants' levels of PVD did not differ across prime ($PVD_{infectability}$: t (163) = 0.72, p = .471; $PVD_{germaversion}$: t (165) = 0.71, p = .481; PVD_{total}: t (160) = 0.68, p = .501), but there were past health history differences, such that scores on the perceived infectability subscale was higher for those who had the flu last year (n = 42; M = 3.41, SD = 1.07) than those who did not (n = 123; M = 3.01, SD = 0.93), t (163) = 2.27, p = .024. Again, $PVD_{infectability}$ from the main study did not moderate the effects, either, β = .20, p = .539.

Lastly, paired samples *t*-tests reveal that the scores on the germ aversion subscale significantly increased from prescreening to the main study (t_{germ} (158) = 2.26, p = .025), however the scores on the infectability subscale and the total PVD scale did not change ($t_{infectability}$ (158) = -0.31, p = .759; t_{total} (154) = 1.61, p = .110). These findings suggest that my participants' general levels of perceptions that they may contract infectious diseases did not change from the prescreening (August) to the main study (October), even though one may expect it to increase, since October is nearer to the flu season than is August.

Additional concerns regarding random assignment. In an attempt to remedy the unequal cell sizes, I had changed the random assignment rule about three weeks into data collection. It is worthwhile to see if changing the assignment rule made a difference in the response patterns. Additionally, it is a valid concern to wonder whether it was ideal to use information about past health history as it was collected from the prescreening questionnaire, as some participants changed their answers when asked again in the main study. I will address these issues here.

First, when the data were collected (i.e., the switch in assignment rule from assigning odd birth months to the cyclical condition and even birth months to the linear condition, to the reverse) did not produce different results. An independent samples *t*-test shows no significant differences between groups (i.e., before and after the switch) for any of the three dependent variables (exposure: $t\ (168) = 0.52$, $p = .606$; contraction: $t\ (168) = 1.34$, $p = .182$; vaccine: $t\ (168) = 0.08$, $p = .938$). The means for each condition (see Tables 10, 11, and 12) are similar in pattern to the original analyses that I previously described.

Insert Tables 10, 11, and 12 here.

Second, I will address the concern about individuals changing what they had reported for their past health history from prescreening to the main study. I ran a MANOVA to compare whether there were different response patterns among individuals who had consistent answers both at the prescreening and at the main study ($n = 147$), and those that changed their answers ($n = 22$, 17 of which changed from yes to no, and 5 of which changed from no to yes), and re-ran the analyses. The individuals who changed their reported past health history from having the flu last year (at prescreening) to not having the flu last year (at main study) are particularly of interest (from hereon referred to as "changers"). It is possible that this group of participants learned more about flu symptoms as a result of participating in the prescreening – as part of the past health history questionnaire (see Appendix B), I had stated that it is possible that individuals experience flu-like illness symptoms regardless of whether they actually have the flu. As this information was provided after participants already reported whether they had the flu last year, it is possible that their new knowledge was reflected in the second time they were asked about having the flu last year (in the main study). Examination of the means for the exposure and contraction variables (see Tables 13 and 14) reveals that changers in the cyclical condition (n = 9) reported answers similar to individuals who consistently reported having had the flu, but changers in the linear condition (n = 8) reported answers similar to individuals who consistently reported not having had the flu. For the vaccine variable, however, changers in both cyclical and linear conditions reported answers that were more similar to individuals who consistently reported having had the flu last year (see Table 15). These patterns are interesting to speculate, as there seems to be a difference in how people predict their exposure and contraction likelihoods vs, vaccination likelihoods depending on the prime, even when they are unsure whether they suffered from the flu last year or not. These exposure and contraction trends, where the changers rate their likelihood more similarly to participants who consistently had the flu in the cyclical, and to participants who did not have the flu in the linear condition, represents, again, the idea of caution that the cyclical prime seems to be activating.

Insert Tables 13, 14, and 15 here.

It is important to note that the overall trend of the responses did not produce systematically different patterns depending on assignment rule or past health history categorization. The lack of significant differences in the analyses when the data are divided this way can be attributed to low power as a result of a smaller sample size.

Correlations

My three dependent variables are predictions regarding exposure to the flu virus, contracting the flu, and receiving a flu vaccine. To understand the extent to which these variables were related to each other, I ran a series of correlation analyses (see Tables 16, 17, 18, and 19), for each level of the independent variables (see Tables 20, 21, 22, and 23), as well as an overall total correlation among dependent variables (see Table 24).

Insert Tables 16, 17, 18, and 19 here.

Insert Tables 20, 21, 22, and 23 here.

An overall correlation across all conditions reveals a positive correlation between likelihood of flu exposure and likelihood of flu contraction, r (168) = .47, $p < .001$, however no other significant overall correlations were found, between flu exposure and flu vaccine, r (168) = .09, p = .226, or between flu contraction and flu vaccine, r (168) = .05, p = .556. This pattern holds even when uninsured individuals are excluded. The correlation between likelihood of flu exposure and likelihood of flu contraction are still significant, r (155) = .45, p <.001, and the other overall correlations remain nonsignificant: the correlation between flu exposure and flu vaccine was nonsignificant, r (155) = .12, p = .146, and so was the correlation between flu contraction and flu vaccine, r (155) = .10, p = .193.

Insert Table 24 here.

Did the size of the correlation between exposure and contraction differ by past health status or by prime? In order to understand the pattern of correlations better, correlations were compared using the Fisher r-to-z transformation. This process assesses the significance of difference in correlation coefficients from independent samples, by taking into account the Pearson correlation coefficient as well as the sample size. I compared all possible pairs of correlations (see Table 25) to see whether correlations differed significantly depending on condition.

Insert Table 25 here.

Results indicate that the correlation between exposure and contraction differed significantly between individuals primed with a cyclical belief (r (98) = .38, p < .001) and individuals primed with a linear belief (r (68) = .57, p < .001), collapsed across levels of past health history, z = -1.61, p = .054, one-tailed. At r

= .57, exposure likelihood ratings from individuals primed with a linear belief more highly positively correlate with likelihood ratings for contracting the flu, compared to individuals primed with a cyclical belief. Comparisons of correlations by levels of prime for each level of past health history show similar patterns of relationship, such that linear primes resulted in higher correlations than cyclical primes did, regardless of past health history. However, these differences in correlation coefficients were not statistically significant.

What might the differences in these correlations mean? Contracting the flu, in itself, is a two-step, linear process where one must first be exposed to the flu virus in order to contract it. It is interesting that participants in the linear prime condition were more likely to report this connection in their responses compared to participants in the cyclical condition. Perhaps this can be attributed to cyclical thinkers' focus on the field (i.e., the environment) compared to the linear thinkers' focus on the object (i.e., the individual). To a cyclical thinker, the fact that there is exposure to flu virus in the environment may not necessarily mean that it will lead to contraction of the disease, as there are many other components (risks of other diseases or dangers, etc.) present in the environment that may not necessarily lead to the next step. On the other hand, to a linear thinker who focuses on the individual (himself or herself), being exposed to the flu virus may more likely lead to contraction of the disease, as the linear thinker is focusing on an individual's likelihood of contraction, following exposure.

It should be noted that these results were unexpected, and are significant with a one-tailed test only. Therefore, we must interpret them with caution until the results are replicated in different samples. Nevertheless, these findings may be informative and can shed light onto possible future directions.

Chapter 4

GENERAL DISCUSSION

Overall, the results partially supported my hypotheses. Two distinct prediction patterns arise: one pattern for risks of having the flu (in terms of exposure to the virus as well as contraction of the disease), another for one's behavioral intentions to avoid having the flu (in terms of obtaining a vaccine). For perceived likelihood of exposure and contraction, the cyclical prime led to higher likelihood ratings than did the linear prime. Furthermore, the cyclical prime had a greater effect among individuals who had the flu last year, such that cyclically primed participants with a recent flu history reported higher likelihoods of exposure and contraction than did cyclically primed participants without a recent flu history. For reported intentions to obtain a vaccine, we find a significant interaction in the hypothesized direction. Among participants who had the flu, those primed with a linear belief rated their likelihood to be higher than those primed with a cyclical belief, and also higher than those primed with a linear (or cyclical) belief that did not have the flu last year. In addition, correlational analyses revealed linearly primed individuals to have a stronger positive relationship between their responses to the exposure and contraction items when compared with cyclically primed individuals.

Negative vs. Positive State Predictions

What may have contributed to these patterns of results? We may want to take a closer look at the variables. The dependent variables of the present study vary in terms of their valence. When participants were asked to predict their likelihood of being exposed to the flu virus, and contracting the flu, they were being asked to predict the likelihood of a negative state. When participants were asked to predict their likelihood of receiving a flu vaccine, they were being asked to predict the likelihood of the lack of a negative state, or, arguably, a positive state. Regulatory orientation theories (Higgins, 1997, 2000) suggest that individuals have different approach or avoidance motivations for negative or positive states. This means that some individuals may be more motivated to avoid a negative state than to approach a positive state (i.e., have a prevention orientation), while others may be more motivated to approach a positive state than to avoid a negative state (i.e., have a promotion orientation). Cross-cultural variations exist in these regulatory orientations, such that East Asians tend to be more prevention oriented whereas North Americans tend to be more promotion oriented (Lee, Aaker, & Gardner, 2000). In the context of the present study, these different motivations for or against negative and positive states would mean that certain individuals (i.e., individuals who think in a cyclical manner) would be more motivated to avoid exposure and contraction of the flu, whereas other individuals (i.e., individuals who think in a linear manner) would be more motivated to receive a flu vaccine. It seems plausible, then, to hypothesize that cyclically primed individuals would predict they are less likely to be exposed to and contract the flu since they are more motivated to avoid such situations, while linearly primed individuals would predict they are more likely to receive a flu vaccine since they are more motivated to approach positive states. The results of the present study only support the hypothesis about linearly primed individuals, and therefore within the context of the present study it is difficult to see whether and how the different cognitive styles (i.e., regulatory orientations and beliefs about change) are intertwined, and regulatory orientations, while providing a feasible framework, are unable to explain the patterns of results. Future studies could empirically investigate whether beliefs about change or regulatory orientations is more likely to influence health status predictions, perhaps by measuring the relationship between trait-level beliefs about change and regulatory orientation, and seeing how they influence dependent variables of systematically varied valence.

What is the Prime Really Priming?

Priming research, especially cultural priming research, always faces the possibility that a prime, in fact, activates more than the intended construct. It seems that the present study is no exception.

The revealed pattern of results suggest the possibility that the cyclical prime activates concepts related to a pessimistic future, since participants primed with a cyclical belief predicted a greater likelihood of flu contraction than did participants primed with a linear belief. The fact that this finding is more robust among individuals who suffered from the flu last year, compared to those that did not, provides further support for the pessimistic bias hypothesis: the participants in this condition (had the flu last year and was primed with a cyclical belief) may be thinking that if the negative state (of suffering from the flu) happened last year, then it may happen again. Predicting that a negative event will happen would allow one to take action to prevent it from actually taking place. The Health

Belief Model would support this view, as it states that perceived susceptibility should lead to health protective behavior. However, this sequence of events does not happen in the present study – cyclically primed individuals who had the flu last year (i.e., those who rated their likelihood of flu exposure and contraction most highly) were the least likely out of all four conditions to predict they would receive a vaccine. This seems to reflect a fatalistic belief, or a sense of helplessness, as a result of the perception of a negative future. If one expects to suffer from the flu anyway, one may not see the benefit of receiving a vaccine.

It is possible that the primes activated the intended constructs, and that my conceptualization of the cycle of flu has been incorrect. Individuals in the FluYes/cyclical condition reported the highest likelihoods of exposure and contraction. This finding would make sense if they were currently healthy, and were making these predictions based on their current health. If individuals had suffered from the flu during the last flu season (as specified in the question), and are now healthy, will a cyclical prime lead them to predict they will get sick again during the flu season? It may, and the results may be reflecting this. This is only a speculation, as I did not gather information about participants' current health at the time of the survey.

Perhaps a cyclical belief, such that change is constant and contradictions are commonplace, activates beliefs about tempting fate. It is possible that individuals who suffered from the flu and are primed with a cyclical belief have a higher belief in tempting fate (or the cyclical prime activated tempting fate beliefs). Making a public statement (by marking an answer choice for the present study) that one is unlikely to be exposed to and contract the flu may be perceived as an act of tempting fate. Thus, by making the opposite statement, individuals in this condition may feel they are not tempting fate (or appeasing the gods), and therefore less likely to have the negative outcome actualize. It is unclear from this study what exactly the link may be between beliefs about change and tempting fate beliefs, but it seems that cyclical beliefs are associated with higher tempting fate beliefs, because both cyclical belief about change and tempting fate beliefs are associated with a more complex perception of the world where different events are intertwined with one another. Additionally, both of these beliefs appear to be more geared toward predicting negative outcomes. Tempting fate beliefs, by definition, refer to predictions of negative outcomes as a result of a current action, and the exploratory evidence from the present study shows that cyclically primed individuals are more likely to predict higher likelihood of negative events (exposure to flu virus and contraction of the flu). This pattern is accentuated among those who do not have health insurance. Negative outcomes may be especially salient for these individuals, since the repercussions are likely greater.

Let us take a look at the prime scenarios themselves. They were in the domains of interpersonal relationships, and in financial situations. Neither of them was in the health domain, although beliefs about change may well be domain-specific. Other cultural beliefs, such as individualism and collectivism, are shown to be domain specific, so perhaps beliefs about change is, too. If a future study that uses domain-consistent scenarios and predictions find results that are more consistent with predictions, it would be good support for domain specificity of beliefs about change. However, for now, we can consider the possibility that beliefs about change primes activate more general beliefs about the nature of life rather than specific beliefs about change. For instance, the cyclical prime may heighten a general sense of unpredictability, not limited to health statuses. This sense of unpredictability may be particularly impactful to those who had the flu last year: it is plausible that the combination of a recent flu history and the sense of unpredictability lowers the (false) sense of invincibility toward illnesses, and for college students (i.e., my participants) to rate their vulnerability more realistically (indeed, FluYes/cyclical participants scored higher (but barely above the midpoint of a 1-7 scale at 3.59), on the $PVD_{infectability}$ scale than any of the other three groups, both at prescreening and at main study).

If the cyclical prime activates pessimism, fatalism, or helplessness, then what could the linear prime activate? Linear primes may activate action tendencies. Linear thinking promotes higher levels of personal agency, and perceived control over the environment. The action of receiving a flu vaccine is in one's control, whereas being exposed to and contracting the flu is, in comparison, largely out of one's control. Perhaps linearly primed individuals rated their likelihood of receiving a vaccine more highly than their likelihood of exposure or contraction, because choosing to receive a vaccine is a domain in which one can exercise personal control.

Cognitive Differences Reflect in Answer Patterns

The differences in correlations between exposure and contraction variables by prime condition may be explained in light of the theory about cognitive style differences among cultural systems. Nisbett and colleagues' (2001) holistic vs. analytic framework, as described earlier, argues that holistic thinkers tend to pay more attention to the social environment, whereas analytic thinkers tend to pay more attention to the focal object. Holistic thinkers, who hold cyclical beliefs about change, tend more to the environment, which is unpredictable. Ancient Chinese people were mostly farmers, who needed to learn to accommodate to the environment, which may be unpredictable or harsh. One can attempt to grow crop efficiently, but if the external environment is unpredictable, then the final outcomes of their crop may not be so great. Since the external environment is largely out of their control, they can only hope that next year, the environment will be less harsh; the same farming technique may result in a great harvest if the weather (external environment) cooperated. Therefore, cyclical thinkers may not always predict a positive relationship (i.e., they will predict a less linear relationship) between two related events. On the other hand, analytic thinkers, who hold linear beliefs about change, tend to think that they have more personal control over the environment. They tend to expect a linear progression of events, and therefore they may be expecting related events to necessarily progress in the same direction. In terms of getting the flu, if the individual (i.e., the object of the situation) is exposed to the flu virus, then he or she might necessarily contract it as that would reflect a linear pattern of events. It may be the case that, since cyclical thinkers' attention is in the field (i.e., the environment), they see the causal sequence of one focal event (i.e., exposure to the flu virus) to another (i.e., contraction of the flu) as less likely than a linear thinker would, who attend more to the object (i.e., the individual's self). The order of the exposure and the contraction question items were not counterbalanced in the present study, so whether the findings actually reflect cognitive style differences, or simply an artifact of answering items on a similar concept (e.g., see Guo, 2012), remains to be further explored through replications in future studies.

Implications, Limitations, and Future Directions

The present study gives rise to some interesting implications for future research. First of all, the current study has three dependent variables that happened to vary in valence. Future studies should explore this in a systematic manner by intentionally varying the valence of the predicted outcome (i.e., whether it is a positive or a negative event). In previous literature on beliefs about change, researchers mostly focused on cyclical thinkers' tendencies to predict more change, in general, across different domains, but to my knowledge, researchers have yet to consider whether the valence of the predicted outcome may influence the extent to which individuals predict change. Congruent with the interpretation that cyclical thinking primes ideas related to pessimism, and my finding that cyclically primed individuals who had the flu last year rated their likelihood of exposure and contraction to be higher, prior research did report that when asked to predict the likelihood of a positive outcome after a series of negative events, cyclical thinkers predicted change to a lesser degree compared to when asked to predict the likelihood of a negative outcome after a series of positive events (e.g., Alter & Kwan, 2009, Study 5). Future studies should consider a more textured approach toward understanding beliefs about change and their influence in making predictions across domains.

Another interesting direction for future research is to consider the influence of beliefs about change on fundamental decision-making processes. In reality, one must be exposed to the flu virus before contraction is a possibility, so getting the flu is a linear, two-step process. Nevertheless, I found differences in the correlation between exposure and contraction likelihood ratings among linear versus cyclical thinkers. It is possible that the differences in correlation reflect a more general cognitive style where linear thinking leads to linear predictions of the progression of events, whereas cyclical thinking leads to a more fluctuating (less linear) predictions of the progression of events, even if the event itself follows a linear progression (such as in the event of exposure and contracting the flu). This, however, may be due partly to the study design: in the current study, the exposure likelihood item always preceded the flu contraction likelihood item. The lack of counterbalancing limits the extent to which I can discuss the potential implications, but this difference in response patterns seems to warrant further research.

Additionally, future research may investigate response patterns of linear and cyclical thinkers in a series of predictions within one domain. Linear thinkers may consistently answer similar questions in the same way, whereas cyclical thinkers may give a different answer to each question. In line with this, a recent study found that East Asians' responses to items on a scale have lower reliability compared to North Americans, because East Asians tend to try to avoid redundancy within the context of an interaction – meaning that, they try to answer similar questions in different manners if they think they have already provided the same information in another question. Since East Asians try to exclude information they have already provided, if many items are asking about the same concept, East Asian responses tend to have lower reliability compared to North American responses (Guo, 2012). It seems plausible that cyclical thinking indeed leads to nonlinear response patterns even for items that warrant linear response patterns. If this effect is a recurrent effect, then current methodological tools such as reverse-coding items may not be sufficient to accurately capture effects. Future research on cross-cultural variation in scale responses should explore whether the differences in beliefs about change do manifest in response patterns of questionnaires (regardless of questionnaire content).

The present study is a quasi-experimental study, as one of my independent variables, past health history, is not manipulated. The quasi-experimental design does have the advantage of enhanced ecological validity, as the past health history variable is based on a naturally occurring phenomenon. However, it also means there is less experimental control. A result of the uncontrollability of the quasi variable is the unequal cell sizes – for example, more people who did not have health insurance were in the FluYes/cyclical condition, despite my efforts to randomly assign participants. The unequal sample sizes compromise a clear understanding of the result patterns. It does not statistically threaten the interpretation of my results as the homogeneity of variances assumptions are not violated in either the omnibus test or for each individual dependent variable, but having less discrepancy in the number of participants in each cell would be advantageous.

Another limitation is that vaccine predictions may not have been the best behavioral intention measure. People's attitudes toward vaccines tend to be quite polarized: some individuals may dogmatically believe that vaccines do not work or even elicit adverse health consequences, while others may consistently obtain a vaccine before every flu season. Additionally, college-aged individuals are among the least likely age group to seek vaccination. If a different behavioral variable was measured, one in which many college-aged individuals participate, the results may have revealed a more distinct pattern.

It is possible that the cyclical prime is actually priming a different construct, such as cautiousness or a pessimistic bias. Prior literature substantiates this claim: Alter and Kwan (2009) show that when primed with a cyclical belief (by means of a yin-yang symbol), European American participants predicted that it was significantly more likely to rain following a series of sunny days, but did not predict that it would be significantly more likely to be sunny following a rainy trend (Study 5). Ji et al.'s (2001) article reports that while Chinese were more likely than Americans to predict a reversal in global economy growth trends, this pattern was especially salient for trends that were accelerating positively and less so for ones that were decelerating (Study 2). This reflects a preference, or a bias, toward predicting a more pessimistic future (since Chinese are predicting a reversal from a positively accelerating trend) on the part of the Chinese participants, which supports my interpretation. Similarly, linear primes may encourage individuals to take action rather than rely on the environment.

Conclusion

Beliefs about change may reflect what individuals think of the nature of change, but it may also help adjust views about one's future health status. Findings from the present study may contribute to health intervention efforts targeting younger populations, who are especially prone to thinking that they are invincible. Cyclical primes in the environment may activate ideas regarding the unpredictability of life, and therefore (rightfully) increase individuals' susceptibility to diseases.

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	FluYes	**FluNo**	**Total**
Cyclical	28	72	100
Linear	15	55	70
Total	43	127	170

Table 1. Sample size per condition.

	Wilks' Lambda	*F*	Hypothesis df	Error df	*p*	η^2_p
Flu Status	.957	2.48	3.00	164.00	.063	.043
Prime	.943	3.30	3.00	164.00	.022*	.057
Interaction	.944	3.21	3.00	164.00	.024*	.056

Table 2. Results of the omnibus MANOVA.

	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	5.21	0.27	4.96	0.17	5.09	0.16
■ Linear	4.40	0.37	4.51	0.20	4.46	0.21
Past Health History	4.81	0.23	4.73	0.13		

Table 3. Estimated marginal means and standard errors for likelihood ratings for exposure to the flu virus.

	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	4.21	0.22	3.24	0.14	3.73	0.13
■ Linear	3.27	0.30	3.18	0.16	3.22	0.17
Past Health History	3.74	0.18	3.21	0.10		

Table 4. Estimated marginal means and standard errors for likelihood ratings for contraction of the flu.

	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	2.93	0.37	3.51	0.23	3.22	0.22
■ Linear	4.13	0.51	3.18	0.27	3.66	0.29
Past Health History	3.53	0.32	3.35	0.18		

Table 5. Estimated marginal means and standard errors for likelihood ratings for receiving a flu vaccine.

MANOVA	*Wilks' Lambda*	*F*	*df*	*p*	η^2_p
Past Health History	.960	2.12	3, 151	.100	.040
Prime	.939	3.29	3, 151	.023	.061
Interaction*	.968	1.66	3, 151	.179	.032

Table 6.1. MANOVA results excluding uninsured individuals (change in statistical significance (from the whole sample) is denoted by an asterisk).

Exposure	*F*	*df*	*p*	η^2_p
Past Health History	0.01	1, 153	.910	.000
Prime	4.44	1, 153	.004	.053
Interaction	0.87	1, 153	.353	.006
Contraction	*F*	*df*	*p*	η^2_p
Past Health History	4.81	1, 153	.030	.030
Prime	4.44	1, 153	.037	.028
Interaction*	2.85	1, 153	.094	.018
Vaccine	*F*	*df*	*p*	η^2_p
Past Health History	1.04	1, 153	.309	.007
Prime	0.14	1, 153	.706	.001
Interaction*	1.57	1, 153	.211	.010

Table 6.2. ANOVA results excluding Ps without health insurance (change in statistical significance is denoted by an asterisk).

Exposure	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	5.24	0.31	4.94	0.17	5.09	0.18
■ Linear	4.15	0.39	4.39	0.20	4.27	0.22
Past Health History	4.70	0.25	4.66	0.13		
Contraction	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	4.10	0.25	3.21	0.14	3.65	0.14
■ Linear	3.23	0.32	3.12	0.16	3.17	0.18
Past Health History	3.66	0.20	3.16	0.11		
Vaccine	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	3.43	0.44	3.52	0.24	3.48	0.25
■ Linear	4.08	0.56	3.17	0.28	3.63	0.31
Past Health History	3.75	0.35	3.35	0.18		
***ns* per cell**	FluYes		FluNo		Total	
■ Cyclical	21		71		92	
■ Linear	13		52		65	
Total	34		123		157	

Table 7. Means, standard error, and *ns* for insured individuals only.

Exposure	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	5.14	0.59	6.00	1.56	5.57	0.83
■ Linear	6.00	1.10	6.50	1.10	6.25	0.78
Past Health History	5.57	0.62	6.25	0.95		
Contraction	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	4.57	0.38	5.00	1.01	4.79	0.54
■ Linear	3.50	0.72	4.00	0.72	3.75	0.51
Past Health History	4.04	0.41	4.50	0.62		
Vaccine	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	1.43	0.38	3.00	1.01	2.21	0.54
■ Linear	4.50	0.72	2.00	0.72	3.25	0.51
Past Health History	2.97	0.41	2.50	0.62		
***ns* per cell**	FluYes		FluNo		Total	
■ Cyclical	7		1		8	
■ Linear	2		2		4	
Total	9		3		12	

Table 8. Means, standard error, and *n*s for uninsured individuals only.

Expose		FluYes		FluNo		Prime	
		M	*SE*	*M*	*SE*	*M*	*SE*
■ C	M	5.33 *n*=6	0.62	4.93 *n*=43	0.23	5.13 *n*=49	0.33
	F	5.18 *n*=22	0.30	5.00 *n*=29	0.26	5.09 *n*=51	0.20
■ L	M	3.25 *n*=4	0.76	4.20 *n*=25	0.30	3.73 *n*=29	0.41
	F	4.82 *n*=11	0.42	4.77 *n*=30	0.25	4.79 *n*=41	0.24
Flu	M	4.29 *n*=10	0.49	4.57 *n*=68	0.19		
	F	5.00 *n*=33	0.26	4.88 *n*=59	0.18		

Contract		FluYes		FluNo		Prime	
		M	*SE*	*M*	*SE*	*M*	*SE*
■ C	M	3.83	0.50	3.07	0.19	3.45	0.27
	F	4.32	0.22	3.48	0.19	3.90	0.15
■ L	M	2.50	0.61	2.72	0.24	2.61	0.33
	F	3.55	0.31	3.57	0.19	3.56	0.18
Flu	M	3.17	0.39	2.90	0.15		
	F	3.93	0.19	3.53	0.13		

Vaccine		FluYes		FluNo		Prime	
		M	*SE*	*M*	*SE*	*M*	*SE*
■ C	M	4.33	0.70	3.26	0.26	3.80	0.37
	F	2.55	0.44	3.90	0.39	3.22	0.29
■ L	M	5.25	0.86	2.44	0.34	3.85	0.46
	F	3.73	0.63	3.80	0.38	3.76	0.37
Flu	M	4.79	0.56	2.85	0.22		
	F	3.14	0.38	3.85	0.27		

Table 9. Means and standard error for MANOVA for each gender.

Original Assignment Rule	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	5.33	0.34	4.95	0.19	5.14	0.20
■ Linear	4.50	0.72	4.41	0.27	4.46	0.38
Past Health History	4.92	0.40	4.68	0.16		
Reversed Assignment Rule	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	5.00	0.48	5.00	0.38	5.00	0.31
■ Linear	4.36	0.46	4.62	0.30	4.49	0.27
Past Health History	4.68	0.33	4.81	0.24		

Table 10. Means and standard errors for exposure before and after changing the assignment rule for the exposure variable.

Original Assignment Rule	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	4.28	0.27	3.29	0.15	3.78	0.15
■ Linear	3.00	0.57	3.41	0.21	3.21	0.30
Past Health History	3.64	0.31	3.35	0.13		
Reversed Assignment Rule	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	4.10	0.37	3.06	0.30	3.58	0.24
■ Linear	3.36	0.36	2.92	0.23	3.14	0.21
Past Health History	3.73	0.26	2.99	0.19		

Table 11. Means and standard errors for contraction before and after changing the assignment rule for the contraction variable.

Original Assignment Rule	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	3.06	0.47	3.39	0.27	3.22	0.27
■ Linear	5.50	0.99	3.24	0.37	4.37	0.53
Past Health History	4.28	0.55	3.32	0.23		
Reversed Assignment Rule	FluYes		FluNo		Prime	
	M	*SE*	*M*	*SE*	*M*	*SE*
■ Cyclical	2.70	0.63	3.94	0.50	3.32	0.40
■ Linear	3.64	0.60	3.12	0.39	3.38	0.36
Past Health History	3.17	0.43	3.53	0.32		

Table 12. Means and standard errors for vaccine before and after changing the assignment rule for the vaccine variable.

	FluYes		FluNo		FluYes to FluNo (changers)		FluNo to FluYes	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
■ C	5.16	0.33	4.91	0.17	5.33	0.51	6.50	0.65
■ L	5.00	0.59	4.54	0.20	3.75	0.54	4.00	0.53

Table 13.1. Means and standard error for each past health history condition for exposure.

	FluYes		FluNo		FluYes to FluNo (changers)		FluNo to FluYes	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
■ C	4.37	0.26	3.19	0.13	3.89	0.41	5.00	0.33
■ L	3.33	0.46	3.12	0.16	3.00	0.44	4.33	0.27

Table 13.2. Means and standard error for each past health history condition for contraction.

	FluYes		FluNo		FluYes to FluNo (changers)		FluNo to FluYes	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
■ C	3.26	0.46	3.54	0.24	2.22	0.48	2.50	0.65
■ L	4.17	0.82	3.02	0.28	3.75	0.51	6.00	0.53

Table 13.3. Means and standard error for each past health history condition for vaccine.

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.265 (p = .173)	1	
Likelihood of Vaccine	.122 (p = .536)	-.214 (p = .274)	1

Table 14.1. Correlation among dependent variables in the FluYes/Cyclical condition (n = 28).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.636* (p = .011)	1	
Likelihood of Vaccine	.005 (p = .985)	.044 (p = .875)	1

Table 14.2. Correlation among dependent variables in the FluYes/Linear condition (n = 15).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.405*** (p < .001)	1	
Likelihood of Vaccine	.220 (p = .063)	.152 (p = .202)	1

Table 14.3. Correlation among dependent variables in the FluNo/Cyclical condition (n = 72).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.555*** (p < .001)	1	
Likelihood of Vaccine	-.006 (p = .963)	.117 (p = .394)	1

Table 14.4. Correlation among dependent variables in the FluNo/Linear condition (n = 55).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.484** (p = .001)	1	
Likelihood of Vaccine	-.008 (p = .959)	-.213 (p = .171)	1

Table 15.1. Correlation among dependent variables in the FluYes condition across the levels of the prime (n = 43).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.471*** (p < .001)	1	
Likelihood of Vaccine	.126 (p = .159)	.138 (p = .122)	1

Table 15.2. Correlation among dependent variables in the FluNo condition across the levels of the prime (n = 127).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.375*** ($p < .001$)	1	
Likelihood of Vaccine	.181 ($p = .071$)	.005 ($p = .961$)	1

Table 16.1. Correlation among dependent variables in the Cyclical condition across the levels of past health history ($n = 100$).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.572*** ($p < .001$)	1	
Likelihood of Vaccine	-.010 ($p = .935$)	.105 ($p = .853$)	1

Table 16.2. Correlation among dependent variables in the Linear condition across the levels of past health history ($n = 70$).

	Likelihood of Exposure	**Likelihood of Contraction**	**Likelihood of Vaccine**
Likelihood of Exposure	1		
Likelihood of Contraction	.471*** ($p < .001$)	1	
Likelihood of Vaccine	.093 ($p = .226$)	.045 ($p = .556$)	1

Table 17. Total correlation among dependent variables across the four conditions ($n = 170$).

	Y/C	Y/L	N/C	N/L	Y	N	C	L	T
Y/C	.								
Y/L	-1.37 .085	.							
N/C	-0.68 .248	-1.03 .152	.						
N/L	-1.45 .073	-0.39 .348	-1.07 .142	.					
Y	-1.01 .156	-0.68 .248	-0.38 .352	0.47 .319	.				
N	-1.09 .138	-0.79 .215	-0.54 .295	0.69 .245	0.09 .464	.			
C	-0.55 .291	-1.17 .121	0.23 .409	1.36 .087	0.71 .239	-0.88 .189	.		
L	-1.62 .053	-0.32 .375	-1.29 .099	-0.13 .448	-0.61 .271	0.92 .179	-1.61 .054	.	
T	-1.12 .131	-0.80 .212	-0.57 .284	0.72 .236	0.10 .460	0.00 .500	-0.92 .179	0.96 .169	.

Table 18. *z*-scores (top row) and one-tailed *p*-values (bottom row) for comparisons between correlations (exposure and contraction).

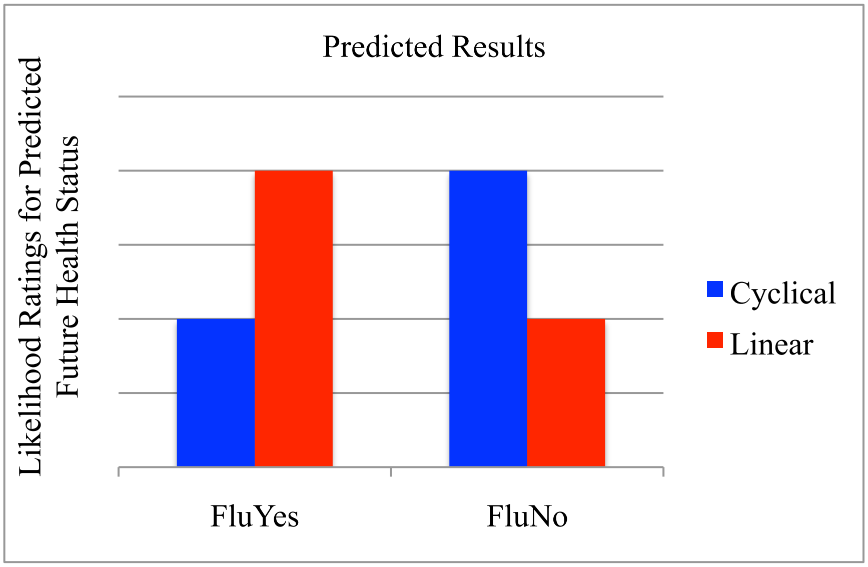

Figure 1. Expected pattern of results across the dependent variables.

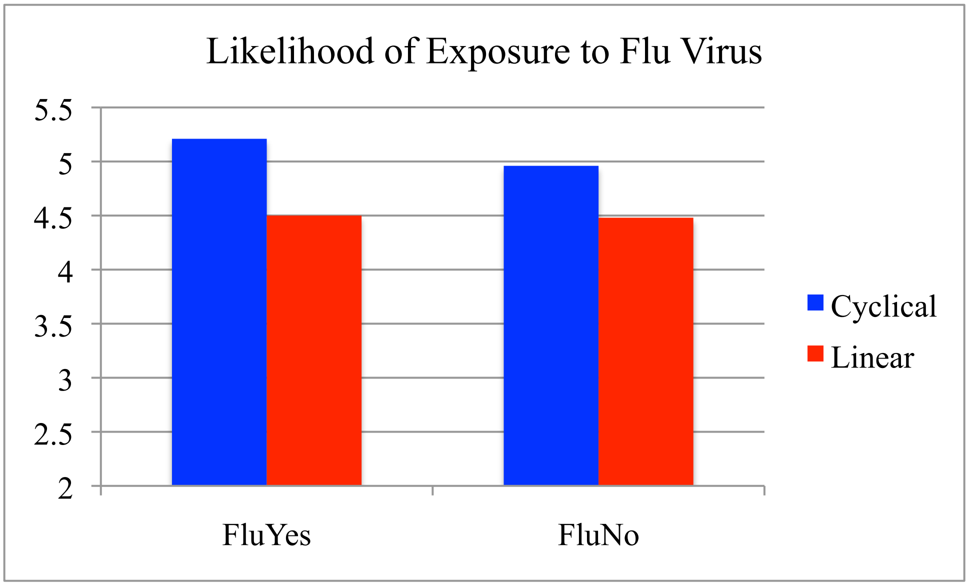

Figure 2. Likelihood ratings for exposure to flu virus (7-point scale).

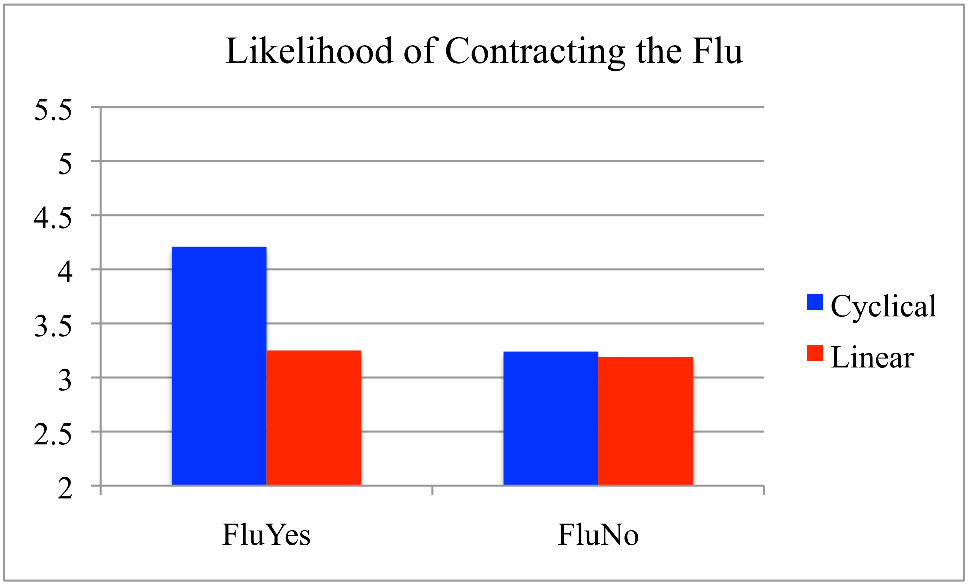

Figure 3. Likelihood ratings for contracting the flu (7-point scale).

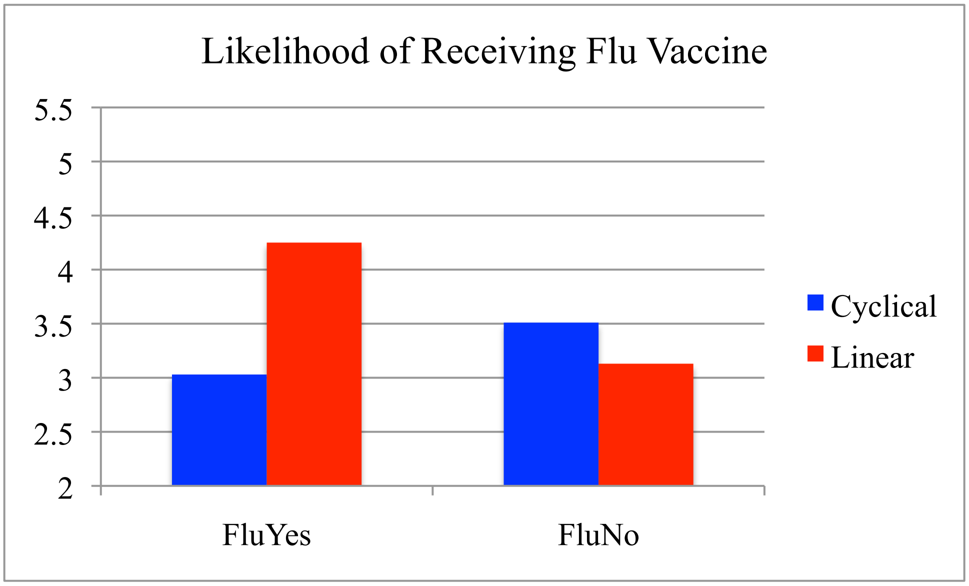

Figure 4. Likelihood ratings for receiving a flu vaccine (7-point scale).

APPENDIX A

PERCEIVED VULNERABILITY TO DISEASES

Please indicate your response to the following items on a 7-point scale, where 1—Strongly Disagree, and 7—Strongly Agree.

1. It really bothers me when people sneeze without covering their mouths.

2. If an illness is 'going around', I will get it.

3. I am comfortable sharing a water bottle with a friend.*

4. I do not like to write with a pencil someone else has obviously chewed on.

5. My past experiences make me believe I am not likely to get sick even when my friends are sick. *

6. I have a history of susceptibility to infectious disease.

7. I prefer to wash my hands pretty soon after shaking someone's hand.

8. In general, I am very susceptible to colds, flu and other infectious diseases.

9. I dislike wearing used clothes because you do not know what the last person who wore it was like.

10. I am more likely than the people around me to catch an infectious disease.

11. My hands do not feel dirty after touching money.*

12. I am unlikely to catch a cold, flu or other illness, even if it is 'going around'.*

13. It does not make me anxious to be around sick people.*

14. My immune system protects me from most illnesses that other people get.*

15. I avoid using public telephones because of the risk that I may catch something from the previous user.

(* Reverse-coded items)

APPENDIX B

PAST HEALTH HISTORY

This section aims to gather information on participants' past health history. Please indicate your response to each of the questions on the scale provided.

I. Did you suffer from the flu last year?

Yes No

II. Exposure to Virus

Please indicate your response to the following question:

How likely do you think you were exposed to the flu virus during the last flu season (November 2010 to February 2011)?

1—Definitely Not

2—Very Unlikely

3—Somewhat Unlikely

4—Somewhat Likely

5—Very Likely

6—Definitely

II. Experienced Symptoms

Whether you have suffered from the flu or not, it is possible that you have experienced some illness symptoms during the past flu season (November 2010 through February 2011). We are interested in your experiences with the symptoms listed below. Please recall your health status from November 2010 to February

2011, and indicate whether you have experienced any of the following symptoms and the severity or duration with which you have experienced them:

1. Fever

    0 – Did not experience this symptom.

    1 – 100°

    2 – 101°

    3 – 102°

    4 – 103°

    5 – 104°

2. Dry Cough

    0 – Did not experience this symptom.

    1 – One week

    2 – Two weeks

    3 – One month

    4 – Two months

    5 – Three months

3. Sore Throat

    0 – Did not experience this symptom.

    1 – Dry throat

    2 – Itchy throat

    3 – Irritated throat

    4 – Hurts to swallow

    5 – Unable to swallow

4. Runny or Stuffy Nose

Yes No

Please describe your symptoms:

____

5. Muscle or Body Aches

Yes No

Please describe your symptoms:

____

6. Headaches

Yes No

Please describe your symptoms:

____

7. Fatigue

Yes No

Please describe your symptoms:

____

APPENDIX C

PRIMING STIMULI

Please read the two following scenarios that describe the beginning and the end of an incident. What happened in-between? What things could have happened that led from the beginning of this story to the outcome? We are interested in what you think went on. There is no right or wrong answer; we are simply interested in what you think happened.

Linear condition

Story 1:

Lucia and Jeff are both seniors at the same university. They have been dating each other for two years.

____

____

____

____

Twenty years later, they are happily married and have children together.

Story 2:

Richard grew up in a poor family.

____

____

____

____

Twenty years later, he is still living in poverty. His life is no different than how it was when he was a child, growing up in a poor family.

Cyclical condition

Story 1:

Lucia and Jeff are both seniors at the same university. They have been dating each other for two years.

____

____

____

____

Twenty years later, they are both married to someone else. Lucia and Jeff are no longer close to each other, and in fact, they have not kept in touch since university.

Story 2:

Richard grew up in a poor family.

____

____

____

____

Twenty years later, Richard is a successful business owner. He leads a wealthy lifestyle, unlike his childhood.

APPENDIX D

INTENTIONS FOR HEALTH-PROMOTIVE BEHAVIOR

How likely are you to participate in the following behaviors? Rate each item on the following scale: 1—Not at All Likely, 2—Very Unlikely, 3—Somewhat Unlikely, 4—Neutral, 5—Somewhat Likely, 6—Very Likely, and 7—Definitely.

_____1. Wash hands more often, with soap and water.

_____2. Avoid crowded places.

_____3. Take multivitamins.

_____4. Consult a doctor.

_____5. Avoid touching your eyes, nose, and mouth.

_____6. Receive a flu vaccine.

APPENDIX E

PERCEPTIONS OF CHANGE ITEMS

Please indicate how much you agree with the following statements, on a scale from 1—Strongly Disagree, to 7—Strongly Agree.

1. Every phenomenon in the world moves in predictable directions.*

2. A person who is currently living a successful life will continue to stay successful.*

3. An individual who is currently honest will stay honest in the future.*

4. If an event is moving toward a certain direction, it will continue to move toward that direction.*

5. Current situations can change at any time.

6. Future events are predictable based on present situations.*

Additional Questions

7. You reap what you sow.*

8. What goes around comes around.

9. Old habits die hard.*

(* Reverse-coded items)