

COGNITIVE BIAS AND HEALTH-RELATED  
DECISION-MAKING

by

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## ABSTRACT

Extant literature suggests that cognitive bias is a pervasive phenomenon that is present in a variety of domains and is associated with negative consequences related to decision-making and interpersonal interactions (Chambers & Melnyk, 2006; Fischer et al., 2005; Lord et al., 1979; Ross & Ward, 1996). The utility of a brief intervention designed to reduce biases in the understudied domain of health was investigated. The present study extended previous work indicating that completion of a brief bias-reducing intervention was associated with significant reductions in inappropriate confidence in interpersonal judgments (Hart, Tullett, Shreves, & Fetterman, 2015). In the present study, participants completing a bias-reducing intervention did not demonstrate significant differences in confidence bias, selective exposure, and willingness to comply with hypothetical health interventions relative to participants completing a control task. Participants completing a bias-reducing task did, however, demonstrate a greater understanding of cognitive bias and its implications than control participants.

Explanations for the present findings including the function of the bias-reducing intervention, measurement of confidence bias and its presumed manifestations, use of Amazon's Mechanical Turk for recruitment and data collection, and the role of accuracy motivation in the domain of health are discussed. Overall results of the current investigation suggest a need to complete follow-up research in order to clarify present results and to reconcile these results with extant literature.

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## 1. Introduction

Bias in human judgment is well established in scientific literature, prevalent in the general public, and can contribute to people making consistently irrational choices (Ariely, 2008; Tversky & Kahneman, 1974). Cognitive biases are particularly troubling because, despite their presence and influence, it remains difficult for individuals to detect bias in themselves. The difficulty associated with gaining insight into one's own biases often leads to the inaccurate belief in the objectivity of one's views. This phenomenon – known as “naïve realism” – may broadly impact people's decision-making and interactions with the world (Chambers & Melnyk, 2006; Fischer, Jonas, Frey, & Schulz-Hardt, 2005; Lord, Ross, & Lepper, 1979; Ross & Ward, 1996). Existing research has established a precedent for bias in the domain of health via investigations of individuals' perceptions of their personal health risks (El-Toukhy, 2013; Katapodi, Dodd, Lee, & Facione, 2009; Weinstein & Lyon 1999; Wright, Barnhart, Freeman, & Walker, 2010). However, the diversity of the potential manifestations and effects of cognitive biases as they relate to health remains understudied.

One particularly concerning potential threat to health is confidence bias. Confidence bias is defined as the difference between the *accuracy* of one's views and the *certainty* with which one holds those views (Keren, 1997; Liberman & Tversky, 1993; McClelland & Bolger, 1994). Confidence bias tends to manifest as overconfidence in which people broadly overestimate the accuracy of their knowledge of the world (Hilbert, 2012; Klayman, Soll, & Gonzalez-Vallejo, Barlas, 1999; West & Stanovich 1997). Overconfidence is problematic in light of its association with cognitive rigidity and overgeneralization (Cohen, 2012).

Though the impact of confidence bias, and particularly overconfidence, on health and utilization of health care systems is currently understudied, the documented impact of confidence bias on decision-making and information gathering suggests that confidence bias could contribute to poorer health outcomes by preventing individuals from effectively using available resources and information to make health-related decisions. For example, biased individuals may be unwilling or unable to consider multiple perspectives on their own health and may be disinclined to adhere to treatments that conflict with their preexisting notions of health and health-related interventions. This rigid interaction within health care systems could reasonably be expected to have deleterious consequences on individuals' health.

The present investigation attempted to better understand cognitive biases in health-related contexts. Specifically, this study investigated inappropriate confidence, biased information gathering, and willingness to comply with suggested interventions in the domain of health. Furthermore, the study explored the utility of an intervention designed to reduce bias and to mitigate consequences surrounding its health-related manifestations.

## **Background**

**Cognitive bias.** Cognitive bias has been shown to negatively impact both decision-making and information gathering in multiple domains (Chambers & Melnyk, 2006; Fischer et al., 2005; Lord et al., 1979; Ross & Ward, 1996). Naïve realism, a likely contributor to many forms of cognitive bias, is a term used to describe individuals' false sense that they perceive the entities and events of the world with objectivity (Ross & Ward, 1996). In addition to being the proposed basis for many cognitive biases, naïve realism naturally leads to these biases being difficult to detect because each individual's search for personal bias is likely itself hindered by bias (Pronin, 2009; Pronin, Lin, & Ross, 2002). Not only does naïve realism cloak

people's subjective attitudes, beliefs, and preferences with an illusory sense of objectivity, it also makes people feel that others would share their perceptions given open-minded access to the same information. Additionally, naïve realism leads people to believe that dissenting perceptions result from others not having exposure to the same information as oneself, others being unable or unwilling to process available information to reach appropriate conclusions, and/or others being biased (Ross & Ward, 1996). Overall, naïve realism is a troubling phenomenon because it is thought to simultaneously create and mask cognitive bias, therefore functioning as both a source of and barrier to overcoming bias.

Confidence bias - and more specifically overconfidence - has been described as the most widespread and influential bias in human judgment (DeBondt & Thaler, 1995; Mannes & Moore, 2013; Plous, 1993). Research suggests that the majority of individuals demonstrate overconfidence in a variety of domains including knowledge of their chosen profession, accuracy in answering questions of general knowledge, social predictions, ability to identify humor, recognition of grammatical errors, and completion of logical reasoning problems (Dunning, Griffin, Milojkovic, & Ross, 1990; Kruger & Dunning, 1999; McKenzie, Liersch, & Yaniv, 2008; Soll & Klayman, 2004). Additionally, literature suggests that overconfidence related to general knowledge can be used to predict overconfidence in eye-witness memory and motor skill within individuals, indicating people may demonstrate relatively consistent manifestations of overconfidence across certain domains (Bornstein & Zickafoose, 1999; West & Stanovich, 1997). Though degree of overconfidence does seem to be influenced by the means of measurement utilized, content of the task, and the sample being studied, overconfidence is a normative finding in a variety of populations, content domains, and styles of assessment (Klayman, et al., 1999).

Overconfidence is a broad term capturing three distinguishable yet related biases: overestimation, overplacement, and overprecision (Moore & Healy, 2008). Overestimation is a well-studied form of overconfidence and is typically operationalized as the overestimation of one's ability or performance; overplacement is very similar to overestimation and is operationalized as the inaccurately inflated belief in one's ability or performance *relative to others*; overprecision is operationalized as "excessive certainty regarding the accuracy of one's beliefs" (Moore & Healy, 2008, p. 502). Although historically much of overconfidence research has focused on overestimation, recent work suggests that overprecision is more pervasive than, and may be able to account for, other forms of overconfidence (Adams & Adams, 1960; Fischhoff, Slovic, Lichtenstein, 1977; Moore & Healy, 2008; Pallier et al., 2002). Despite research identifying overconfidence as a contributor to a diverse set of societal problems including failures in the stock market, avoidable errors in medical diagnoses, intolerance of individuals with different views, and even international conflict, it remains understudied in the context of health and health outcomes (Daniel, Hirshleifer, & Subrahmanyam, 2001; Christensen-Szalanski & Bushyhead, 1981; Harvey & Fischer, 1997; Johnson, 2009; Johnson et al, 2006; Odean, 1999).

In addition to the aforementioned consequences of confidence bias, overconfidence has been proposed as one mechanism underlying selective exposure (Brannon, Tagler, & Eagly, 2007; Fischer, Fischer, Weisweiler, & Frey, 2010; Fischer, Jonas, Frey, & Kastenmüller, 2008; Fischer et al., 2011; Hart & Albarracin, 2012). Selective exposure is often theorized as a behavioral manifestation of overconfidence that presents as the seeking of congenial information and avoidance of uncongenial information. Theoretical underpinnings of models of confidence and selective exposure suggest that because individuals are highly confident in their decisions

they feel little need or desire to change their beliefs and behaviors; thus, they are not inclined to seek uncongenial information because it represents a challenge to existing thoughts and actions that is not useful or necessary. Indeed, empirical investigations have established that increased decisional certainty or confidence in one's attitudes, beliefs, and behaviors is associated with increased tendency to demonstrate selective exposure (Fischer et al., 2008, 2010, 2011). Selective exposure research has historically produced inconsistent results, which is reflected in the relatively small number of studies addressing selective exposure specifically within the domain of health. Thus, available literature has yet to create a cohesive narrative surrounding health-related selective exposure. Straightforward examples of selective exposure in the domain of health are available (e.g., greater avoidance of uncongenial smoking information among smokers; preference for attitude consistent information regarding cancer risk; underutilization of HIV-prevention intervention among high risk individuals; Brock and Balloun, 1967; Noguchi, Albarracin, Durantini, & Glasman, 2007; Weinstein, 1979), though such findings are not ubiquitous. Additional investigations of selective exposure have instead indicated that individuals are no less interested in challenging, uncongenial health information than friendly, congenial health-related messages. For example, research suggests that smokers may not avoid information that challenges habitual smoking behaviors and attitudes (Feather 1962, 1963; Bertrand, 1979; Brock, 1965; Hwang, 2010), coffee drinkers do not appear inclined to avoid reading about cancer risks related to coffee consumption (Weinstein, 1985), and individuals with hypertension do not avoid dissonance-arousing information related to their hypertensive status (Bertrand, 1979).

While much remains unknown regarding health-related manifestations of bias, available literature points to a variety of practical consequences associated with the broad forms of

cognitive biases considered in the present investigation. For example, individuals who are confident in their views about complex issues are inclined to demonstrate bias when evaluating relevant empirical evidence, underestimate the complexity of the issue, and see alternative opinions as uninformed and biased (Lord et al., 1979). In fact, exposing individuals who hold opposing views to the same empirical evidence has been associated with increased polarization (Lord et al., 1979). The unwillingness to consider alternative perspectives associated with overconfidence has been demonstrated to promote the devaluation of individuals who hold opposing views, to impair interpersonal interactions, and to decrease individuals' quality of decision-making (Chambers & Melnyk, 2006; Janis, 1982; Vallone, Ross, & Lepper, 1985). The associations between confidence bias and interpersonal interactions, confirmatory information search, and ineffective decision-making appear to be present in many domains, suggesting the utility of studying bias in the context of health.

**Health.** Bias as a potential threat to health is concerning in light of health's assumed role as a prerequisite to well-being in humans. Health is a foundational component in modern instruments used to assess quality of life, the most self-reported aspect of global quality of life in community samples, and a need second in importance only to breathing, food, and water in Maslow's longstanding model of human needs (Martin et al., 2012; Maslow, 1943; World Health Organization, 1998). Additionally, the significance of good health is ubiquitously acknowledged by diverse populations throughout the world (Schwartz, Cole, Vickrey, Gelber, & 1994). Health thus seems to represent one of the most basic and important constructs in psychological research.

Furthermore, health, and concordantly health care, is a particularly salient issue in the modern United States. Despite spending more than any other nation on health care and accounting for more than forty percent of global health care spending, the United States has

relatively poor health outcomes compared to other developed nations (Health, 2011; Murray & Frenk, 2010; Worldwide Health Care Spending, 2013). Out of 191 studied countries, the United States ranks 39<sup>th</sup> in infant mortality, 43<sup>rd</sup> in adult female mortality, 42<sup>nd</sup> in adult male mortality, and 36<sup>th</sup> in overall life expectancy (Murray & Frenk, 2010). Overall, health and health care represents a serious pragmatic and fiscal challenge within the United States.

Though information related to cognitive bias in the domain of health is limited, existing literature indicates that people commonly underestimate their risk of negative health consequences and overestimate their likelihood of experiencing positive health consequences (El-Toukhy, 2013; Katapodi et al., 2009; Weinstein & Lyon, 1999; Wright, Barnhart, Freeman, & Walker, 2010). Furthermore, this inaccurate risk perception has been associated with a decreased tendency to engage in health promoting behaviors (Brewer et al., 2007). Literature has established a connection between bias and health behaviors in a limited capacity, indicating the benefit of more fully exploring this relationship.

One timely consideration is misinformation related to health. Research indicates that 59% of Americans use the Internet to access health information, and 70% of adults report that online information impacts their health decisions and behaviors (Fox, 2011; Fox & Raine, 2002; Zickuhr, 2010). Furthermore, 74% of adults report that one can believe most or all health information found online (Fox & Raine, 2002). The ubiquity of using online information to inform health decisions in combination with the high levels of confidence in online health information may be problematic in light of research on the accuracy of health-related information retrieved online. Estimates of the accuracy of online health information vary greatly according to health issue and the source of the information; however, research suggests that online health information is often inaccurate, incomplete, irrelevant, or outdated (Chung, Oden,

Joyner, Sims, & Moon 2012; Fallis & Fricke, 2002; Kunst, Groot, Latthe, Latthe, & Kahn, 2002). Unfortunately, research also suggests that when individuals encounter this type of misinformation they tend not to recognize its failings and instead endorse its veracity (Furnham & Hughes, 2014). The current conflation of widespread reliance on online information and prevalence of misinformation on the Internet may therefore exacerbate issues of confidence bias by creating preexisting notions within patients that may be inaccurate and unhelpful for promoting and maintaining well-being.

The presently discussed concept of health-related confidence should be distinguished from health-related self-efficacy. Whereas health-related self-efficacy represents individuals' beliefs about their personal control over and ability to perform specific health behaviors, health-related confidence is conceptualized as an individuals' certainty regarding prognoses, interventions, and general health information (Schwarzer & Renner, 2009). These constructs contain both theoretical and practical distinctions. For example, it seems reasonable to imagine patients could demonstrate significant health-related overconfidence (i.e., express certainty in beliefs that chronic illnesses are invariably severe, greatly impact lifestyle, and cannot be improved by any interventions) and low health-related self-efficacy (i.e., express beliefs that they have no personal control over their health). While efficacy and confidence related to health are likely both important constructs, they are concepts with meaningful distinctions.

Resolving current problems in the health care system is doubtlessly an important endeavor and one that will require numerous changes. The proposed study sought to explore one factor that may potentially be important for improving health and health care utilization through improving patients' health-related decision-making.

## **The Present Study**

In light of the interpersonal interactions and decision-making associated with health care, cognitive bias may have measureable and broad health-related consequences. The proposed study sought to (1) identify potential barriers (i.e., confidence bias, selective exposure, and low willingness to comply) to the successful utilization of the health care system and (2) to develop a greater understanding of possible means of mitigating these barriers in order to improve health outcomes and increase the quality of life of patients. The proposed study attempted to accomplish these aims by providing empirical information regarding confidence bias, selective exposure, and self-reported willingness to comply in the domain of health as well as information regarding associations among these phenomena. Furthermore, the present study explored the utility of a brief intervention designed to reduce confidence bias and selective exposure and increase willingness to comply with suggested interventions in hypothetical health scenarios.

## **2. Pilot Study**

### **Confidence Bias and Willingness to Comply**

The pilot study in the current project was used to accomplish several important goals. First, pilot data was used to evaluate potential differences in demand experienced by participants in the experimental and control conditions, and thereafter helped guide decisions related to strengthening the experimental manipulation – in order to achieve larger effect sizes – while also attempting to ensure demand did not become a confound. Second, results of pilot data allowed dependent measures to be refined and optimized. For example, pilot data collection informed efforts to match the general and health-related confidence bias measures on difficulty and length. Data gathered during pilot data collection was also used to determine the ideal paradigm (i.e., low familiarity, high believability) for vignettes measuring willingness to comply. Third, results from pilot data were used to establish expected effects sizes for the current project and accordingly to select an appropriate sample size for the primary study.

In the pilot study it was hypothesized that the experimental group – in which participants complete a bias reducing intervention - would show less confidence bias than the control group – in which participants complete a reading comprehension task. Additionally, it was hypothesized that the experimental group would demonstrate increased self-reported willingness to comply with health interventions.

### **3. Pilot Study Methods**

#### **Participants**

Pilot data was collected using Amazon’s crowd sourcing platform Mechanical Turk. A survey of Mechanical Turk workers indicates that workers are mostly from the United States (57%), have an mean age of 31, are 55% female, are highly educated (66% have at least a college degree), and have a median annual income of between \$20,000 and \$30,000 (Ross, Zaldivar, Irani, & Tomlinson, 2009). Literature suggests that, relative to typically recruited participants, Mechanical Turk workers respond to experimental tasks similarly, are generally more representative of the national population, devote at least as much attention to tasks, and produce results that are both internally and externally valid (Horton, Rand, & Zeckhauser, 2010; Paolacci, Chandler, & Ipeirotis, 2010). Replications of extant research findings – particularly those based on traditional data collection means – using Mechanical Turk workers have produced findings consistent with the original studies (Berinsky, Huber, & Lenz, 2011; Horton, Rand, & Zeckhauser, 2010). Pilot data collection targeted 50 individuals. All participants in the study received monetary compensation (i.e., fifty cents) for completing the study. The criteria used to determine eligibility for participation in the present study included: (1) currently residing in the United States, (2) being 18 years of age or older, and (3) consenting to complete all portions of the online experiment.

For pilot data collection a total of 51 participants were collected using Amazon’s Mechanical Turk. Participants in the pilot data collection were 69.2% female, 26.9% male, and included one individual (1.96%) who identified as “other” for gender. Additionally, 55.8% of

participants identified as White non-Hispanic, 19.2% as White Hispanic, 13.5% as Black non-Hispanic, 5.8% as Asian, and 3.9% as Other. Participants' mean age was 39.12 years (SD = 12.84) and mean years of education was 15.08 (SD = 2.42).

## **Materials**

**Bias-Reducing Intervention.** An experiential intervention designed to combat naïve realism and associated biases was the designated task for the experimental condition in the present study (see Appendix A). This intervention is a modified version of an existing manipulation that has previously been shown to successfully reduce confidence (Hart et al., 2015). Modifications to the original intervention were made to strengthen the existing manipulation, increase ecological validity, and offer subtle health-related applications throughout. The intervention allowed participants to experience common perceptual biases (e.g., Necker Cube, Adelson Checker Shadow Illusion) while educating participants about such biases. Additionally, participants' knowledge of everyday items (e.g., an American penny) was challenged to emphasize the discrepancy between the “feeling” of knowing and objective knowledge. Finally, participants were shown a series of statements with accompanying evidence for each statement and asked to rate the strength of the provided evidence. After rating the strength of evidence associated with four statements, participants were shown that each piece of evidence, though superficially strong, was missing key information necessary to support the associated claim. Throughout the completion of the experimental task participants were reminded of the broader implications of naïve realism.

**Reading Comprehension Control.** A publically available reading comprehension exercise was utilized as a control task in the present study (see Appendix B; Read Theory, 2012). In the task participants read a brief passage, answered questions about the passage, then were

provided feedback regarding the correct answers to previously answered questions. The measure was designed for individuals with an 11<sup>th</sup> grade reading level and in the present experiment was modified to increase difficulty in order to better match the experimental condition (i.e., more difficult questions were added following the provided passage to ensure that participants were receiving feedback indicating they had made mistakes).

**Confidence Bias.** Convention dictates that confidence bias be determined by having participants respond to a series of questions assessing knowledge (e.g., “What is the length of the Earth’s equator?”) while also having participants rate their confidence in the correctness of each of their answers. An average is then calculated for both correctness and confidence. The difference between these two values represents confidence bias (Adams & Adams, 1960; Fischhoff et al., 1977; Lichtenstein & Fischhoff, 1977). This well-established format was followed for the creation of present measures of confidence bias.

In the pilot study a 19-item measure of health-related confidence bias was created by compiling health-related questions from a series of quizzes available on popular medical websites (see Appendix C). The accuracy of the information assessed in these quizzes was confirmed through external sources. The measure contains multiple-choice questions assessing health-related knowledge (e.g., “What causes animal related allergies?”) accompanied by four possible answers. Additionally, the measure collects ratings of participants’ confidence in the correctness of their provided answers (ranging from 25%, completely unsure of the correctness of the provided answer, to 100%, completely sure of the correctness of the provided answer) following each multiple-choice question. Because participants’ confidence scores, when averaged across questions, should correspond to their prediction about the proportion of questions they would get correct, we can compare this to the actual proportion correct in order to

quantify their bias. A similar, 20-item measure was created to assess general confidence bias (see Appendix D). This measure was created by compiling questions of general knowledge previously utilized by researchers for the measurement of confidence bias (Blavatsky, 2009; Michailova, 2010).

**Willingness to Comply.** In the present study willingness to comply with suggested health interventions was measured by asking participants to respond to a series of vignettes (see Appendix E). The health interventions presented to participants were intended to be relatively unfamiliar interventions that participants may not have had personal experience with and therefore would not likely be consistent with an existing preference. Thus by asking participants their willingness to engage in a hypothetical behavior that is inconsistent with existing behaviors, the task has a conceptual framework similar to traditional selective exposure tasks.

Each vignette presented a health-related issue (e.g., sleep disturbance) and suggested intervention (e.g., use of melatonin). Participants were asked to self-report the likelihood of their compliance (ranging from 0%, absolutely would not implement the suggestion, to 100%, absolutely would implement the suggestion) with the suggested intervention in each of the presented scenarios. This measure also asked participants to rate (on a scale from 0-100%) the likelihood that they would have considered the presented intervention had it not been suggested by a health professional, their familiarity with the suggested intervention, and their perception of realism in each presented scenario. Vignettes in the pilot study addressed back pain, anxiety, headaches, and sleep disturbance.

**Demographics.** Participants' demographic information was obtained by directly asking for a self-report of age, gender, ethnicity, marital status, and level of education completed (see Appendix F).

**Health Status.** A shortened version of the RAND 36-Item Short Form Health Survey (SF-36) was utilized to measure health-related quality of life in the present study (see Appendix G; Ware & Sherbourne, 1992). The RAND SF-36 is a publically available self-report instrument that includes 36 items assessing participants' health status using both Likert- type items ("My health is excellent" – 1 = Definitely True, 5 = Definitely False) and binary scale items ("During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?: a. Cut down on the amount of time you spent on work or other activities"- 1 = Yes, 2 = No). In addition to the RAND SF-36, health status was measured following the convention of asking participants to rate their health compared to peers on single Likert -scale item (Idler & Benyamini, 1997; Mäntyselkä, Turunen, Ahonen, & Kumpusalo 2003; Mavaddat, Parker, Sanderson, Mant, & Kinmonth, 2014).

**Demand.** Participants' experience of demand throughout the experiment was assessed through a 6-item self-report questionnaire (see Appendix H). Participants were asked to answer a mixture of six true-false and Likert-type items designed to indicate how compelled they felt to respond in a manner consistent with potential experimenter demand (e.g., To what extent did you feel pressured to indicate less confidence in your answers?).

**Understanding.** Participants were prompted to answer five true-false questions assessing their understanding of concepts associated with cognitive bias and its implications after completing the experiment (e.g., Our brains shape our views and perceptions and this process can be hidden from our conscious awareness; see Appendix I).

## **Procedure**

All participants initially read a brief description of the study and indicated their informed consent. Upon opting to participate in the study, participants were directed to complete either the intervention task or the control task.

Subsequently, participants completed measures designed to assess confidence bias in both the domain of health-related and general knowledge. Participants then read and responded to a series of four vignettes about health-related issues and interventions. Participants rated their willingness to comply with each intervention, their familiarity with each intervention, their likelihood of independently considering each intervention, and the realism of each intervention.

Participants then completed a demographic questionnaire, a shortened version of the RAND SF-36, and rated their health compared to peers on single Likert scale item. Finally, participants answered several questions assessing their understanding of the experiment and their perception of demand from experimenters. Before exiting the study participants were presented with debriefing material that included contact information for the researcher and affiliated institutional review board. The total time for the completion of the aforementioned protocol averaged approximately 37 minutes.

#### 4. Pilot Study Results.

Two MANOVAs were run to compare the experimental and control groups on their willingness to comply with suggested health interventions and on measures confidence bias. Statistical assumptions, including normality, independence of observations, homogeneity of variance, and homogeneity of covariance were met for both MANOVA analyses.

The first MANOVA did not indicate a statistically significant effect for experimental condition on self-reported willingness to comply related to any of the four individually proposed health interventions,  $F(4, 46) = .35, p = .84$ . Results related to willingness to comply with a back pain intervention were in the expected direction, with the experimental group indicating greater willingness to comply ( $M = 53.12, SD = 26.62$ ) than the control group ( $M = 47.15, SD = 27.91$ ). However, results of other analyses were not in the expected direction, and indicated greater willingness to comply with an anxiety intervention in the control group ( $M = 56.00, SD = 36.11$ ) than the experimental group ( $M = 55.44, SD = 32.54$ ). Estimated effect sizes for all willingness to comply measures ranged from 0.22, 95% CI [-0.034, 0.77] for willingness to implement a back pain intervention to -0.02, 95% CI [-0.057, 0.53] for willingness to implement an anxiety intervention.

A second MANOVA did not indicate a statistically significant effect for experimental condition on cognitive bias in the form of health-related confidence, general confidence, health-related confidence bias, and general confidence bias,  $F(4, 46) = .79, p = .54$ . Results related to confidence were in the expected direction, with the experimental group indicating lower health-related and general confidence bias ( $M = 24.94, SD = 16.48; M = 7.79, SD = 18.69$  respectively)

than the control group ( $M = 25.08$ ,  $SD = 13.83$ ;  $M = 13.30$ ,  $SD = 19.36$  respectively).  
Estimated effect sizes for all confidence measures ranged from  $-.29$ , 95% CI  $[-.84, .27]$ , for  
general confidence bias to  $-.01$ , 95% CI  $[-.56, .54]$ , for health-related confidence bias.

## **5. Primary Study**

### **Selective Exposure, Confidence Bias, Willingness to Comply**

Primary data collection and analyses were completed with the goals of (1) gathering empirical information related to bias in the domain of health and (2) assessing the utility of a brief intervention to reduce overconfidence and theoretically related variables including selective exposure and willingness to comply. The present study extended previous research indicating that a brief, naïve realism intervention could successfully reduce confidence in interpersonal judgments (Hart et al., 2015) into the understudied, yet seemingly important, domain of health. Based on the results of previous work and pilot data collection, the experimental manipulation was modified in order to be more compelling and ecologically valid. In addition, dependent variables assessing bias were modified and/or added to improve function, increase ecological validity, and to more closely mirror convention.

It was hypothesized that the experimental group would demonstrate (1) decreased selective exposure, (2) lower general and health-related confidence and confidence bias, and (3) increased willingness to comply with suggested interventions relative to control group. Additionally, it was hypothesized that confidence bias would mediate the relationship between experimental condition and selective exposure.

## 6. Primary Study Methods

### Participants

The present sample size was largely dictated by a need to achieve sufficient statistical power to complete mediational analyses. Existing literature provides guidelines regarding the necessary sample sizes for detecting mediation effects. In particular, Fritz and MacKinnon (2007) identify the sample sizes required to obtain .8 power to detect an effect given various strengths of correlations between the independent variable and the mediator ( $\alpha$ ) and the mediator and dependent variable ( $\beta$ ). Fritz and MacKinnon's work suggests that a sample size between 71 and 90 is sufficient to detect mediation using most mediation models when  $\alpha$  and  $\beta$  are medium (.39). Assuming more modest correlations between variables ( $\alpha$  and  $\beta = .26$ ), sample sizes between 142 and 196 are adequate for detecting mediation in commonly used models (Fritz & MacKinnon, 2007).

In pilot data collection effect sizes were small, suggesting the necessity of a relatively large sample (i.e., approximately 200 participants). This estimate was increased for primary data collection because researchers desired to (1) account for unusable participant data (2) collect a demographically diverse sample, and (3) maintain statistical power to run comparisons between relatively small demographic subsets within the collected sample. The referenced statistical literature in combination with estimated effect sizes in pilot data collection and researchers' goals for primary data collection ultimately led researchers to the decision to recruit a sample of 400 participants.

Four-hundred individuals were targeted for recruitment using Amazon's Mechanical Turk. All participants in the study received monetary compensation (i.e., fifty five cents) for their participation. The criteria used to determine eligibility for participation in the present study included (1) currently residing in the United States, (2) being 18 years of age or older, and (3) consenting to complete all portions of the online experiment.

Participants' data were screened for outliers, checked for normality, and assessed for missing data. Results of this preliminary data analysis indicated the absence of significant outliers and the presence of normally distributed variables as judged by the shape of observed distributions (variables were assessed by viewing histograms with normal curves as per Field, 2007). Participants who did not offer informed consent or who exited the study prior to completing the experimental manipulation or control task ( $n=145$ ) were not included in analyses. Additionally, data from participants who indicated knowledge of the true purpose of the experiment in the funneled debriefing ( $n= 6$ ) were excluded from analyses.

A total of 311 participants with usable data were recruited during primary data collection. Participants' average age was 37.11 years ( $SD = 12.87$ ) and average education was 15.02 years ( $SD= 2.42$ ). The study sample was 60.50 % female. Participants were 58.8% White non-Hispanic, 20.6 % White Hispanic, 6.8% Black non-Hispanic, 4.8% Asian, 1.9% Black Hispanic, 1.0% Native American, 0.3% Pacific Islander, and 3.2% Other.

## **Measures**

**Bias-Reducing Intervention.** The experimental task was modified to more directly associate common cognitive biases with the potential implications of these biases for health-related decision-making (see Appendix J). In the pilot study, demand reported by participants in the experimental condition ( $M = 2.06$ ,  $SD = 1.23$ ) was approximately equivalent to, and not

statistically different from, demand reported by participants in the control condition ( $M = 2.05$ ,  $SD = 0.98$ ),  $t(49) = 0.01$ ,  $p > .05$ . The failure of participants in the experimental condition to report significant demand associated with the bias-reducing intervention justified experimenters' attempts to further strengthen the present manipulation. Demand was also assessed during primary data collection and did not appear to be problematic. Demand will be further addressed in the discussion. For primary data collection, the bias-reducing intervention was altered to more convincingly convey the ubiquity of bias and its consequences (e.g., more references to research and the automatic nature of bias) and to directly highlight the potential implications of cognitive biases as they relate to features of daily life, such as health.

**Control Task.** The same reading comprehension task utilized as a control task in pilot data collection was used in primary data collection. One question was deleted from the original control task for primary data collection in order to better match the experimental and control task on length of time to complete (see Appendix K).

**Selective Exposure.** Participants in the primary data collection completed an exercise designed to assess selective exposure (see Appendix L). Selective exposure is a well-studied form of bias and was a primary variable of interest during primary data collection. The presently utilized selective exposure task followed the format of previous work on selective exposure (e.g., Feather, 1962, 1963; Fischer et al., 2005; Fischer, Jonas, Frey, & Schulz-Hardt, 2005; Fischer, Schulz-Hardt, & Frey, 2008; Frey, 1986). Participants read a brief paragraph indicating that common health-related issues (i.e., headaches) are often treated with different interventions. Participants then indicated their preferences for treating headaches (i.e., over-the-counter analgesics or relaxation). After indicating their preference, participants were presented with titles of ten articles, five of which were preference consistent and five of which were preference

inconsistent, about headache treatments. The article titles clearly indicated whether the article was consistent or inconsistent with participants preferred headache treatment. Participants were told that they could receive the full articles with easy to read summaries following the experiment and were asked to indicate which full articles they wished to be sent. The selection of preference consistent and inconsistent articles was used to create a difference score that quantified selective exposure (i.e., selective exposure score equals number of preference consistent articles minus the number of preference inconsistent articles). Cronbach's alpha ( $\alpha$ ) for the selective exposure measure in the present sample was .67.

**Confidence Bias.** The pilot measures of health-related and general confidence bias were edited to include only thirteen questions each and were matched for difficulty (see Appendix M and N respectively). Cronbach's alpha for the health-related confidence bias measure and general confidence bias measure in the present sample were  $\alpha = .77$  and  $.83$ , respectively.

**Willingness to Comply.** During primary data collection four vignettes assessing willingness to comply were utilized. These vignettes followed the practical format of those utilized in the pilot data. During primary data collection new vignettes was created to mirror the conceptual paradigm (i.e., highly realistic but relatively unfamiliar interventions) of the previously best functioning vignette (see Appendix O). Cronbach's alpha for the willingness to comply measure in the present sample was  $\alpha = .67$ .

Measures of demographics (see Appendix F), health status (see Appendix G), demand (see Appendix H), and understanding (see Appendix I) were also included in primary data collection, though these measures were not modified following pilot data collection.

## **Procedure**

During the primary data collection participants were administered a protocol similar to the protocol used in the pilot study (e.g., the protocol includes obtaining informed consent then completing a bias-reducing or reading comprehension task, confidence bias measures, responding to vignettes with follow-up questions, demographic survey, measures of health status, questions related to understanding and demand, and reading a debriefing sheet). Participants in the primary data collection also completed a selective exposure task immediately after the experiential or control task. The practical format of the study and types of independent and dependent variables utilized remained largely consistent between pilot and primary data collection. Time required to complete the protocol averaged approximately 35 minutes in the present study.

## 7. Primary Study Results

A set of statistical analyses similar to those used during pilot data analysis were run. A *t*-test was run to compare the experimental and control group on tendency to engage in selective exposure. It was expected that the experimental group would demonstrate relatively less biased information gathering and thus less selective exposure. MANOVAs were run to assess differences between the experimental and control group on measures of confidence and confidence bias and willingness to comply with suggested interventions. It was expected that the experimental group would show reduced confidence bias and increased willingness to comply relative to the control group. Regression analyses were also completed to examine experimental condition as a predictor of willingness to comply and selective exposure. Predicting willingness to comply from experimental condition using regression allowed researchers to control for continuous covariates associated with the willingness to comply dependent variable (e.g., familiarity with and independent consideration of suggested health interventions). The regression analysis predicting selective exposure from experimental condition was completed as a preliminary step in a potential mediational analysis. Preacher and Hayes' (2008) mediational analysis was planned to test for mediation effects, though this analysis was contingent upon significant results of the aforementioned regression. It was expected that the experimental group would show relatively reduced selective exposure compared to the control group and that confidence bias would mediate this relationship.

A *t*-test comparing the experimental group and control group on selective exposure was not significant,  $t(309) = .39$ ,  $p = .305$ , suggesting that participants in the experimental ( $M = -.04$ ,

$SD = 2.10$ ) and control group ( $M = -.14$ ,  $SD = 2.42$ ) did not display significantly different tendencies to seek congenial information and avoid uncongenial information. The estimated effect size of experimental condition on selective exposure was 0.04, 95% CI [-0.18, 0.27]. Negative effects are in the expected direction and indicated reduced selective exposure.

A MANOVA comparing the experimental and control groups on health-related confidence, general confidence, health-related confidence bias, and general confidence bias was not significant,  $F(4, 306) = .47$ ,  $p = .75$ , suggesting the experimental and control groups did not display differences in confidence or confidence bias when responding to factual questions related to health and general knowledge. Estimates of the effect size of experimental condition on confidence variables ranged from -0.08, 95% CI [-0.30, 0.14], for health confidence bias to -0.14, 95% CI [-0.36, 0.08], for general confidence bias. Negative effects are in the expected direction and indicate reduced confidence bias. Statistical assumptions of MANOVA, including a conceptual relationship between dependent variables, independence of observations, random sampling, and normal distribution were met.

A MANOVA comparing the experimental and control groups on four willingness to comply measures was not significant,  $F(4, 298) = 1.88$ ,  $p = .11$ , suggesting the experimental and control groups did not display differences in willingness to comply with suggested interventions for back pain, joint pain, shortness of breath, and fatigue presented in hypothetical health scenarios. Estimates of the effect size of experimental condition on willingness to comply variables ranged from 0.09, 95% CI [-0.14, 0.31], for an intervention for fatigue to -0.22, 95% CI [-0.11, 0.01], for an intervention for back pain. Positive effects are in the expected direction and indicate greater willingness to comply. Statistical assumptions of MANOVA, including a

conceptual relationship between dependent variables, independence of observations, random sampling, and normal distribution were met.

A hierarchical multiple regression analysis was conducted predicting willingness to comply with suggested health interventions by experimental condition while controlling for familiarity with presented health interventions and likelihood of considering presented health interventions independent of a health professional's suggestion. Assumptions of regression including absence of multicollinearity, homoscedasticity, independent errors, normally distributed errors, independence of outcome variables, and linearity were met. Results from the first block of variables entered indicate that independent consideration and familiarity account for a significant amount of variability,  $F(2, 300) = 77.25$ ,  $p = .00$ ,  $R^2 = .34$ , suggesting that greater likelihood of independently considering various health interventions,  $\beta = .47$ , 95% CI [.37, .64], and greater familiarity,  $\beta = .16$ , 95% CI [.04, .30], with said interventions are related to greater willingness to comply with those health interventions when suggested by a health professional. A second block evaluated experimental condition as a predictor of willingness to comply with health interventions suggested by a health professional over and above independent consideration of and familiarity with said health interventions. Experimental condition did not account for a significant amount of variance after controlling for independent consideration of and familiarity with health interventions,  $F(1, 299) = 51.68$ ,  $p = .40$ ,  $R^2 \Delta = .00$ ,  $\beta = .04$ , 95% CI [-1.30, 3.21]. These results suggest that experimental condition does not predict willingness to comply with a suggested intervention among individuals with similar likelihood of independently considering and familiarity with said health interventions.

A regression evaluating experimental condition as a predictor of selective exposure was not significant,  $F(1, 309) = .16$ ,  $p = .69$ ,  $R^2 = .00$ ,  $\beta = -.02$ , 95% CI [-.30, .20] suggesting that

experimental and control groups were not differentially likely to display selective exposure. Assumptions of regression including absence of multicollinearity, homoscedasticity, independent errors, normally distributed errors, independence of outcome variables, and linearity were met. Because of the null results of the regression predicting selective exposure from experimental condition, follow-up meditational analyses were not completed. Means and standard deviations for dependent measures as well as Correlations between dependent variables can be viewed in Tables 1 and 2 respectively.

## 8. Discussion

Original hypotheses of the study, including relatively reduced confidence bias, reduced selective exposure, and increased willingness to comply with suggested health interventions in the experimental group, were not supported by results. In general, these findings suggest that the completion of an experiential learning task related to cognitive bias was not associated with significant changes in participants' tendencies to demonstrate overconfidence, disproportionately seek congenial information, or report willingness to comply with hypothetically suggested health interventions. Such results are unexpected in light of previous research indicating that completion of a similar experimental task has been associated with reductions in participant confidence (Hart et al., 2015; Tullett & Hart, 2014) and extant literature indicating overconfidence as a mechanism underlying selective exposure (Brannon et al., 2007; Fischer et al., 2008, 2010, 2011; Hart & Albarracin, 2012). Several aspects of the present study - including the function of the experimental manipulation, modifications made to experimental intervention and dependent measures utilized in the present study, the use of Mechanical Turk for recruitment and data collection, and the health specific focus of the present research – and their relation to the null findings are discussed below.

In the present study the experimental manipulation failed to produce significant reductions in several measured forms of bias. A manipulation check, however, reveals that the experimental group ( $M = 4.16$ ,  $SD = 1.03$ ) did possess a greater understanding of bias in human perception and its potential implications than the control group ( $M = 3.77$ ,  $SD = 1.14$ ),  $t(301) = 3.09$ ,  $p < .01$ . Despite gaining an increased understanding of cognitive bias and its consequences,

participants completing the experiential learning task did not report greater demand to indicate reduced confidence than participants in the control group,  $t(301) = 1.33, p > .05$ . These results suggest that the experimental manipulation worked as planned and effectively taught participants about the nature of bias and the corresponding need to compensate for said bias.

The failure of this understanding of bias to translate to reductions in measured bias suggests two apparent interpretations. First, an experiential learning task may be an inherently ineffective means of reducing bias. The previous efficacy of a similar intervention contradicts this interpretation. Second, an experiential intervention may be an effective tool for combating bias, however the present intervention may not have been strong enough to produce reliable and discernible changes in dependent variables. If this is the case, a similar but more compelling manipulation may be effective at producing the originally hypothesized reductions in demonstrated bias. In the present study, correlations between the measure of understanding and dependent measures are small (confidence bias:  $r(303) = -.26, p < .001$ ; selective exposure:  $r(303) = -.09, p > .05$  willingness to comply:  $r(303) = .08, p > .05$ ). It is unsurprising that confidence bias, as the most straightforward metric of bias and proposed mechanism underlying the other dependent variables, is most highly correlated with understanding. The correlation between understanding of the experimental intervention and confidence bias would seem to indicate that learning about bias may be a useful means of reducing bias and its mechanisms. Indeed, the estimated effect size of the experimental manipulation on participant understanding in the present study was 0.36, 95% CI [.13, 0.58] compared to an estimated effect size of 0.81, 95% CI [.39, 1.22] for a similar intervention producing significant results in previous research (Hart et al., 2015). These differences in effect size and outcomes suggest that a more compelling

manipulation, producing greater understanding of bias and its consequences, could potentially create significant differences in presently utilized dependent measures.

Strengthening the present manipulation to produce increased effects sizes may, however, come with undesirable consequences. The present intervention was already modified from its original form in order to be more compelling and, though demand was not problematic in the present study, further strengthening of the manipulation may produce significant demand effects. The estimated effect size in the present study was relatively small, .36, and the previously successful intervention demonstrated a large estimated effect size, .81. The amount of strengthening of the present iteration of the experimental manipulation required to produce such a drastic increase in effect size would almost certainly be impractical and result in significant demand. In light of problems associated with further strengthening of the present manipulation and previous work indicating a similar manipulation can produce significant results, distinctions between the original and currently utilized manipulation warrant consideration.

The present study served as an extension of an existing investigation of a brief intervention designed to combat cognitive bias (Hart et al., 2015). In the current study, several modifications were made to the experimental manipulation utilized by Hart and colleagues with the intention of strengthening the manipulation. In the original version of the intervention, participants were exposed to a series of visual illusions which were accompanied by explanations of and implications related to bias and fallibility in human perception. The intervention in the present study was modified such that it included visual illusions and explanations similar to the original intervention but also challenged participants' "trust in common knowledge" (i.e., participants completed tasks requiring the identification of an American penny and drawing of a bicycle) and participants' potential tendencies to draw untenable conclusions based on partial

evidence (i.e., participants completed a task highlighting problems related to the type of incomplete, though seemingly strong, evidence that is often used to justify claims in daily life; See Appendix J). These modifications resulted in an intervention with fewer visual illusions and two novel bias-reducing techniques. It seems plausible that visual illusions and information describing unavoidable bias at the level of the brain proved most compelling to participants. Visual illusions may be difficult to deny and require little effort to understand and therefore may most effectively convey the message that our brains bias our perception and obscure objectivity. Challenges to participants' confidence in apparent common knowledge and specious reasoning strategies may have been too complex and indirect to successfully convince participants that they unknowingly demonstrate cognitive biases that they cannot detect or control but must account for. Furthermore, because inaccurate presumptions of knowledge and use of faulty logic do not represent base, physiological processes, participants may have believed that they personally did not make such errors in daily life or that they could regularly identify and correct such errors when made. The singular focus of the original intervention allowed for reiteration of a single, simple message using concrete examples and justification. Despite attempts to strengthen the original manipulation, the present intervention's diverse approach to having participants experience and learn about bias may ultimately have proved too convoluted and abstract to produce the intended reductions in bias.

In addition to the aforementioned differences between the present and original experimental manipulations, distinctions between dependent measures in the present study and previous work exist. In previous work the primary dependent variable was choice confidence (Hart et al., 2015). This is a measure of self-reported confidence in a judgment about an ambiguous situation (e.g., participants read a scenario about an individual acting in a manner that

is difficult to interpret, label the individual involved as hostile or assertive, then rate their confidence in the label they applied to the individual). The present study also used confidence as a dependent variable but measured confidence using a confidence paradigm popularized by Lichtenstein and Fischhoff (1977). The inherent ambiguity of the choice confidence dependent variable may make that measure more sensitive to detecting differences between the experimental and control groups. That is, participants may have recognized the subjective nature of the decisions they were making while completing the choice confidence dependent variable and accordingly lowered their confidence ratings, particularly after completing the intervention designed to challenge feelings of objectivity. By having participants offer personal judgments about intentionally ambiguous stimuli, a choice confidence task may be highly sensitive to reductions in participant confidence. Conversely, the objective nature of the questions participants responded to in the present confidence dependent variable may have produced confidence bias in participants that was not as easily tempered by the intervention addressing the ubiquity and liabilities of cognitive bias. Awareness of objective correctness and incorrectness within the context of the current confidence task may have both elicited increased participant confidence and created resistance to recalibration. Furthermore, the measures of selective exposure and willingness to comply are theorized behavioral manifestations of overconfidence and, by being less direct, were likely less sensitive to any realized differences in bias between participants in the experimental and control groups.

While measures utilized in the present study may have resulted in null results, the use of Amazon's Mechanical Turk for recruiting subjects and collecting data should also be considered. Utilization of Mechanical Turk is a clear demarcation between the present study and work upon which this study was based. Mechanical Turk not only represents a different format for

recruitment and data collection, it also targets participants that may be demographically distinct from traditional university samples. One significant difference between the present and more traditional samples is age. In the present study, mean age of participants was 37.11 years ( $SD = 12.87$  years). This is substantially older than typical university samples and is distinctly different from previous samples responding to a similar bias-reducing intervention ( $M = 18.93$  years,  $SD = 1.86$  years; Hart et al., 2015). In the present study age shows a small negative correlation with dependent measures (confidence bias:  $r(301) = -.17$ ,  $p < .01$ ; selective exposure:  $r(301) = -.04$ ,  $p > .05$ ; willingness to comply:  $r(301) = -.15$ ,  $p < .05$ ). Such correlations indicate that older age may be associated with relative reductions in bias. However, even assuming that age represents a real and relevant confound in the present study, these correlations remain small and, in isolation, fail to offer compelling rationale for null findings. In the present sample, average years of education completed is also relatively high ( $M = 15.02$ ,  $SD = 2.42$ ) and is significantly correlated with two main dependent measures (confidence bias:  $r(297) = -.23$ ,  $p < .001$ ; selective exposure:  $r(297) = -.16$ ,  $p < .01$ ; willingness to comply:  $r(297) = .04$ ,  $p > .05$ ). Relatively high educational attainment is, however, consistent with university samples and does not seem to represent a relative difference compared to individuals previously responsive to a similar bias-reducing intervention (In previous work by Hart et al., 2015 exact educational attainment data was not collected. However the educational attainment of the 126 participants recruited from a university subject pool, 29 participants recruited from a university affiliated law school, and 38 participants recruited from university public spaces is likely similar to the educational attainment of participants in the present study). In both the present and previous sample, participants were primarily White non-Hispanic, 58.8% and 84.5% respectively, and were largely female participants, 60.50% and 78.8% respectively. Furthermore, differences on dependent measure

were not found between members of different racial/ethnic groups,  $F(21, 398) = 1.26, p > .05$ , or between different genders,  $F(2, 300) = 2.03, p > .05$ . In summation, age, education, gender, and race/ethnicity of present participants are likely not able to account for present null results.

A final consideration of Mechanical Turk is its unique use of the online medium, absent of experimenters or a laboratory setting. Though published research indicates use of Mechanical Turk is associated with valid data that mirrors data collected through traditional means, literature suggesting the utility of Mechanical Turk typically focuses on results of studies with short completion times (i.e., 10 minutes or fewer; e.g., Berinsky, Huber, & Lenz, 2012; Berinsky, Lenz, & Huber, 2011; Paolacci, Chandler, & Ipeirotis, 2010). It is therefore possible that longer experiments requiring sustained attention and effort from participants without the oversight of experimenters or the structure of the laboratory setting, such as the present study ( $M = 33.39$  minutes,  $SD = 11.83$  minutes), are inappropriate for the online format represented by Amazon's Mechanical Turk.

The present study sought to examine known phenomena - confidence bias and presumed behavioral consequences such as selective exposure and willingness to comply - as they manifest in an unknown domain, health. The materials used in the study thus generally reflect the health focus of the study. It is therefore possible that the context of health and use of health-related materials contributed to present null findings. Extant literature offers insight into several variables theorized to prompt and moderate bias, some of which may be especially relevant in the context of health. Accuracy motivation is the desire to discern truth through objectivity and is understood to minimize bias (Chaiken, Wood, & Eagly, 1996; Hart et al., 2009). Health may be a domain in which accuracy motivation is particularly strong and accordingly a domain in which individuals are naturally less prone to demonstrate bias. Indeed, in the present study participants

demonstrate decreased health-related confidence bias ( $M = 0.52$ ,  $SD = 21.21$ ) relative to general confidence bias ( $M = 8.49$ ,  $SD = 19.83$ ). This difference may be related to participants' lower performance on the test of general knowledge ( $M = 48.63$ ,  $SD = 17.14$ ) relative to the test of health-related knowledge ( $M = 57.21$ ,  $SD = 18.05$ ) as lower performance is known to be associated with increased confidence bias (Kruger & Dunning, 1999). However, such a difference could also be indicative of increased accuracy motivation in the context of health which naturally mitigates typical displays of bias.

There are several reasons to believe that accuracy motivation may be particularly powerful in the context of health. Research indicates that when the consequences of biased, poor decision-making are highly salient, individuals show reductions in selective exposure (Fischer et al., 2008). It may be that health, more than other domains, prompts individuals to consider practical consequences of biased thinking and action. The disparaged “sick care” system of medicine in the United States may surround health and the process of health care with a negative valence and make consequences of poor health obvious (Fani Marvasti & Stafford, 2012). That is, because health care in the United States is more often associated with treating disease than promoting wellness, individuals may be consistently reminded of the consequences of poor health and therefore demonstrate inordinate motivation to avoid bias in the domain of health. Additionally, good health may be seen as a means of accomplishing global and meaningful goals. Literature suggests that individuals encouraged to reach higher-order goals (e.g., gather information that will help you promote well-being for yourself and your family) show less bias than individuals prompted to reach concrete, acute goals (e.g., gather the information that looks best; Fischer et al., 2005, 2008). The relevance of health to achieving broad life goals may discourage biased health-related thought and action. Additionally, research indicates health may

be a domain in which uncongenial information is *not* avoided as it may serve to motivate positive health change. Specifically, literature suggests that as individuals perceive increasing discrepancy between their own behavior and health standards, they are decreasingly likely to selectively seek congenial information (Knobloch-Westerwick et al., 2013). Overall, some available evidence supports the possibility that individuals' health-related attitudes and behaviors may naturally be less prone to bias than other types of thoughts and actions.

### **Future Directions**

The present study raises several questions that can readily be addressed in future research. Exploring the previously discussed factors that may have contributed to null findings is a straightforward, seemingly worthwhile pursuit. Replicating the present study while incorporating the unmodified, previously proven independent and dependent variables would greatly aid in the interpretation of present results. Similarly, running the present study in the context of a traditional university subject pool and laboratory would offer valuable insight into the utility of and potential problems associated with online recruitment and data collection using Amazon's Mechanical Turk. As research inevitably incorporates new technologies and formats, clarifying the liabilities of novel research tools and strategies is of the utmost importance. Simple replication of the present studying using traditional participant recruitment and data collection strategies, presents an ideal opportunity to elucidate existing areas of ambiguity and provide guidance for researchers moving forward.

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Table 1

*Means for Experimental and Control Group on Dependent Measures*

Measure	Experimental		Control	
	M	SD	M	SD
HC	57.10	12.15	58.37	15.11
GC	56.05	13.85	58.16	17.11
HCB	-0.35	19.13	1.39	23.11
GCB	7.10	20.41	9.85	19.21
SE	-0.05	2.11	-0.14	2.43
WTC-B	51.29	31.80	58.41	33.12
WTC-J	45.18	34.85	51.10	33.56
WTC-SB	46.83	34.83	47.40	36.21
WTC-F	49.90	36.10	46.81	33.98
UNDRSTD	4.16	1.03	3.77	1.15

*Note.* HC = Health Confidence. GC = General Confidence. CON = Overall Confidence. HCB = Health-Related Confidence Bias. GCB = General Confidence Bias. CONBI = Overall Confidence Bias. SE = Selective Exposure. WTC-B = Willingness to Comply with a Back Pain Intervention. WTC-J = Willingness to Comply with a Joint Pain Intervention. WTC-SB = Willingness to Comply with a Shortness of Breath Intervention. WTC-F = Willingness to Comply with a Fatigue Intervention. WTC-Avg = Averaged Willingness to Comply. UNDRSTD = Participant Understanding Score.

Table 2

*Pearson's Correlations between Dependent Measures*

Variables	HC	GC	CON	HCB	GCB	CONBI	SE	WTC-B	WTC-J	WTC-SB	WTC-F	WTC-Avg	UNDRSTD
HC	1												
GC	.65**	1											
Con	.90**	.92**	1										
HCB	.54**	.33**	.47**	1									
GCB	.25**	.55**	.45**	.36**	1								
CONBI	.48**	.53**	.56**	.84**	.81**	1							
SE	-.04	-.05	-.05	.07	.08	.09	1						
WTC-B	.04	.10	.08	-.06	.05	-.01	-.01	1					
WTC-J	.12*	.22**	.19**	.01	.19**	.12*	-.14*	.39**	1				
WTC-SB	.08	.12*	.11	.00	.05	.03	-.06	.29**	.33**	1			
WTC-F	.20**	.20**	.22**	.11	.10	.13*	-.03	.33**	.35**	.34**	1		
WTC-Avg	.16**	.23**	.21**	.02	.14*	.01	-.11	.70**	.73**	.70**	.72**	1	
UNDRSTD	.08	.07	.08	-.19**	-.23**	-.26**	-.09	.11	.04	.04	.05	.08	1

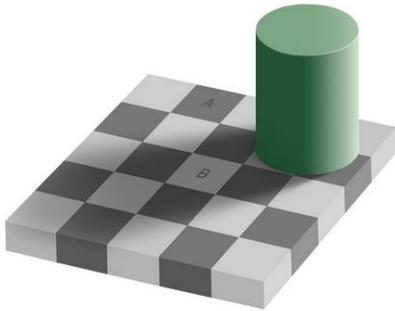
Note. \*\* =  $p < .01$ ; \* =  $p < .05$

## Appendices

### Appendix A: Pilot Study Bias-Reducing Intervention

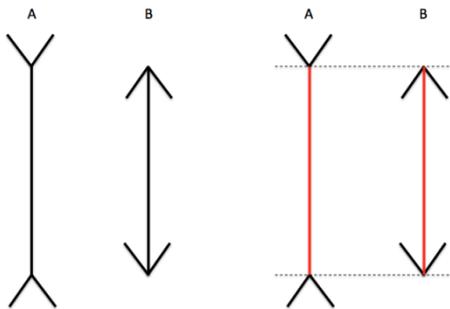
#### I. Sample Visual Illusions and Excerpts of Accompanying Text

##### A. Adelson Checker Shadow Illusion



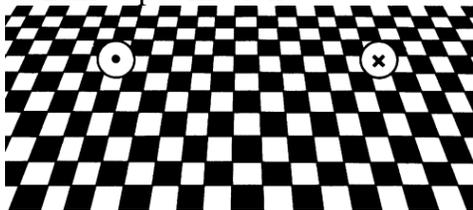
“This demonstration is not an intelligence test; rather, it exposes certain aspects of how the brain works... Although you likely have the strong intuition that square "A" is darker than square "B," the two squares are actually the exact same shade.”

##### B. Müller-Lyer Lines



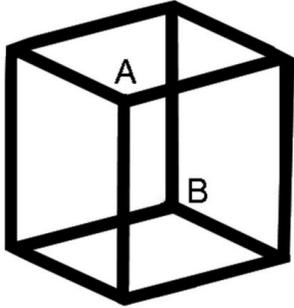
“Strong intuitions about relationships do not only exist in illusions; such intuition is present in many areas of daily life. This type of intuition often leads people to believe or feel that they accurately assess information they are presented even as they are making errors in their judgments.”

##### C. Blind Spot Illusion



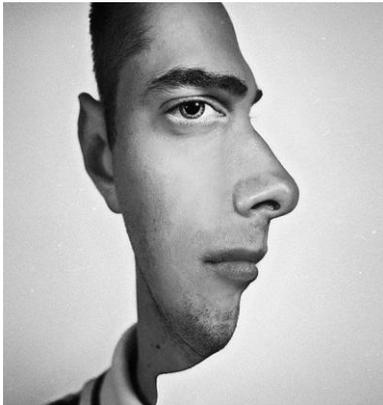
“People regularly fill in missing information with ‘best guesses’ or assumptions in daily life... When people do not have all the facts or information in a given situation they are inclined to fill in the missing information themselves, often with bias.”

#### D. Necker Cube



“Many real life situations mirror this illusion. It is often the case that dilemmas people face in life have multiple solutions or right answers. It is often important to recognize the potential value of several perspectives in order to reach the best conclusion.”

#### E. Two Face Illusion



“Again, this illusion shows that there isn't one correct way of seeing the world. Sometimes there are multiple alternatives that are equally plausible. What's more, it is often the case that the alternative perspectives aren't immediately obvious to us, and this can lead us to think that our perspective is the only "right" answer.”

## II. Test of Common Knowledge and Excerpt of Accompanying Text

#### A. Draw a Penny Test



“You likely had the strong feeling that you "know" what an American penny looks like. When we put this knowledge to the test, however, we realize that sometimes our knowledge isn't as clear as we originally thought. This illustrates another aspect of how the human brain works: it tricks you into thinking you know things when you don't.”

## III. Sample Misperceiving Relationships Task and Excerpts of Accompanying Text

#### A. Absent-Minded Professors Example

Statement 1: Professors are more absent-minded than most people.

Evidence: A researcher polled a representative sample of 735 professors and found that 67% were classified as absent-minded based on their performance on a well-validated personality test.

How would you describe this evidence in terms of the support it provides for Statement 1? (Note: Please try to evaluate the evidence independent of your own personal view of the topic.)

Very Weak      Weak      Somewhat Weak      Somewhat Strong      Strong      Very Strong

Reconsider Statement 1. You read the following:

"Statement 1: Professors are more absent-minded than most people.

Evidence: A researcher polled a representative sample of 735 professors and found that 67% were classified as absent-minded based on their performance on a well-validated personality test."

Now, consider the following table:

	Absent-Minded	
	No	Yes
Professors	33%	67%
Non-Professors	?	?

"...In order to evaluate whether professors are more absent-minded THAN MOST PEOPLE, you need to know this information. If you found this evidence convincing to some degree, this is probably because your brain filled in the information in a way that was consistent with Statement 1. In other words, you may have unconsciously assumed that 67% would be high relative to the rest of the population. This amounts to guessing that for non-professors, the numbers would be much higher than 33% for "No" and much lower than 67% for 'Yes'..."

## Appendix B: Pilot Study Reading Comprehension Control Task

**Directions: Please read the passage carefully and do your best to correctly answer the questions below.**

Concussions are brain injuries that occur when a person receives a blow to the head, face, or neck. Although most people who suffer a concussion experience initial bouts of dizziness, nausea, and drowsiness, these symptoms often disappear after a few days. The long-term effects of concussions, however, are less understood and far more severe. Recent studies suggest that people who suffer multiple concussions are at a significant risk for developing chronic traumatic encephalopathy (CTE), a degenerative brain disorder that causes a variety of dangerous mental and emotional problems to arise weeks, months, or even years after the initial injury. These psychological problems can include depression, anxiety, memory loss, inability to concentrate, and aggression. In extreme cases, people suffering from CTE have even committed suicide or homicide. The majority of people who develop these issues are athletes who participate in popular high-impact sports, especially football. Although both new sports regulations and improvements in helmet technology can help protect players, the sports media and fans alike bear some of the responsibility for changing the modern zeitgeist of fandom in order to reduce the incidence of these devastating injuries.

Improvements in diagnostic technology have provided substantial evidence to link severe—and often fatal—psychological disorders to the head injuries players receive while on the field. Recent autopsies performed on the brains of football players who have committed suicide have shown advanced cases of CTE in every single victim.

In response to the growing understanding of this danger, the National Football League (NFL) has revised its safety regulations. Players who have suffered a head injury on the field must undergo a "concussion sideline assessment"—a series of mental and physical fitness tests—before being allowed back in the game. In an effort to diminish the amount of head and neck injuries on the field, NFL officials have begun enforcing stricter penalty calls for helmet-to-helmet contact, leading with the head, and hitting a defenseless player. Furthermore, as of 2010,

if a player's helmet is accidentally wrenched from his head during play, the ball is immediately whistled dead. There is hope that these new regulations, coupled with advances in helmet design, will reduce the number of concussions players endure, and thus curb the number of CTE cases.

Efforts by the NFL and other professional sports leagues are certainly laudable; indeed, we should commend every attempt to protect the mental and physical health of players. However, new regulations at the professional level cannot protect amateur players, especially young people. Fatal cases of CTE have been reported in victims as young as 21. With appropriate equipment and form, tackling need not be dangerous. Proper tackling form—using the arms and shoulders to aim for a player's midsection rather than leading with the top of the head—should be taught at an early age. Youth, high school, and college leagues should also adopt safety rules even more stringent than the NFL's. Furthermore, at an early age, athletes should be educated about the serious dangers of head injuries.

Perhaps the most important factor in reducing the number of traumatic brain injuries, however, lies not with the players, the coaches, or the administrators, but with the media and fans. Sports media producers have become accustomed to showcasing the most aggressive tackles and the most intense plays. NFL broadcasts often replay especially violent collisions, while the commentators marvel at the physical prowess of the players involved. Some sports programs even feature weekly countdowns of the hardest hits. Modern media's sensationalization effectively makes players commodities of the entertainment industry. Furthermore when the media exalts such hazardous behavior, professionals are rewarded for injuring each other on the field, and amateurs become more likely to try to imitate their favorite NFL athletes. Announcers, commentators, television producers, and sportswriters should engage in a collective effort to cease glorifying brutal plays. In turn, fans should stop expecting their favorite players to put their lives on the line for the purposes of entertainment. Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game.

1. The author apparently believes that:

- A. NFL officials have not thoroughly implemented stricter safety regulations
- B. doctors need to do more research about the potential long-term effects of CTE
- C. amateur athletes suffer more serious long-term effects of CTE than professional athletes
- D. fans share some of the blame for athletes' injuries
- E. young people should not be encouraged to play football due to CTE risks

2. As used in paragraph 1, which is the best synonym for **zeitgeist** considering the context of the article?

- A. litigation
- B. milieu
- C. fanaticism
- D. purlieu
- E. intensity

3. According to the author, each of the following statements are true EXCEPT which one?

- A. Tackling itself is not dangerous; however, players who use improper tackling form may suffer injury.
- B. Scientists have established a link between players who shoot themselves and others and the onset of CTE.
- C. NFL officials have done nothing to address the problem of CTE.
- D. Athletes who are praised for exceptionally brutal hits are likely to continue engaging in such dangerous behavior.
- E. Sports programs showcase exceptionally hard hits.

4. According to the author, which of the following contribute(s) to an increase in incidences of CTE in amateur players?

I. fewer safety regulations than professional players

II. a lack of education geared to youth players about the dangers of head injuries

III. a desire to emulate professionals

- A. I. only
- B. II. only
- C. I. and II. only
- D. II. and III. only
- E. I., II., and III.

5. As used in paragraph 4, which is the best synonym for **laudable**?

- A. praiseworthy
- B. ineffective
- C. determined
- D. blameworthy
- E. satisfactory

6. The author's tone in the final paragraph can best be described as

- A. apologetic
- B. depressed
- D. confused
- E. solemn
- F. hopeless

7. As used in the final paragraph, which is the best antonym for **exalts**?

- A. ignores
- B. misrepresents
- C. praises
- D. reports
- E. criticizes

8. In the final paragraph, the author states, "Modern media's sensationalization effectively makes players commodities of the entertainment industry." Which of the following is related to the idea the author communicates in this sentence?

- A. Professional football players are anthropomorphized by the media
- B. Professional football players are revered by the media
- C. Professional football players are archons within the entertainment industry
- D. Professional football players are dehumanized by the media
- E. Professional football players are misstated by the media

9. In the final paragraph, the author writes, “Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game.” Which of the following literary devices is used in this quotation?

- A. Irony, characterized by the expression of something which is contrary to the intended meaning.
- B. Climax, characterized by the arrangement of words, phrases, or causes in an order of ascending power.
- C. Litotes, characterized by the expression of understatement used for intensification of a rhetorical purpose.
- D. Hyperbole, characterized by the use of exaggeration for emphasis or rhetorical effect.
- E. Apostrophe, characterized by a sudden turn from addressing the general audience to addressing a specific person, group, or personified abstraction.

**Directions: Please carefully review the correct answers to the questions you just completed.**

1) The author apparently believes that

- A. NFL officials have not thoroughly implemented stricter safety regulations
- B. doctors need to do more research about the potential long-term effects of CTE
- C. amateur athletes suffer more serious long-term effects of CTE than professional athletes
- D. fans share some of the blame for athletes’ injuries
- E. young people should not be encouraged to play football due to CTE risks

1) **D**

**Question Type: Global**

In the first paragraph, the author notes that fans are partially responsible for players’ violent hits, writing, “the sports media and fans alike bear some of the responsibility.” This is interpreted in the final paragraph when the author writes, “Sports media producers have become accustomed to showcasing the most aggressive tackles” and “NFL broadcasts often replay especially violent collisions, while the commentators marvel at the physical prowess of the players involved.” Using this information, we can infer that the sports entertainment industry does these things to boost ratings, because fans are more likely to watch when violence is on display. If broadcasters collectively decided to stop glorifying violent tackles and fans stopped choosing programming based on them, the players would be less likely to hit each other with devastating force. Therefore (**D**) is correct. In paragraph 2, the author writes, “the National Football League (NFL) has revised its safety regulations,” before detailing all of the ways that the league has implemented stricter safety regulations. Therefore (**A**) is incorrect. In paragraph 1, the author writes, “In extreme cases, people suffering from CTE have even committed suicide or homicide.” Since loss of life is the final, long-term effect anyone with a disease can incur, this

information indicates that long term effects of CTE have been studied. The passage does not provide information that would lead us to infer that doctors need to do more research about the potential long-term effects of CTE. Therefore **(B)** is incorrect. The passage does not provide information that would lead us to infer that amateur athletes suffer more serious long-term effects of CTE than professional athletes. Instead, because professional athletes are typically stronger and faster than amateur athletes, we might actually infer the opposite because hits at the professional level are presumably harder. Therefore **(C)** is incorrect. The passage does not provide information that would lead us to infer that the author believes that young people should not be encouraged to play football due to CTE risks. Instead, the author proposes education on proper tackling technique as a potential solution: “Proper tackling form—using the arms and shoulders to aim for a player’s midsection rather than leading with the top of the head—should be taught at an early age.” Therefore **(E)** is incorrect.

2) As used in paragraph 1, which is the best synonym for **zeitgeist**?

- A. litigation
- B. milieu
- C. fanaticism
- D. purlieu
- E. intensity

2) **B**

**Question Type: Vocabulary**

**zeitgeist** (*noun*): the general intellectual, moral, and cultural climate of an era

In paragraph 1, the author writes, "Although both new sports regulations and improvements in helmet technology can help protect players, the sports media and fans alike bear some of the responsibility for changing the modern zeitgeist of fandom in order to reduce the incidence of these devastating injuries." If media and fans have some responsibility in changing the “zeitgeist” of fandom, and another word for the cultural climate of a group is milieu, then to say that media and fans are responsible for changing the milieu (cultural climate) of fandom is the same as saying they are responsible for changing the zeitgeist. Therefore **(B)** is correct. *Litigation* relates to bringing a lawsuit to court. Since the author references regulations in the previous clause and indicates a separate responsibility for media and fans, we know that **(A)** is incorrect because it most closely relates to the separately identified need to create a new system of rules. *Fanaticism* means zeal. The author gives no indication that the intensity or enthusiasm of fans and media is inappropriate. Rather the author suggests the uncritical or misguided nature of fans needs to be reconsidered. Fanaticism in itself is unlikely to be viewed as problematic by the author. Therefore **(C)** is incorrect. *Purlieu* means the area surrounding a place. Although the author does reference the conditions surrounding media and fans, purlieu has a physical connotation and the author is more directly concerned with the intangible spirit of football fandom. Therefore **(D)** is incorrect. *Intensity* means depth of feeling. Once again, the author has not suggested that the depth of passion in sports fans and media is inappropriate. Instead the author seems to assert that the sometimes underinformed nature of fandom and its disregard for player safety must be changed. Intensity does not need to be changed. Therefore **(E)** is incorrect.

- 3) According to the author, each of the following statements are true EXCEPT which one?
- A. Tackling itself is not dangerous; however, players who use improper tackling form may suffer injury.
  - B. Scientists have established a link between players who shoot themselves and others and the onset of CTE.
  - C. NFL officials have done nothing to address the problem of CTE.
  - D. Athletes who are praised for exceptionally brutal hits are likely to continue engaging in such dangerous behavior.
  - E. Sports programs showcase exceptionally hard hits.

3) C

**Question Type: Detail**

In paragraph 2, the author writes, “the National Football League (NFL) has revised its safety regulations,” before detailing specific ways in which the NFL has tried to combat the problem of CTE. Therefore, (C) is correct because the author does not suggest that the NFL has done “nothing to address the problem.” In paragraph 3, the author writes, “With appropriate equipment and form, tackling need not be dangerous.” Using this information we can see that tackling can be done safely. In paragraph 2, the author writes “NFL officials have begun enforcing stricter penalty calls for helmet-to-helmet contact, leading with the head, and hitting a defenseless player.” Using this information, we can understand that improper tackling form is not safe, since penalties are called on players who tackle this way. Because it provides information present in the passage, (A) is incorrect. In paragraph 1, the author cites “recent studies” which have found that, “In extreme cases, people suffering from CTE have even committed suicide or homicide.” In paragraph 2, the author writes, “Recent autopsies performed on the brains of football players who have committed suicide have shown advanced cases of CTE in every single victim.” Using this information, we can see that some link has been established between murder, suicide, and the onset of CTE. Because it provides information present in the passage, (B) is incorrect. In the final paragraph, the author writes, “When the media exalts such hazardous behavior, professionals are rewarded for injuring each other on the field, and amateurs become more likely to try to imitate their favorite NFL athletes.” Using this information, we can see that individuals who receive positive attention—praise or glorification for their actions—are more likely to continue those actions. Therefore, athletes who are praised for their brutal hits will likely continue hitting violently. Because it provides information present in the passage, (D) is incorrect. In the final paragraph, the author writes, “Sports media producers have become accustomed to showcasing the most aggressive tackles” and “NFL broadcasts often replay especially violent collisions, while the commentators marvel at the physical prowess of the players involved.” Using this information, we can see that sports programs showcase exceptionally hard hits, since showcasing can also occur through replays and commentary. Therefore (E) is incorrect.

4) According to the author, which of the following contribute(s) to an increase in incidences of CTE in amateur players?

- I. fewer safety regulations than professional players
- II. a lack of education geared to youth players about the dangers of head injuries
- III. a desire to emulate professionals

- A. I only
- B. II only
- C. I and II only
- D. II and III only
- E. I, II, and III

4) E

**Question Type: Detail**

In paragraph 3, the author writes, “Youth, high school, and college leagues should also adopt safety rules even more stringent than the NFL’s.” The author suggests that NFL standards may protect professional players, but the regulations for amateurs are not as strict, if they exist at all, as those for professional players. Therefore, increased NFL safety standards do not directly address the injuries suffered by amateurs, who have fewer, or less strict safety regulations. This supports **option (I)**. In paragraph 3, the author writes, “at an early age athletes should be educated about the serious dangers of head injuries.” Using this information, we can see that youth are not educated properly. This supports **option (II)**. In the final paragraph, the author argues that “amateurs” are “likely to try to imitate their favorite NFL athletes” when they watch violent highlight reels on sports programs. This supports **option (III)**. Therefore **(E)** is correct.

5) As used in paragraph 4, which is the best synonym for **laudable**?

- A. praiseworthy
- B. ineffective
- C. determined
- D. blameworthy
- E. satisfactory

5) A

**Question Type: Vocabulary**

**laudable** (*adjective*): worthy of praise; commendable.

In paragraph 3, the author writes, “Efforts by the NFL and other professional sports leagues are certainly laudable; indeed, we should commend every attempt to protect the mental and physical health of players.” If we should “commend” these attempts, and another word for commend is praise, then to say that the efforts are praiseworthy (worthy of praise) is the same as saying they are laudable. Therefore **(A)** is correct. *Ineffective* means without producing results. Since we know that we are looking for the word that most nearly means worthy of praise, we know that **(B)** is incorrect because it describes the extent to which the efforts of the NFL and other professional sports leagues are effective. This choice does not speak to how we should receive

those efforts as individuals who want to see the mental and physical health of players protected. *Determined* means decided, settled, or resolved. Using context clues, we can tell that we are looking for a word that most nearly means commendable since the sentence connected by a semicolon to the one containing *laudable* reads “indeed, we should commend every attempt to protect the mental and physical health of players.” Using this information, we can see that being determined speaks to the nature of the actions while commendable speaks to how an audience should react to the actions. Therefore (C) is incorrect. *Blameworthy* means deserving criticism or blame. We know that we are looking for the word that most nearly means worthy of praise. To praise the actions of the NFL and other professional sports leagues is not at all the same as blaming them for their actions. Therefore (D) is incorrect. *Satisfactory* means fulfilling the requirements. We know that we are looking for the word that most nearly means worthy of praise. Satisfactory does not adequately express the extent to which the NFL and other professional leagues are reacting to the CTE threat, based on the fact that we should be commending them. The word merely implies that they are doing the bare minimum to fill requirements. Most things worthy of praise—as a synonym for *laudable* would be—are above and beyond the satisfactory. Therefore (E) is incorrect because it does not fully express the extent of the groups’ efforts.

- 6) The author’s tone in the final paragraph can best be described as
- A. apologetic
  - B. depressed
  - C. confused
  - D. solemn
  - E. hopeless

6) D

**Question Type: Global**

An author’s tone is directly related to the language, content, and imagery of a passage. In the final paragraph, the author writes, “Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game.” A solemn tone is serious. Using the above information, we sense that the author views the potential death of athletes—simply for the sake of a game—as a solemn or serious matter. The author’s tone is thus solemn, as the adamant language is used to persuade us that CTE is not just a serious threat to football players’ health, but that it could also end their lives. If we look at the syntax—the arrangement of the words—we also see a progression from the less serious (loss of career), to the most solemn consequence (death). This structure furthers the development of the solemn tone in the final paragraph. Therefore (D) is correct. An apologetic tone conveys a sense of remorse. The final paragraph provides no evidence to indicate that the author feels sorry, or apologetic, for arguing that CTE is a serious threat to football players’ health. Instead, language like “Announcers, commentators, television producers, and sportswriters should engage in a collective effort...” indicate the author’s confidence in making a call to action. Therefore (A) is incorrect. A depressed tone conveys a sense of extreme sadness. The final paragraph provides no evidence to indicate that the author feels depressed about this situation. The author express some frustration with fans and “the media [for] exalt[ing] such hazardous behavior,” but there is nothing that would indicate the

author is so sad that he or she feels depressed. Instead, language like “Announcers, commentators, television producers, and sportswriters should engage in a collective effort...” indicate the author’s confidence and hope that change is possible. Therefore **(B)** is incorrect. In the final paragraph, the author articulates precisely how fans and the media perpetuate aggressive, violent hits. There is no information provided in the final paragraph that would indicate that the author feels confused about this topic or how we should react. The last sentence of the passage clearly states that “Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game.” Using this information, we can see that the author knows exactly what needs to happen. Therefore **(C)** is incorrect. The author makes an argument throughout the passage that is emphasized in the last paragraph. The fact that the argument is being made at all indicates that the author feels hopeful that change is a possibility. Language like, “Announcers, commentators, television producers, and sportswriters should engage in a collective effort...” indicate the author’s hope that change is possible. Using this information, we can see that the author does not feel hopeless about the possibilities of curbing CTE cases, since the final paragraph outlines measures that we can take, as fans, to discourage violent hits in football. Therefore **(E)** is incorrect.

7) As used in the final paragraph, which is the best antonym for **exalts**?

- A. ignores
- B. misrepresents
- C. praises
- D. reports
- E. criticizes

7) **E**

**Question Type: Vocabulary**

**exalt** (*verb*): to praise or glorify something or somebody.

In the final paragraph, the author writes, “When the media exalts such hazardous behavior, professionals are rewarded for injuring each other on the field, and amateurs become more likely to try to imitate their favorite NFL athletes.” Using context, we can see that professional players are rewarded when the media exalts their hazardous behavior. We can also use the sentence immediately following it—which suggests an appropriate response—to provide context clues: “Announcers, commentators, television producers, and sportswriters should engage in a collective effort to cease glorifying brutal plays.” Using this information, we can see that the author believes that “glorifying brutal plays” needs to stop. Thus, using the information above, exalt must mean to reward or to glorify. We know that we are looking for the word that most nearly means the opposite of reward or glorify. *Criticize* means to be critical of, scold, or find flaws with, which is quite opposite of rewarding or glorifying something. Likewise, if the media were critical of the players for hitting violently, the behavior would be less likely to continue. Therefore **(E)** is correct. Using the information above, we know that we are looking for the word that most nearly means the opposite of reward or glorify. To simply *ignore* the players’ violent hits does not express the opposite of reward or glorify to the same extent. Because it is not an adjective equal in degree to exalt, we know that ignore is not a strong enough opposite. Therefore **(A)** is incorrect. Using the information above, we know that we are looking for the

word that most nearly means the opposite of reward or glorify. For the media to *misrepresent* the players' violent hits implies a level of deceit and corruption not accurate in a word that most nearly means the opposite of exalt. Therefore **(B)** is incorrect because it speaks to the character of the media and not the way they react to the violent hits. *Praises* is a synonym for exalts. We know that we are looking for the word that most nearly means the opposite; therefore **(C)** is incorrect. *Reports* does not adequately express the opposite of what the media does with footage of violent hits. Simply reporting on the players who make the hits is not as bad as praising them, but it's also not equally opposite of praising the players. To report something implies an absence of emotion in relaying facts. The word that most nearly means the opposite of praise would have to be somewhat critical to be adequately opposite. Therefore **(D)** is incorrect.

**8)** In the final paragraph, the author comes to the conclusion, "Modern media's sensationalization effectively makes players commodities of the entertainment industry." Which of the following claims is related to the idea the author communicates in this sentence.

- A. Professional football players are anthropomorphized by the media
- B. Professional football players are revered by the media
- C. Professional football players are archons within the entertainment industry
- D. Professional football players are dehumanized by the media
- E. Professional football players are mistreated by the media

**8) D**

**Question Type: Global**

In this sentence within the final paragraph, the author concludes that the media's tendency to marvel at and showcase violent hits by professional football players naturally leads to disregard for player safety and in doing so strips players of a basic form of human respect. This conclusion is consistent with the statement that players are dehumanized or robbed of their unique humanness and turned into objects only valuable for their ability to entertain fans and media. Therefore, choice **(D)** is correct. Choice **(A)** suggests that players are literally not human but are given human characteristics and personality. This idea contradicts the authors point by suggesting that the media makes players more rather than less human. Choices **(B)** and **(C)** indicate the the media/entertainment industry are serving a positive role for the players which does not reflect the authors statement or the broader tone of the article. Choice **(E)** does indicate that the media does a disservice to players, however this statement is vague and does not communicate the specific way in which the media harms professional football players. These choices are therefore incorrect.

9) In the final paragraph, the author writes, “Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game.” Which of the following literary devices is used in this quotation?

- A. Irony, characterized by the expression of something which is contrary to the intended meaning.
- B. Climax, characterized by the arrangement of words, phrases, or causes in an order of ascending power.
- C. Litotes, characterized by the expression of understatement used for intensification of a rhetorical purpose.
- D. Hyperbole, characterized by the use of exaggeration for emphasis or rhetorical effect.
- E. Apostrophe, characterized by a sudden turn from addressing the general audience to addressing a specific person, group, or personified abstraction.

9) B

**Question Type: Inference**

In the last sentence, the author urges players to stop trading “their careers, their health, their happiness, and their lives for the sake of a game.” The ideas progress from least crucial (careers) to most crucial (lives). Organizing ideas in order of ascending power or importance is called climax. Therefore **(B)** is correct. The passage does not provide information to support choices **(A)**, **(C)**, **(D)**, and **(E)**. Therefore they are incorrect.

## Appendix C: Pilot Study Health Confidence Bias Measure

We'd now like you to complete a task that assesses knowledge. For each question we will ask you to choose one of four answers to a multiple choice question.

After each question we will ask you about your confidence in your answer. Here, you will be able to enter a number between 25% and 100%. 25% would indicate that you are completely unsure (i.e. guessing), while 100% would indicate that you are completely sure. In other words, the number you choose can be seen as the percentage of times you would get that question correct. So, if you said 70%, you would be saying that you think you'd get that question right 70% of the time. Because these questions only have four options, confidence ratings lower than 25% are not appropriate because 25% is what you would get if you were just choosing randomly.

What causes animal allergies?

- a. Urine
- b. Fur
- c. Proteins
- d. Dander

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which of the following is potentially harmful if you have osteoarthritis?

- a. Walking
- b. Tennis
- c. Biking
- d. Weight Lifting

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which spice may boost the effect of radiation treatment and help protect your skin?

- a. Cinnamon
- b. Garlic
- c. Turmeric
- d. All of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What's the most effective way to boost nutrition during cancer treatment?

- a. Extra vitamins
- b. Nutritional supplements
- c. Eat frequent, small meals consisting of nutrient rich food
- d. All of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What causes colds?

- a. Bacteria
- b. Molds and fungi
- c. Viruses
- d. An allergic reaction

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which body mass index (BMI) category is healthiest?

- a. Anything below obese
- b. Anything below overweight
- c. Anything in the normal range
- d. The low end of the normal range

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Scientific studies suggest people with fibromyalgia may benefit from:

- a. Exercise
- b. Guaifenesin
- c. Medical marijuana
- d. All of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

How much of the average person's daily water intake is from food?

- a. 5%
- b. 20%
- c. 50%
- d. 80%

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Daily aspirin therapy can prevent?

- a. Heart attack and stroke
- b. Diabetes
- c. High cholesterol
- d. Dementia

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Most sodium in the typical Western diet comes from:

- a. Processed foods
- b. Salt added at the table
- c. Salt added during cooking
- d. None of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Your bones start to thin at what age?

- a. After 30
- b. After 50
- c. After 65
- d. After 75

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What is the most effective birth control method for preventing sexually transmitted diseases?

- a. Birth control pills
- b. IUD
- c. Spermicide
- d. Male condom

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Spot specific fat reduction can trim weight from your:

- a. Arms
- b. Thighs
- c. Abdomen
- d. None of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which of the following helps turn short-term memories into long term-memories?

- a. Exercise
- b. Sleep
- c. Aging
- d. Digestion

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What kinds of cough can be treated with cough medicine?

- a. Asthma
- b. Chronic bronchitis
- c. Cold or flu
- d. Pneumonia

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which of the following is the most common source of lower back pain?

- a. A problem with spine
- b. A problem with muscles
- c. A problem with ligaments
- d. A problem with nerves

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which is worst for your cholesterol?

- a. Coconut milk
- b. Coconut meat
- c. Coconut water
- d. Coconut root

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The number of bacteria in your mouth is closest to the population of which of the following?

- a. New York City
- b. The United States
- c. North America
- d. Earth

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

## Appendix D: Pilot Study General Confidence Bias Measure

We'd now like you to complete a task that assesses knowledge. For each question we will ask you to choose one of four answers to a multiple-choice question.

After each question we will ask you about your confidence in your answer. Here, you will be able to enter a number between 25% and 100%. 25% would indicate that you are completely unsure (i.e. guessing), while 100% would indicate that you are completely sure. In other words, the number you choose can be seen as the percentage of times you would get that question correct. So, if you said 70%, you would be saying that you think you'd get that question right 70% of the time. Because these questions only have four options, confidence ratings lower than 25% are not appropriate because 25% is what you would get if you were just choosing randomly.

Earth's Equator is around how many miles long?

- a. 25,000
- b. 40,000
- c. 10,000
- d. 33,000

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Our solar system consists of how many known planets?

- a. 13
- b. 8
- c. 12
- d. 9

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The first Tour de France took place in what year?

- a. 1898
- b. 1915
- c. 1903
- d. 1938

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which triple of notes contains C major?

- a. A-C-B
- b. D-F-A
- c. C-D-G
- d. C-E-G

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Ludwig van Beethoven wrote how many symphonies?

- a. 14
- b. 9
- c. 41
- d. 13

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Electrical frequency in the United States is how many Hz?

- a. 220
- b. 110
- c. 60
- d. 50

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Human cells consist of how many chromosomes?

- a. 32
- b. 46
- c. 38
- d. 23

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The human body has how many sense organs?

- a. 4
- b. 5
- c. 6
- d. 7

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The sum of all the angles in a triangle is how many degrees?

- a. 360
- b. 60
- c. 90
- d. 180

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The "Lord of the Rings" is a volume of books written by which author?

- a. Tolkien
- b. Tolstoy
- c. Thomas
- d. Trevier

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

In which country is the Nobel Peace Prize awarded?

- a. Belgium
- b. Norway
- c. Holland
- d. Sweden

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which of the following is a hot chili sauce?

- a. Tabasco
- b. Curacao
- c. Macao
- d. Hollandaise

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

How many letters does the Russian alphabet consist of?

- a. 40
- b. 33
- c. 26
- d. 36

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What is the name of the Greek goddess of wisdom?

- a. Pallas Athena
- b. Nike
- c. Penelope
- d. Aphrodite

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which is the most abundant metal on Earth?

- a. Iron
- b. Aluminum
- c. Copper
- d. Tin

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which enterprise does Bill Gates belong to?

- a. Intel
- b. Microsoft
- c. Dell Computers
- d. Next Computers

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What is the fasting month in Islam called?

- a. Sharia
- b. Ramadan
- c. Imam
- d. Rajab

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which language does the concept “Fata Morgana” come from?

- a. Italian
- b. Arabic
- c. Swahili
- d. Portuguese

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

How many day does a hen need to incubate an egg?

- a. 21
- b. 14
- c. 18
- d. 30

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What is ascorbic acid?

- a. Apple vinegar
- b. Vitamin C
- c. Vitamin A
- d. Gastric acid

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

## Appendix E: Pilot Study Willingness to Comply Measure

Imagine you have been experiencing chronic pain in your lower back. These symptoms are impacting your functioning and you hope to resolve this issue. You visit a health professional and mention the chronic pain in your lower back. The health professional suggests that you try mindfulness-based meditation to address your symptoms.

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you would absolutely would have considered the intervention):

\_\_\_\_\_ %

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

Imagine you have been experiencing anxiety that causes dizziness. These symptoms are impacting your functioning and you hope to resolve this issue. You visit a health professional and mention your anxiety that causes dizziness. The health professional suggests that you try an over the counter motion sickness medication to address your symptoms.

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you would absolutely would have considered the intervention):

\_\_\_\_\_ %

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

Imagine you have been experiencing stress related headaches. These symptoms are impacting your functioning and you hope to resolve this issue. You visit a health professional and mention your stress related headaches. The health professional suggests that you try anti-tension exercises and deep breathing to address your symptoms.

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you would absolutely would have considered the intervention):

\_\_\_\_\_ %

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

Imagine you have been experiencing difficulty initiating and maintaining sleep . These symptoms are impacting your functioning and you hope to resolve this issue. You visit a health professional and mention your difficulty initiating and maintaining sleep. The health professional suggests that you try taking a low dose of melatonin every night to address your symptoms (melatonin is a hormone naturally produced in the brain that helps regulate sleep cycles; natural production of the hormone may be supplemented by taking the hormone orally at bedtime).

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you would absolutely would have considered the intervention):

\_\_\_\_\_ %

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

Appendix F: Demographics Measure

Please respond to the following questions:

What is your gender?

Male\_\_

Female\_\_

Other\_\_

How old are you (please respond in years)?

\_\_\_

How many years of education have you completed (e.g., completing high school =12)?

\_\_\_

What racial/ethnic group do you identify with?

Asian/Indian\_\_

American Indian \_\_

Asian/Pacific Islander \_\_

White (Hispanic) \_\_

Black (Hispanic) \_\_

White (non-Hispanic) \_\_

Black (non-Hispanic) \_\_

Other \_\_

What is your marital status?

Currently married \_\_

Never married \_\_

Currently living with partner \_\_

Separated \_\_

Divorced \_\_

Widowed \_\_

What is the highest level of schooling you have completed?

Less than 8<sup>th</sup> grade \_\_

Some college\_\_

8<sup>th</sup> to 11<sup>th</sup> grade \_\_

College graduate \_\_

High school graduate or Equivalent GED \_\_

Some-post graduate work \_\_

Technical or vocational school \_\_

Post-graduate degree \_\_

Appendix G: Health Status Measure

1. In general, would you say your health is:	
Excellent	1

2. <b>Compared to one year ago,</b> how would you rate your health in general <b>now</b> ?	
Much better now than one year ago	1
Somewhat better now than one year ago	2
About the same	3
Somewhat worse now than one year ago	4
Much worse now than one year ago	5
Very good	2
Good	3
Fair	4
Poor	5

The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

**(Circle One Number on Each Line)**

	Yes, Limited a Lot [1]	Yes, Limited a Little [2]	No, Not limited at All [3]
3. <b>Vigorous activities</b> , such as running, lifting heavy objects, participating in strenuous sports	[1]	[2]	[3]
4. <b>Moderate activities</b> , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	[1]	[2]	[3]
5. Lifting or carrying groceries	[1]	[2]	[3]
6. Climbing <b>several</b> flights of stairs	[1]	[2]	[3]
7. Climbing <b>one</b> flight of stairs	[1]	[2]	[3]
8. Bending, kneeling, or stooping	[1]	[2]	[3]
9. Walking <b>more than a mile</b>	[1]	[2]	[3]
10. Walking <b>several blocks</b>	[1]	[2]	[3]
11. Walking <b>one block</b>	[1]	[2]	[3]
12. Bathing or dressing yourself	[1]	[2]	[3]

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

(Circle One Number on Each Line)

	Yes	No
13. Cut down the amount of time you spent on work or other activities	1	2
14. <b>Accomplished less</b> than you would like	1	2
15. Were limited in the <b>kind</b> of work or other activities	1	2
16. Had <b>difficulty</b> performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

(Circle One Number on Each Line)

	Yes	No
17. Cut down the <b>amount of time</b> you spent on work or other activities	1	2
18. <b>Accomplished less</b> than you would like	1	2
19. Didn't do work or other activities as <b>carefully</b> as usual	1	2

20. During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle One Number)

Not at all 1      A little bit 2      Moderately 3      Quite a bit 4      Extremely 5

21. How much **bodily** pain have you had during the **past 4 weeks**?

**(Circle One Number)**

None 1      Very mild 2      Mild 3      Moderate 4      Severe 5      Very severe 6

22. During the **past 4 weeks**, how much did **pain** interfere with your normal work (including both work outside the home and housework)?

**(Circle One Number)**

Not at all 1      A little bit 2      Moderately 3      Quite a bit 4      Extremely 5

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks** . . .

**(Circle One Number on Each Line)**

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
23. Did you feel full of pep?	1	2	3	4	5	6
24. Have you been a very nervous person?	1	2	3	4	5	6
25. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
26. Have you felt calm and peaceful?	1	2	3	4	5	6
27. Did you have a lot of energy?	1	2	3	4	5	6
28. Have you felt downhearted and blue?	1	2	3	4	5	6
29. Did you feel worn out?	1	2	3	4	5	6
30. Have you been a happy person?	1	2	3	4	5	6
31. Did you feel tired?	1	2	3	4	5	6

32. During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

**(Circle One Number)**

All of the time 1      Most of the time 2      Some of the time 3      A little of the time 4      None of the time 5

How TRUE or FALSE is each of the following statements for you.

**(Circle One Number on Each Line)**

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
33. I seem to get sick a little easier than other people	1	2	3	4	5
34. I am as healthy as anybody I know	1	2	3	4	5
35. I expect my health to get worse	1	2	3	4	5
36. My health is excellent	1	2	3	4	5

Compared to others your age, would you say your health is:

Poor \_\_\_      Fair \_\_\_      Good \_\_\_      Very Good \_\_\_      Excellent \_

## Appendix H: Demand Measure

The next set of questions addresses your views and interpretations as you were completing the study. There are no right or wrong answers; we are only interested in your honest response.

1. While completing the experiment did you ever feel skeptical about the purpose of the study as explained in the information sheet? If yes, please explain.
2. As you were completing the experiment, did you feel that the researchers who designed the tutorial wanted to make you feel less confident in your perceptions and ideas?

Yes. I thought the researchers intended to make me less confident \_\_\_\_

No. I didn't think the researchers intended to make me less confident. \_\_\_\_

3. Please respond to each of the following questions.

a. To what extent did you feel like the researchers who designed the tutorial might have been motivated to make you feel less confident in your perceptions and ideas?

1 – Not at all \_\_\_\_      2\_\_\_\_      3\_\_ Moderately \_\_\_\_      4\_\_\_\_      5 Extremely \_\_\_\_

b. To what extent throughout the experiment did you question your own perceptions, judgments, or beliefs?

1 – Not at all \_\_\_\_      2\_\_\_\_      3\_\_ Moderately \_\_\_\_      4\_\_\_\_      5 Extremely \_\_\_\_

c. To what extent throughout the experiment did you question the perceptions, judgments, or beliefs of people generally?

1 – Not at all \_\_\_\_      2\_\_\_\_      3\_\_ Moderately \_\_\_\_      4\_\_\_\_      5 Extremely \_\_\_\_

d. To what extent do you think the experiment would make you experience more doubt in daily life?

1 – Not at all \_\_\_      2\_\_\_      3\_\_ Moderately \_\_\_      4\_\_\_      5 Extremely \_\_\_

e. To what extent did you feel pressured to indicate less confidence in your answers?

1 – Not at all \_\_\_      2\_\_\_      3\_\_ Moderately \_\_\_      4\_\_\_      5 Extremely \_\_\_

## Appendix I: Understanding of Cognitive Bias Measure

The next set of questions measures your understanding of the information in the demonstrations. The questions are in a True or False format. Please read all the questions carefully. It is critical to this research that you try to do your best on this test.

1. Our brains shape our views and perceptions and this process can be hidden from our conscious awareness.

True \_\_\_\_                      False \_\_\_\_

2. There is very little evidence that the brain's hidden processes can shape our views and perceptions.

True \_\_\_\_                      False \_\_\_\_

3. If you try hard you can "shut off" the brain's hidden processes.

True \_\_\_\_                      False \_\_\_\_

4. People will very often be aware of times when they have a biased perception.

True \_\_\_\_                      False \_\_\_\_

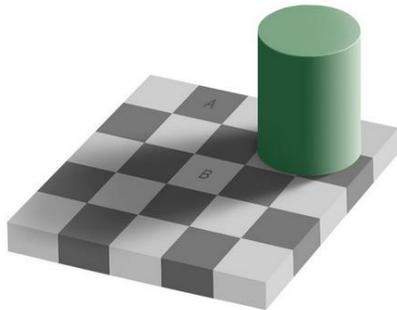
5. Because of the way the brain works, people may often feel too confident in their ideas.

True \_\_\_\_                      False \_\_\_\_

Appendix J: Primary Study Bias-Reducing Intervention

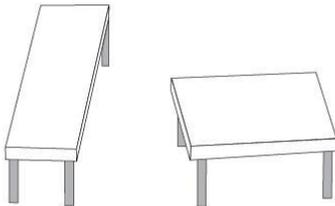
**I. Sample Visual Illusions and Excerpts of Accompanying Text**

A. Adelson Checker Shadow Illusion



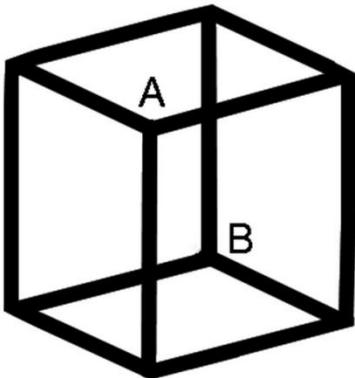
“As you can see from the examples of the checkerboard and the tables, this process of "filling in" information can lead us to make errors. What's more, scientific research shows us that it can lead us to make errors even when we feel quite certain that we're correct.”

B. Shepherd's Table



“...research indicates that you cannot stop your brain from doing this. The only thing you can do is take steps to compensate for this [bias]. In everyday life you can compensate for this process by considering multiple perspectives rather than assuming that your initial understanding of a situation is entirely accurate.”

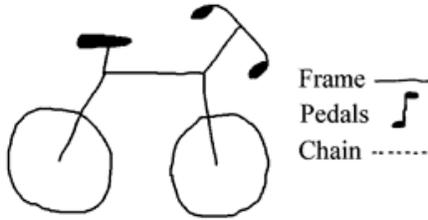
C. Necker Cube



“This illusion demonstrates that there isn't one ‘true’ or ‘objective’ way to see the world... Being open to the potential utility of alternative perspectives may allow you to achieve the best possible outcomes in life (e.g., trying a new strategy completing work for your job or school or combining a new approach with your existing habits may result in better performance).”

## II. Test of Common Knowledge and Excerpt of Accompanying Text

### A. Draw a Bicycle Test



“You likely had the strong feeling that you ‘know’ what a bicycle looks like and where the basic parts are located. When we put this knowledge to the test, however, we realize that sometimes our knowledge isn't as clear as we originally thought. This illustrates another aspect of how the human brain works: it tricks you into thinking you know things when you don't.”

### B. Identify the Real Penny Task



“Again, it is important to be aware that too much certainty can be a bad thing. In fact, scientific evidence indicates that too much certainty decreases the quality of decision making. Researchers suggest that great confidence has contributed to failures in the stock market, errors in medical diagnoses, and international conflicts.”

## III. Sample Misperceiving Relationships Task and Excerpts of Accompanying Text

### A. Absent-Minded Professors Example

Statement 1: Professors are more absent-minded than most people.

Evidence: A researcher polled a representative sample of 735 professors and found that 67% were classified as absent-minded based on their performance on a well-validated personality test. How would you describe this evidence in terms of the support it provides for Statement 1? (Note: Please try to evaluate the evidence independent of your own personal view of the topic.)

Very Weak	Weak	Somewhat Weak	Somewhat Strong	Strong	Very Strong
<input type="radio"/>					

Reconsider Statement 1. You read the following:

"Statement 1: Professors are more absent-minded than most people.

Evidence: A researcher polled a representative sample of 735 professors and found that 67% were classified as absent-minded based on their performance on a well-validated personality test."

Now, consider the following tables:

	Absent-Minded	
	No	Yes
Professors	33%	67%
Non-Professors	?	?

**B)**

	Absent-Minded	
	No	Yes
Professors	33%	67%
Non-Professors	33%	67%

**C)**

	Absent-Minded	
	No	Yes
Professors	33%	67%
Non-Professors	10%	90%

"...If you found this evidence convincing to some degree, this is probably because your brain filled in the information in a way that was consistent with Statement 1. In other words, you may have unconsciously assumed that 67% would be high relative to the rest of the population. This amounts to guessing that for non-professors, the numbers would be much higher than 33% for "No" and much lower than 67% for 'Yes'..."

"...But, you don't know this for sure, and if it were the case that non-professors scored the same way as professors did (or scored as more absent-minded than professors did), your assumptions would have led you to the wrong conclusion. These possibilities are depicted here in Tables B and C."

## Appendix K: Primary Study Reading Comprehension Control Task

**Directions: Please read the passage carefully and do your best to correctly answer the questions below.**

Concussions are brain injuries that occur when a person receives a blow to the head, face, or neck. Although most people who suffer a concussion experience initial bouts of dizziness, nausea, and drowsiness, these symptoms often disappear after a few days. The long-term effects of concussions, however, are less understood and far more severe. Recent studies suggest that people who suffer multiple concussions are at a significant risk for developing chronic traumatic encephalopathy (CTE), a degenerative brain disorder that causes a variety of dangerous mental and emotional problems to arise weeks, months, or even years after the initial injury. These psychological problems can include depression, anxiety, memory loss, inability to concentrate, and aggression. In extreme cases, people suffering from CTE have even committed suicide or homicide. The majority of people who develop these issues are athletes who participate in popular high-impact sports, especially football. Although both new sports regulations and improvements in helmet technology can help protect players, the sports media and fans alike bear some of the responsibility for changing the modern zeitgeist of fandom in order to reduce the incidence of these devastating injuries.

Improvements in diagnostic technology have provided substantial evidence to link severe—and often fatal—psychological disorders to the head injuries players receive while on the field. Recent autopsies performed on the brains of football players who have committed suicide have shown advanced cases of CTE in every single victim.

In response to the growing understanding of this danger, the National Football League (NFL) has revised its safety regulations. Players who have suffered a head injury on the field must undergo a "concussion sideline assessment"—a series of mental and physical fitness tests—before being allowed back in the game. In an effort to diminish the amount of head and neck injuries on the field, NFL officials have begun enforcing stricter penalty calls for helmet-to-helmet contact, leading with the head, and hitting a defenseless player. Furthermore, as of 2010,

if a player's helmet is accidentally wrenched from his head during play, the ball is immediately whistled dead. There is hope that these new regulations, coupled with advances in helmet design, will reduce the number of concussions players endure, and thus curb the number of CTE cases.

Efforts by the NFL and other professional sports leagues are certainly laudable; indeed, we should commend every attempt to protect the mental and physical health of players. However, new regulations at the professional level cannot protect amateur players, especially young people. Fatal cases of CTE have been reported in victims as young as 21. With appropriate equipment and form, tackling need not be dangerous. Proper tackling form—using the arms and shoulders to aim for a player's midsection rather than leading with the top of the head—should be taught at an early age. Youth, high school, and college leagues should also adopt safety rules even more stringent than the NFL's. Furthermore, at an early age, athletes should be educated about the serious dangers of head injuries.

Perhaps the most important factor in reducing the number of traumatic brain injuries, however, lies not with the players, the coaches, or the administrators, but with the media and fans. Sports media producers have become accustomed to showcasing the most aggressive tackles and the most intense plays. NFL broadcasts often replay especially violent collisions, while the commentators marvel at the physical prowess of the players involved. Some sports programs even feature weekly countdowns of the hardest hits. Modern media's sensationalization effectively makes players commodities of the entertainment industry. Furthermore when the media exalts such hazardous behavior, professionals are rewarded for injuring each other on the field, and amateurs become more likely to try to imitate their favorite NFL athletes. Announcers, commentators, television producers, and sportswriters should engage in a collective effort to cease glorifying brutal plays. In turn, fans should stop expecting their favorite players to put their lives on the line for the purposes of entertainment. Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game.

1. The author apparently believes that:

- A. NFL officials have not thoroughly implemented stricter safety regulations
- B. doctors need to do more research about the potential long-term effects of CTE
- C. amateur athletes suffer more serious long-term effects of CTE than professional athletes
- D. fans share some of the blame for athletes' injuries
- E. young people should not be encouraged to play football due to CTE risks

2. As used in paragraph 1, which is the best synonym for **zeitgeist** considering the context of the article?

- A. litigation
- B. milieu
- C. fanaticism
- D. purlieu
- E. intensity

3. According to the author, each of the following statements are true EXCEPT which one?

- A. Tackling itself is not dangerous; however, players who use improper tackling form may suffer injury.
- B. Scientists have established a link between players who shoot themselves and others and the onset of CTE.
- C. NFL officials have done nothing to address the problem of CTE.
- D. Athletes who are praised for exceptionally brutal hits are likely to continue engaging in such dangerous behavior.
- E. Sports programs showcase exceptionally hard hits.

4. According to the author, which of the following contribute(s) to an increase in incidences of CTE in amateur players?

I. fewer safety regulations than professional players

II. a lack of education geared to youth players about the dangers of head injuries

III. a desire to emulate professionals

- A. I. only
- B. II. only
- C. I. and II. only
- D. II. and III. only
- E. I., II., and III.

5. As used in paragraph 4, which is the best synonym for **laudable**?

- A. praiseworthy
- B. ineffective
- C. determined
- D. blameworthy
- E. satisfactory

6. The author's tone in the final paragraph can best be described as

- A. apologetic
- B. depressed
- D. confused
- E. solemn
- F. hopeless

7. As used in the final paragraph, which is the best antonym for **exalts**?

- A. ignores
- B. misrepresents
- C. praises
- D. reports
- E. criticizes

8. In the final paragraph, the author states, "Modern media's sensationalization effectively makes players commodities of the entertainment industry." Which of the following is related to the idea the author communicates in this sentence?

- A. Professional football players are anthropomorphized by the media
- B. Professional football players are revered by the media
- C. Professional football players are archons within the entertainment industry
- D. Professional football players are dehumanized by the media
- E. Professional football players are misstated by the media

**Directions: Please carefully review the correct answers to the questions you just completed.**

1) The author apparently believes that

- A. NFL officials have not thoroughly implemented stricter safety regulations
- B. doctors need to do more research about the potential long-term effects of CTE
- C. amateur athletes suffer more serious long-term effects of CTE than professional athletes
- D. fans share some of the blame for athletes' injuries
- E. young people should not be encouraged to play football due to CTE risks

**1) D**

**Question Type: Global**

In the first paragraph, the author notes that fans are partially responsible for players' violent hits, writing, "the sports media and fans alike bear some of the responsibility." This is interpreted in the final paragraph when the author writes, "Sports media producers have become accustomed to showcasing the most aggressive tackles" and "NFL broadcasts often replay especially violent collisions, while the commentators marvel at the physical prowess of the players involved." Using this information, we can infer that the sports entertainment industry does these things to boost ratings, because fans are more likely to watch when violence is on display. If broadcasters collectively decided to stop glorifying violent tackles and fans stopped choosing programming based on them, the players would be less likely to hit each other with devastating force. Therefore **(D)** is correct. In paragraph 2, the author writes, "the National Football League (NFL) has revised its safety regulations," before detailing all of the ways that the league has implemented stricter safety regulations. Therefore **(A)** is incorrect. In paragraph 1, the author writes, "In extreme cases, people suffering from CTE have even committed suicide or homicide." Since loss of life is the final, long-term effect anyone with a disease can incur, this information indicates that long term effects of CTE have been studied. The passage does not provide information that would lead us to infer that doctors need to do more research about the potential long-term effects of CTE. Therefore **(B)** is incorrect. The passage does not provide information that would lead us to infer that amateur athletes suffer more serious long-term effects of CTE than professional athletes. Instead, because professional athletes are typically stronger and faster than amateur athletes, we might actually infer the opposite because hits at the professional level are presumably harder. Therefore **(C)** is incorrect. The passage does not provide information that would lead us to infer that the author believes that young people should not be encouraged to play football due to CTE risks. Instead, the author proposes education on proper tackling technique as a potential solution: "Proper tackling form—using the arms and shoulders to aim for a player's midsection rather than leading with the top of the head—should be taught at an early age." Therefore **(E)** is incorrect.

2) As used in paragraph 1, which is the best synonym for **zeitgeist**?

- A. litigation
- B. milieu
- C. fanaticism
- D. purlieu
- E. intensity

2) **B**

**Question Type: Vocabulary**

**zeitgeist** (*noun*): the general intellectual, moral, and cultural climate of an era

In paragraph 1, the author writes, "Although both new sports regulations and improvements in helmet technology can help protect players, the sports media and fans alike bear some of the responsibility for changing the modern zeitgeist of fandom in order to reduce the incidence of these devastating injuries." If media and fans have some responsibility in changing the "zeitgeist" of fandom, and another word for the cultural climate of a group is milieu, then to say that media and fans are responsible for changing the milieu (cultural climate) of fandom is the same as saying they are responsible for changing the zeitgeist. Therefore **(B)** is correct. *Litigation* relates to bringing a lawsuit to court. Since the author references regulations in the previous clause and indicates a separate responsibility for media and fans, we know that **(A)** is incorrect because it most closely relates to the separately identified need to create a new system of rules. *Fanaticism* means zeal. The author gives no indication that the intensity or enthusiasm of fans and media is inappropriate. Rather the author suggests the uncritical or misguided nature of fans needs to be reconsidered. Fanaticism in itself is unlikely to be viewed as problematic by the author. Therefore **(C)** is incorrect. *Purlieu* means the area surrounding a place. Although the author does reference the conditions surrounding media and fans, purlieu has a physical connotation and the author is more directly concerned with the intangible spirit of football fandom. Therefore **(D)** is incorrect. *Intensity* means depth of feeling. Once again, the author has not suggested that the depth of passion in sports fans and media is inappropriate. Instead the author seems to assert that the sometimes underinformed nature of fandom and its disregard for player safety must be changed. Intensity does not need to be changed. Therefore **(E)** is incorrect.

3) According to the author, each of the following statements are true EXCEPT which one?

- A. Tackling itself is not dangerous; however, players who use improper tackling form may suffer injury.
- B. Scientists have established a link between players who shoot themselves and others and the onset of CTE.
- C. NFL officials have done nothing to address the problem of CTE.
- D. Athletes who are praised for exceptionally brutal hits are likely to continue engaging in such dangerous behavior.
- E. Sports programs showcase exceptionally hard hits.

### 3) C

#### Question Type: Detail

In paragraph 2, the author writes, “the National Football League (NFL) has revised its safety regulations,” before detailing specific ways in which the NFL has tried to combat the problem of CTE. Therefore, (C) is correct because the author does not suggest that the NFL has done “nothing to address the problem.” In paragraph 3, the author writes, “With appropriate equipment and form, tackling need not be dangerous.” Using this information we can see that tackling can be done safely. In paragraph 2, the author writes “NFL officials have begun enforcing stricter penalty calls for helmet-to-helmet contact, leading with the head, and hitting a defenseless player.” Using this information, we can understand that improper tackling form is not safe, since penalties are called on players who tackle this way. Because it provides information present in the passage, (A) is incorrect. In paragraph 1, the author cites “recent studies” which have found that, “In extreme cases, people suffering from CTE have even committed suicide or homicide.” In paragraph 2, the author writes, “Recent autopsies performed on the brains of football players who have committed suicide have shown advanced cases of CTE in every single victim.” Using this information, we can see that some link has been established between murder, suicide, and the onset of CTE. Because it provides information present in the passage, (B) is incorrect. In the final paragraph, the author writes, “When the media exalts such hazardous behavior, professionals are rewarded for injuring each other on the field, and amateurs become more likely to try to imitate their favorite NFL athletes.” Using this information, we can see that individuals who receive positive attention—praise or glorification for their actions—are more likely to continue those actions. Therefore, athletes who are praised for their brutal hits will likely continue hitting violently. Because it provides information present in the passage, (D) is incorrect. In the final paragraph, the author writes, “Sports media producers have become accustomed to showcasing the most aggressive tackles” and “NFL broadcasts often replay especially violent collisions, while the commentators marvel at the physical prowess of the players involved.” Using this information, we can see that sports programs showcase exceptionally hard hits, since showcasing can also occur through replays and commentary. Therefore (E) is incorrect.

4) According to the author, which of the following contribute(s) to an increase in incidences of CTE in amateur players?

- I. fewer safety regulations than professional players
- II. a lack of education geared to youth players about the dangers of head injuries
- III. a desire to emulate professionals

- A. I only
- B. II only
- C. I and II only
- D. II and III only
- E. I, II, and III

4) E

**Question Type: Detail**

In paragraph 3, the author writes, “Youth, high school, and college leagues should also adopt safety rules even more stringent than the NFL’s.” The author suggests that NFL standards may protect professional players, but the regulations for amateurs are not as strict, if they exist at all, as those for professional players. Therefore, increased NFL safety standards do not directly address the injuries suffered by amateurs, who have fewer, or less strict safety regulations. This supports **option (I)**. In paragraph 3, the author writes, “at an early age athletes should be educated about the serious dangers of head injuries.” Using this information, we can see that youth are not educated properly. This supports **option (II)**. In the final paragraph, the author argues that “amateurs” are “likely to try to imitate their favorite NFL athletes” when they watch violent highlight reels on sports programs. This supports **option (III)**. Therefore **(E)** is correct.

5) As used in paragraph 4, which is the best synonym for **laudable**?

- A. praiseworthy
- B. ineffective
- C. determined
- D. blameworthy
- E. satisfactory

5) A

**Question Type: Vocabulary**

**laudable** (*adjective*): worthy of praise; commendable.

In paragraph 3, the author writes, “Efforts by the NFL and other professional sports leagues are certainly laudable; indeed, we should commend every attempt to protect the mental and physical health of players.” If we should “commend” these attempts, and another word for commend is praise, then to say that the efforts are praiseworthy (worthy of praise) is the same as saying they are laudable. Therefore **(A)** is correct. *Ineffective* means without producing results. Since we know that we are looking for the word that most nearly means worthy of praise, we know that **(B)** is incorrect because it describes the extent to which the efforts of the NFL and other professional sports leagues are effective. This choice does not speak to how we should receive those efforts as individuals who want to see the mental and physical health of players protected. *Determined* means decided, settled, or resolved. Using context clues, we can tell that we are looking for a word that most nearly means commendable since the sentence connected by a semicolon to the one containing laudable reads “indeed, we should commend every attempt to protect the mental and physical health of players.” Using this information, we can see that being determined speaks to the nature of the actions while commendable speaks to how an audience should react to the actions. Therefore **(C)** is incorrect. *Blameworthy* means deserving criticism or blame. We know that we are looking for the word that most nearly means worthy of praise. To praise the actions of the NFL and other professional sports leagues is not at all the same as blaming them for their actions. Therefore **(D)** is incorrect. *Satisfactory* means fulfilling the requirements. We know that we are looking for the word that most nearly means worthy of praise. Satisfactory does not adequately express the extent to which the NFL and other professional leagues are reacting to the CTE threat, based on the fact that we should be

commending them. The word merely implies that they are doing the bare minimum to fill requirements. Most things worthy of praise—as a synonym for laudable would be—are above and beyond the satisfactory. Therefore (E) is incorrect because it does not fully express the extent of the groups' efforts.

6) The author's tone in the final paragraph can best be described as

- A. apologetic
- B. depressed
- C. confused
- D. solemn
- E. hopeless

6) D

**Question Type: Global**

An author's tone is directly related to the language, content, and imagery of a passage. In the final paragraph, the author writes, "Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game." A solemn tone is serious. Using the above information, we sense that the author views the potential death of athletes—simply for the sake of a game—as a solemn or serious matter. The author's tone is thus solemn, as the adamant language is used to persuade us that CTE is not just a serious threat to football players' health, but that it could also end their lives. If we look at the syntax—the arrangement of the words—we also see a progression from the less serious (loss of career), to the most solemn consequence (death). This structure furthers the development of the solemn tone in the final paragraph.

Therefore (D) is correct. An apologetic tone conveys a sense of remorse. The final paragraph provides no evidence to indicate that the author feels sorry, or apologetic, for arguing that CTE is a serious threat to football players' health. Instead, language like "Announcers, commentators, television producers, and sportswriters should engage in a collective effort..." indicate the author's confidence in making a call to action. Therefore (A) is incorrect. A depressed tone conveys a sense of extreme sadness. The final paragraph provides no evidence to indicate that the author feels depressed about this situation. The author express some frustration with fans and "the media [for] exalt[ing] such hazardous behavior," but there is nothing that would indicate the author is so sad that he or she feels depressed. Instead, language like "Announcers, commentators, television producers, and sportswriters should engage in a collective effort..." indicate the author's confidence and hope that change is possible. Therefore (B) is incorrect. In the final paragraph, the author articulates precisely how fans and the media perpetuate aggressive, violent hits. There is no information provided in the final paragraph that would indicate that the author feels confused about this topic or how we should react. The last sentence of the passage clearly states that "Players must stop being encouraged to trade their careers, health, happiness, and their lives for the sake of a game." Using this information, we can see that the author knows exactly what needs to happen. Therefore (C) is incorrect. The author makes an argument throughout the passage that is emphasized in the last paragraph. The fact that the argument is being made at all indicates that the author feels hopeful that change is a possibility. Language like, "Announcers, commentators, television producers, and sportswriters should engage in a collective effort..." indicate the author's hope that change is possible. Using this

information, we can see that the author does not feel hopeless about the possibilities of curbing CTE cases, since the final paragraph outlines measures that we can take, as fans, to discourage violent hits in football. Therefore (E) is incorrect.

7) As used in the final paragraph, which is the best antonym for **exalts**?

- A. ignores
- B. misrepresents
- C. praises
- D. reports
- E. criticizes

7) E

**Question Type: Vocabulary**

**exalt** (*verb*): to praise or glorify something or somebody.

In the final paragraph, the author writes, “When the media exalts such hazardous behavior, professionals are rewarded for injuring each other on the field, and amateurs become more likely to try to imitate their favorite NFL athletes.” Using context, we can see that professional players are rewarded when the media exalts their hazardous behavior. We can also use the sentence immediately following it—which suggests an appropriate response—to provide context clues:

“Announcers, commentators, television producers, and sportswriters should engage in a collective effort to cease glorifying brutal plays.” Using this information, we can see that the author believes that “glorifying brutal plays” needs to stop. Thus, using the information above, exalt must mean to reward or to glorify. We know that we are looking for the word that most nearly means the opposite of reward or glorify. *Criticize* means to be critical of, scold, or find flaws with, which is quite opposite of rewarding or glorifying something. Likewise, if the media were critical of the players for hitting violently, the behavior would be less likely to continue. Therefore (E) is correct. Using the information above, we know that we are looking for the word that most nearly means the opposite of reward or glorify. To simply *ignore* the players’ violent hits does not express the opposite of reward or glorify to the same extent. Because it is not an adjective equal in degree to exalt, we know that ignore is not a strong enough opposite.

Therefore (A) is incorrect. Using the information above, we know that we are looking for the word that most nearly means the opposite of reward or glorify. For the media to *misrepresent* the players’ violent hits implies a level of deceit and corruption not accurate in a word that most nearly means the opposite of exalt. Therefore (B) is incorrect because it speaks to the character of the media and not the way they react to the violent hits. *Praises* is a synonym for exalts. We know that we are looking for the word that most nearly means the opposite; therefore (C) is incorrect. *Reports* does not adequately express the opposite of what the media does with footage of violent hits. Simply reporting on the players who make the hits is not as bad as praising them, but it’s also not equally opposite of praising the players. To report something implies an absence of emotion in relaying facts. The word that most nearly means the opposite of praise would have to be somewhat critical to be adequately opposite. Therefore (D) is incorrect.

**8)** In the final paragraph, the author comes to the conclusion, "Modern media's sensationalization effectively makes players commodities of the entertainment industry." Which of the following claims is related to the idea the author communicates in this sentence.

- A. Professional football players are anthropomorphized by the media
- B. Professional football players are revered by the media
- C. Professional football players are archons within the entertainment industry
- D. Professional football players are dehumanized by the media
- E. Professional football players are mistreated by the media

**8) D**

**Question Type: Global**

In this sentence within the final paragraph, the author concludes that the media's tendency to marvel at and showcase violent hits by professional football players naturally leads to disregard for player safety and in doing so strips players of a basic form of human respect. This conclusion is consistent with the statement that players are dehumanized or robbed of their unique humanness and turned into objects only valuable for their ability to entertain fans and media. Therefore, choice **(D)** is correct. Choice **(A)** suggests that players are literally not human but are given human characteristics and personality. This idea contradicts the authors point by suggesting that the media makes players more rather than less human. Choices **(B)** and **(C)** indicate the the media/entertainment industry are serving a positive role for the players which does not reflect the authors statement or the broader tone of the article. Choice **(E)** does indicate that the media does a disservice to players, however this statement is vague and does not communicate the specific way in which the media harms professional football players. These choices are therefore incorrect.

### Appendix L: Selective Exposure Measure

In the following task we are collecting information on preferences for various medical treatments. Please respond to the task as prompted.

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Common health symptoms are often addressed differently by different individuals and it is not unusual for people to have preferences regarding the interventions they choose to utilize to address the symptoms they experience. Headaches, for example, have been treated by over-the-counter analgesics (e.g., non-prescription medications such as acetaminophen/Tylenol, aspirin, ibuprofen/Advil, and an aspirin-acetaminophen-caffeine combination/Excedrin) and relaxation (e.g., rhythmic/deep/visualized breathing, progressive muscle relaxation, imagery). Which of these two choices do you believe is superior and correspondingly which would you be most likely to use to treat a headache?

Over-the-counter analgesics

Relaxation

---

We would like you to have the opportunity to learn more about the previously mentioned headache treatments. We will provide you with the titles of various articles related to the treatments and would like you to let us know which articles you would be interested in viewing. The full articles along with brief, easy to read summaries will be sent to you electronically as soon as you conclude the study. Please select "yes" if you would like to have the article and summary sent to you or "no" if you do not want to have the article and summary sent to you. A series of ten titles will be presented to you. You are welcome to choose to view or not view as many articles as you like.

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Problems associated with the use of over-the-counter analgesics (Blanchard & McCrory, 2014).

Yes

No

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Risk factors of non-prescription medications for headaches (Chesney, 2015).

Yes

No

The clinical benefits of over-the-counter analgesics in treating headaches (Melin, 2013).

Yes

No

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Successful treatment of headaches through the use of non-prescription medications (Mooney & Hannah, 2015).

Yes

No

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Decreased headache symptoms via the use of over-the-counter analgesics (McGrath, Martin, & Evans, 2014).

Yes

No

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Limitations of relaxation training for the management of headaches (Rains and Neff, 2014).

Yes

No

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Liabilities associated with the use of relaxation strategies for headache treatment (Shelton, 2015).

Yes

No

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The successful management of headaches through relaxation (Griffin, 2013).

Yes

No

---

Advantages of using relaxation to treat various types of headache (Goodman & Anderson, 2015)

Yes

No

---

Improved outcomes in headache symptoms using relaxation techniques (Wilson, Turner, & Lake, 2014).

Yes

No

## Appendix M: Primary Study Health Confidence Bias Measure

We'd now like you to complete a task that assesses knowledge. For each question we will ask you to choose one of four answers to a multiple choice question.

After each question we will ask you about your confidence in your answer. Here, you will be able to enter a number between 25% and 100%. 25% would indicate that you are completely unsure (i.e. guessing), while 100% would indicate that you are completely sure. In other words, the number you choose can be seen as the percentage of times you would get that question correct. So, if you said 70%, you would be saying that you think you'd get that question right 70% of the time. Because these questions only have four options, confidence ratings lower than 25% are not appropriate because 25% is what you would get if you were just choosing randomly.

Which spice may boost the effect of radiation treatment and help protect your skin?

- e. Cinnamon
- f. Garlic
- g. Turmeric
- h. All of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What causes colds?

- e. Bacteria
- f. Molds and fungi
- g. Viruses
- h. An allergic reaction

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which body mass index (BMI) category is healthiest?

- e. Anything below obese
- f. Anything below overweight
- g. Anything in the normal range
- h. The low end of the normal range

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

How much of the average person's daily water intake is from food?

- e. 5%
- f. 20%
- g. 50%
- h. 80%

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Most sodium in the typical Western diet comes from:

- e. Processed foods
- f. Salt added at the table
- g. Salt added during cooking
- h. None of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Your bones start to thin at what age?

- e. After 30
- f. After 50
- g. After 65
- h. After 75

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Spot specific fat reduction can trim weight from your:

- e. Arms
- f. Thighs
- g. Abdomen
- h. None of the above

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which of the following helps turn short-term memories into long term-memories?

- e. Exercise
- f. Sleep
- g. Aging
- h. Digestion

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What kinds of cough can be treated with cough medicine?

- e. Asthma
- f. Chronic bronchitis
- g. Cold or flu
- h. Pneumonia

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which of the following is the most common source of lower back pain?

- e. A problem with spine
- f. A problem with muscles
- g. A problem with ligaments
- h. A problem with nerves

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which is worst for your cholesterol?

- e. Coconut milk
- f. Coconut meat
- g. Coconut water
- h. Coconut root

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The number of bacteria in your mouth is closest to the population of which of the following?

- e. New York City
- f. The United States
- g. North America
- h. Earth

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

## Appendix N: Primary Study General Confidence Bias Measure

We'd now like you to complete a task that assesses knowledge. For each question we will ask you to choose one of four answers to a multiple-choice question.

After each question we will ask you about your confidence in your answer. Here, you will be able to enter a number between 25% and 100%. 25% would indicate that you are completely unsure (i.e. guessing), while 100% would indicate that you are completely sure. In other words, the number you choose can be seen as the percentage of times you would get that question correct. So, if you said 70%, you would be saying that you think you'd get that question right 70% of the time. Because these questions only have four options, confidence ratings lower than 25% are not appropriate because 25% is what you would get if you were just choosing randomly.

Our solar system consists of how many known planets?

- e. 13
- f. 8
- g. 12
- h. 9

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

The first Tour de France took place in what year?

- e. 1898
- f. 1915
- g. 1903
- h. 1938

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which triple of notes contains C major?

- e. A-C-B
- f. D-F-A
- g. C-D-G
- h. C-E-G

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Ludwig van Beethoven wrote how many symphonies?

- e. 14
- f. 9
- g. 41
- h. 13

How confident do you feel that you correctly answered the preceding question (25-100%)?  
\_\_\_\_\_

Human cells consist of how many chromosomes?

- e. 32
- f. 46
- g. 38
- h. 23

How confident do you feel that you correctly answered the preceding question (25-100%)?  
\_\_\_\_\_

The human body has how many sense organs?

- e. 4
- f. 5
- g. 6
- h. 7

How confident do you feel that you correctly answered the preceding question (25-100%)?  
\_\_\_\_\_

The sum of all the angles in a triangle is how many degrees?

- e. 360
- f. 60
- g. 90
- h. 180

How confident do you feel that you correctly answered the preceding question (25-100%)?  
\_\_\_\_\_

In which country is the Nobel Peace Prize awarded?

- e. Belgium
- f. Norway
- g. Holland
- h. Sweden

How confident do you feel that you correctly answered the preceding question (25-100%)?  
\_\_\_\_\_

How many letters does the Russian alphabet consist of?

- e. 40
- f. 33
- g. 26
- h. 36

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What is the name of the Greek goddess of wisdom?

- e. Pallas Athena
- f. Nike
- g. Penelope
- h. Aphrodite

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

Which language does the concept “Fata Morgana” come from?

- e. Italian
- f. Arabic
- g. Swahili
- h. Portuguese

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

How many days does a hen need to incubate an egg?

- e. 21
- f. 14
- g. 18
- h. 30

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

What is ascorbic acid?

- e. Apple vinegar
- f. Vitamin C
- g. Vitamin A
- h. Gastric acid

How confident do you feel that you correctly answered the preceding question (25-100%)?

\_\_\_\_\_

## Appendix O: Primary Study Willingness to Comply Measure

*Imagine you have been experiencing chronic pain in your lower back. These symptoms are impacting your functioning and you hope to resolve this issue. You visit a health professional and mention the chronic pain in your lower back. The health professional suggests that you try mindfulness-based meditation to address your symptoms.*

---

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

---

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

---

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you absolutely would have considered the intervention):

\_\_\_\_\_ %

---

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

---

---

*Imagine you have been experiencing shortness of breath. The shortness of breath is impacting your functioning and you hope to resolve the issue. You visit a health professional and mention the shortness of breath. The health professional suggests that you try progressive muscle relaxation (i.e., a technique that involves the systematic tensing and relaxing of specific muscle groups) to address your symptoms.*

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

---

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

---

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you absolutely would have considered the intervention):

\_\_\_\_\_ %

---

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

---

*Imagine you have been experiencing joint pain. The pain is impacting your functioning and you hope to resolve the issue. You visit a health professional and mention the joint pain. The health professional suggests that you try taking fish oil (i.e., fish oil is an orally consumed over the counter medication high in Omega-3 fatty acids) to address your symptoms.*

---

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

---

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

---

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you absolutely would have considered the intervention):

\_\_\_\_\_ %

---

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %

---

*Imagine you have been experiencing fatigue. These symptoms are impacting your functioning and you hope to resolve this issue. You visit a health professional and mention the fatigue. The health professional suggests that you try biofeedback (i.e., a technique where you receive moment-by-moment feedback about your body's functioning in order to learn to better control your body's functioning) to address your symptoms.*

---

How likely is it that you would implement the health professional's suggestion?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* implement the suggestion) to 100% (you absolutely would implement the suggestion):

\_\_\_\_\_ %

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---

How familiar are you with the intervention suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you have absolutely *no* familiarity with the suggested intervention) to 100% (you are completely familiar with the suggested intervention):

\_\_\_\_\_ %

---

How likely is it that you would have considered the intervention if it had not been suggested by the health professional?

Please provide your answer as a percentage ranging from 0% (you absolutely *would not* have considered the intervention) to 100% (you absolutely would have considered the intervention):

\_\_\_\_\_ %

---

How realistic does the presented scenario seem to you?

Please provide your answer as a percentage ranging from 0% (absolutely *unrealistic* and *unbelievable*) to 100% (absolutely realistic and believable):

\_\_\_\_\_ %