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APPROACH-AVOIDANCE AND OPTIMISM

by

Jason Paul Rose

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Psychology
in the Graduate College of
The University of Iowa

July 2009

Thesis Supervisor: Professor Paul D. Windschitl

ABSTRACT

It is a widely assumed principle that organisms reflexively approach possibilities for pleasure and avoid possibilities for pain. However, highly evolved organisms not only reflexively react to future possibilities of pleasure vs. pain, but also evaluate the chance or risk of actually experiencing such possibilities. Given the import of optimism judgments in shaping behavior and other outcomes, the main goal of the current research was to examine the relationship between the rudimentary systems of approach-avoidance that orient us toward possible outcomes in the environment and the higher-order optimism judgments we make when evaluating whether such outcomes are likely to occur. To this end, two experiments examined the impact of approach-avoidance cues in shaping participants' optimism judgments about experiencing positive and negative future life events. For the primary operationalization of approach-avoidance, college student participants engaged in arm flexion (a motor movement associated with approach) or arm extension (a motor movement associated with avoidance) while simultaneously making optimism judgments about experiencing a range of positive and negative events in the future. A secondary operationalization involved correlations computed between participants' chronic personality tendencies related to approach-avoidance (e.g., positive vs. negative affectivity) and their optimism judgments. The results of these experiments revealed complexities in the relationship between approach-avoidance and optimism, suggesting that when, how and why approach-avoidance cues will shape optimism may critically depend upon 1) the specific operationalization of approach-avoidance, 2) how optimism is measured, and 3) characteristics of the outcomes under consideration. Explanations for the complexities in the results are offered, and attempts are made to link the current work to broader theoretical and practical aspects of the connection between approach-avoidance and optimism.

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APPROACH-AVOIDANCE AND OPTIMISM

by

Jason Paul Rose

A thesis submitted in partial fulfillment
of the requirements for the Doctor of
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Graduate College
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Iowa City, Iowa

CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

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Shaun Vecera

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Dhananjay Nayakankuppam

To Michelle

I try to avoid looking forward or backward, and try to keep looking upward.

Charlotte Bronte

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There have been countless individuals who have offered their advice, support, time, and effort into facilitating my progress as a scholar and ultimately shaping the direction of this (and all) of my research while at the University of Iowa. There are three individuals who warrant direct mention here. These three individuals were critical to my success, and I owe them all a tremendous debt of gratitude for shaping my perspective as a scholar/thinker and for providing me with the tools necessary to achieve my goals.

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ABSTRACT

It is a widely assumed principle that organisms reflexively approach possibilities for pleasure and avoid possibilities for pain. However, highly evolved organisms not only reflexively react to future possibilities of pleasure vs. pain, but also evaluate the chance or risk of actually experiencing such possibilities. Given the import of optimism judgments in shaping behavior and other outcomes, the main goal of the current research was to examine the relationship between the rudimentary systems of approach-avoidance that orient us toward possible outcomes in the environment and the higher-order optimism judgments we make when evaluating whether such outcomes are likely to occur. To this end, two experiments examined the impact of approach-avoidance cues in shaping participants' optimism judgments about experiencing positive and negative future life events. For the primary operationalization of approach-avoidance, college student participants engaged in arm flexion (a motor movement associated with approach) or arm extension (a motor movement associated with avoidance) while simultaneously making optimism judgments about experiencing a range of positive and negative events in the future. A secondary operationalization involved correlations computed between participants' chronic personality tendencies related to approach-avoidance (e.g., positive vs. negative affectivity) and their optimism judgments. The results of these experiments revealed complexities in the relationship between approach-avoidance and optimism, suggesting that when, how and why approach-avoidance cues will shape optimism may critically depend upon 1) the specific operationalization of approach-avoidance, 2) how optimism is measured, and 3) characteristics of the outcomes under consideration. Explanations for the complexities in the results are offered, and attempts are made to link the current work to broader theoretical and practical aspects of the connection between approach-avoidance and optimism.

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CHAPTER I

APPROACH-AVOIDANCE, OPTIMISM, AND THEIR CONNECTION

Nineteenth century novelist Anatole France once wrote about the human obsession with future-focused thought, noting "That man is prudent who neither hopes nor fears anything from the uncertain events of the future." Although France might think it is more useful to focus one's thoughts and emotions on the present, it is clear that most of us spend an incredible amount of time, as he put it, hoping and fearing about what's to come. What kinds of outcomes or possibilities do people typically hope to acquire but fear may come true?

At the most fundamental level, most of us want to experience positive future outcomes and avoid experiencing negative outcomes (Armor & Taylor, 1998; Klein & Zajac, 2009; Krizan & Windschitl, 2007; Weinstein, 1980, 1987). The notion that organisms approach pleasurable situations, such as food consumption, sexual activity, social acceptance, or achievement, but avoid painful situations, such as harm from predators, illness, social rejection, or failure, is a core motivational assumption across a range of biological and psychological theories of human thought and behavior (Elliot & Covington, 2001). For instance, approach-avoidance is a key component for theories on animal learning (i.e., reward vs. punishment; Thorndike, 1935), unconscious drives (i.e., pleasure vs. pain; Freud, 1952/1920; see also Higgins, 1997), human judgment and decision making (i.e., gain-seeking vs. loss-aversion; Kahneman & Tversky, 1979), self-regulation (i.e., promotion-focus vs. prevention-focus; Higgins, 1997), personality (i.e., extraversion vs. neuroticism; Elliot & Thrash, 2002; Watson, Wiese, Vaidya, & Tellegen, 1999), and evolutionary adaptation (i.e., responses to opportunities vs. threats; Lazarus, 1991). Furthermore, some suggest we evolved two distinct motivational systems in the brain that serve different needs for an organism: an activation system that moves an organism toward rewards and an inhibition system that moves an organism away from threat (cf. Carver & White, 1994; Fowles, 1987; Gray, 1987, 1990, 1994).

However, it is clear from the opening quote that we not only reflexively approach pleasurable possibilities and avoid painful ones, we have also evolved the ability to think about such possibilities before they do or do not happen (Gilbert & Wilson, 2008). That is, we can judge the chance or risk of experiencing future possibilities, and such assessments can have a profound influence on our behaviors and psychologically-relevant outcomes (cf. Fishburn, 1988; Janz & Becker, 1984; Klein & Zajac, 2009; Mellers & McGraw, 2001; Taylor & Brown, 1988; Weinstein, 1988). The current research examined how the rudimentary motives, emotions, and physical actions that "pull" us toward positive possibilities vs. "push" us away from negative possibilities interface with higher-order optimism judgments about experiencing such positive and negative possibilities. The next three sections provide more detail about the concepts of 1) approach-avoidance, 2) optimism, and 3) the intersection of the two.

Approach-Avoidance

The notions of approach and avoidance have been discussed for centuries (e.g., James, 1950; see review in Elliot & Covington, 2001). The key premise is that humans and other organisms have fundamental tendencies to approach desirable end states and avoid undesirable end states (cf. Elliot & Thrash, 2002; Higgins, 1997). Moreover, psychologists have proposed that we evolved two distinct motivational systems that aid in the adaptive regulation of emotions, cognitions, and behaviors aimed at coping in an environment where positive and negative possibilities are in constant flux (Carver & White, 1994; Fowles, 1987; Gray, 1987, 1990, 1994). First, the *behavioral activation system* (BAS) is primarily oriented toward self-enhancement, a desire for pleasure, and the presence or absence of reward. Moreover, the BAS has been described as constituting a neurobiological sensitivity to positive stimuli or possibilities, which is accompanied by a series of emotions, cognitions and behaviors aimed at moving an organism toward such stimuli or possibilities. Second, the *behavioral inhibition system* (BIS) is oriented toward self-protection, vigilance for pain, and the presence or absence

of threat. Moreover, the BIS has been described as constituting a neurobiological sensitivity to negative stimuli and possibilities, which is accompanied by a series of emotions, cognitions and behaviors aimed at moving an organism away from such stimuli or possibilities (Cunningham, Raye, & Johnson, 2005; Elliot & Thrash, 2002; Watson et al., 1999).

There are a number of ways in which researchers have empirically examined the strength or presence of approach vs. avoidance systems. Some work has focused on the neurochemical and neurobiological aspects of these two systems, and how the brain reacts differently when pursuing appetitive vs. withdrawal goals, such as consuming food vs. escaping a shock (cf. Cunningham et al., 2005; Gray, 1987, 1990, 1994). Other work has focused on chronic personality traits, emotions, or temperaments that can be reduced to underlying tendencies for approach vs. avoidance. For instance, the personality traits of extraversion, curiosity, reward sensitivity, and general positive affectivity have been linked to the approach system, whereas neuroticism, anxiety, punishment sensitivity, and general negative affectivity have been linked to the avoidance system (Carver & White, 1994; Elliot & Thrash, 2002; Watson et al, 1999; see also Robinson, Wilkowski, & Meier, 2007; Zelenski & Larsen, 2002).

Moreover, both the biologically- and personality- based approaches assume these systems are critical for survival and are a fundamental feature of most organisms. In fact, these tendencies are so ingrained that merely engaging in an approach- or avoidance-related motor action can activate these motivational systems and have a profound influence on cognitive and emotional processing (e.g., Cacioppo, Priester, & Bernston, 1993; Chen & Bargh, 1999; Forster & Friedman, 2008; Forster & Stepper, 2000; Friedman & Forster, 2000). For instance, flexing one's arm toward the body is associated with consuming desirable stimuli or possibilities, whereas extending one's arm away from the body is associated with evading undesirable stimuli or possibilities. Cacioppo and colleagues (1993) reasoned that a lifetime of physically approaching good

things and avoiding bad things results in a classically conditioned association between approach actions and positive stimuli vs. avoidance actions and negative stimuli. Moreover, activation of these differential systems via approach vs. avoidance motor actions has been linked to various aspects of cognitive and emotional processing.

For example, people are faster to categorize positive stimuli while engaging in arm flexion, but are faster to categorize negative stimuli while engaging in arm extension. Categorization response times are typically inhibited when motor actions and the valence of the stimuli are incompatible (see Chen & Bargh, 1999; Neumann & Strack, 2000). Likewise, Centerbar, Schnall, Clore, & Garvin (2008) showed that when affectively-related material from a story was compatible with one's experiential cues from flexion or extension, there was enhanced recall for the material relative to when there was incompatibility (see also Forster & Strack, 1997). One explanation for such categorization and recall effects is that engaging in a particular motor response associated with specific motivational systems primes an organism to attend to aspects of the environment associated with rewards vs. threats, hence facilitating recall and categorization for such information. Consistent with this idea, arm flexion vs. extension differentially influence whether people engage in carefree vs. careful processing styles when solving analytical problems, suggesting a benign vs. threatening appraisal of the environment (Friedman & Forster, 2000, 2005; Gawronski, Deutsch, & Strack, 2005; Riis & Schwarz, 2003). Finally, in addition to influencing categorization, processing style, and memory, these motor movements have also been shown to influence evaluation. For instance, participants who flexed their arms while viewing initially desirable stimuli (e.g., pleasant-looking Chinese characters, attractive consumer products) rated these stimuli even more positively than participants in control and arm extension conditions. Contrariwise, participants who extended their arms while viewing initially undesirable stimuli (e.g., unpleasant-looking Chinese characters, unattractive consumer products)

rated these stimuli even more negatively than participants in control and arm flexion conditions (Cacioppo et al., 1993; Forster, 2004; although see Centerbar & Clore, 2006).

Thus far, I have described the influence of approach and avoidance systems on cognitive and emotional processing as operating at a very low level, such as having an effect on attentional search processes, categorization, and memory. However, in modern humans these systems may also influence higher-order psychological judgment and decision-making (Carver & White, 1994; see also Clore & Gasper, 2000; Lauriola & Levin, 2001; Lauriola, Russo, Lucidi, Violani, & Levin, 2005; Schwarz, 1990, 1998, 2006; Schwarz & Clore, 1996). Moreover, Elliot & Covington (2001) suggest that organisms with higher-order cognition can sometimes override initial impulses for reflexive appetitive and withdrawal behaviors. For example, a delectable chocolate dessert may initially evoke approach motives and actions, but this can be overridden by thoughts about the likelihood of weight gain that ultimately engage the withdrawal system. The main point here is that it is important to understand how the activation of rudimentary approach and avoidance systems might interface with higher-order judgment and decision making. More specifically, the current research examined the influence of approach vs. avoidance actions and traits on people's judgments of optimism about experiencing positive vs. negative future outcomes. The link between the concepts of approach-avoidance and optimism will be discussed in more detail later, but first I will broadly discuss the concept of optimism.

Optimism about the Future

Humans are constantly focused on what their futures hold. Importantly, whether people are optimistic or pessimistic about uncertain outcomes can have a profound influence on people's actual futures, experiences, intentions, decisions, and actions (cf. Armor & Taylor, 1998; Fishburn, 1988; Janz & Becker, 1984; Kahneman & Tversky, 1979; Mellers & McGraw, 2001; Olson, Roese, & Zanna, 1996; Weinstein, 1988). For example, future-directed thoughts are an important determinant of anxiety and depression

(Ahrens & Haaga, 1993), illness recovery (Taylor & Brown, 1988), preparation to achieve a gain or prevent a loss (Forster, Grant, Idson, & Higgins, 2001), and risk-taking behaviors (Weinstein, 1988). In fact, contrary to the attitude of the novelist in the opening quotation, thinking about and planning for the future has been a key survival tool in our evolutionary history (cf. Gilbert & Wilson, 2008).

There are numerous ways that researchers have studied future-directed thinking, most of which focus on whether people are optimistic or pessimistic (for overviews see Armor & Taylor, 1998; Buehler, Griffin, & Ross, 2002; Helweg-Larsen & Shepperd, 2001; Klein & Zajac, 2009; Weinstein & Klein, 1996). The most common approach to studying optimism is to examine whether one's generalized expectancies are optimistic or pessimistic (Dember, Martin, Hummer, Howe, & Melton, 1989; Scheier & Caver, 1985; Scheier, Carver, & Bridges, 1994). However, more relevant to the current research, a second approach to studying optimism is to examine what might be termed *situation-specific optimism* (Klein & Zajac, 2009). For example, studies have asked participants to make specific predictions about exam performances, tax completion times, the longevity of romantic relationships, work success, the outcomes of sporting events, and illness susceptibility (e.g., Armor & Sackett, 2006; Bar-Hillel, Budescu, & Amar, 2008; Buehler, Griffin, & MacDonald, 1997; Buehler, Griffin, & Ross, 1995; Irwin, 1953; Price, 2000; Weinstein, 1980, 1987).

In the current research, I will focus on people's optimism judgments about experiencing a range of specific positive and negative future life events (e.g., living past the age of 80, developing cancer). In the vast literature that has examined people's judgments about their chances of experiencing various outcomes, the predominant conclusion appears to be that people are quite optimistic. Indeed, hundreds of studies have documented that people typically report being more likely to experience positive than negative future outcomes, and that people believe this to be more true for themselves than for other people (see reviews in Armor & Taylor, 1998; Chambers & Windschitl,

2004; Helweg-Larsen & Shepperd, 2001; Krizan & Windschitl, 2007). Moreover, there are also many occasions when people's predictions are more optimistic than is warranted by objective indicators or actual outcomes, such as when people underestimate the time it will take to complete certain tasks (for review see Buehler et al., 2002).

A number of theories and factors appear to account for so-called optimistic biases. For instance, some work has focused on motivations to preserve self-esteem, maintain pleasant moods, facilitate interpersonal liking, and encourage goal pursuit (e.g., see Helweg-Larsen, Sadeghian, & Webb, 2002; Regan, Snyder, & Kassim, 1995; Segerstrom, Taylor, Kemeny, & Fahey, 1998; Taylor & Brown, 1988). Other work has focused on cognitive factors, such as heuristics and information processing biases (see reviews in Chambers & Windschitl, 2004; Krizan & Windschitl, 2007). Still other work has focused on the role of personality and individual difference factors in shaping whether a person shows optimistic biases (e.g., Harris, Griffin, & Murray, 2008).

The current work can be viewed in the context of other work examining the role of chronic and temporary subjective experiences in shaping optimism (see also Clore & Gasper, 2000; Lerner & Gonzalez, 2005; Schwarz, 1990, 2006; Schwarz & Clore, 1996). In particular, the current experiments examined how rudimentary approach-avoidance signals or experiences might shape people's likelihood judgments about future positive and negative outcomes. Notably, there is a connection between the way that optimism biases have been described and the overall concept of approach-avoidance. In particular, the predominant tendency for people to have inflated likelihood judgments about experiencing desirable outcomes but deflated likelihood judgments about experiencing undesirable outcomes seems highly consistent with the aforementioned notion that we reflexively approach pleasure but avoid pain. This potential connection, which is discussed in more detail below, was the main impetus for conducting the current research.

The Connection between Approach-Avoidance and Optimism

Two primary conclusions from the preceding sections can be summarized in the following way. First, we have an approach system that is associated with processing and judgment for positive possibilities and an avoidance system that is associated with processing and judgment for negative possibilities. Second, people judge that they are more likely to experience positive possibilities than negative possibilities. I will first note three, broad connections between the ways that these two ideas have been formulated, suggesting the potential for approach-avoidance cues to play a role in shaping optimism judgments. A later section articulates the specific hypotheses for the current research.

First, various conceptualizations of approach-avoidance actually allude to future-directed thought. For instance, the approach system has been described as involving feelings of hope and optimism about the future, whereas the avoidance system has been described as involving feelings of worry, anxiety, and pessimism (Gable et al., 2000; Gray, 1987, 1990, 1994). A related idea is that classifying an individual as depressed (a condition associated with low approach sensitivity) vs. anxious (a condition associated with high avoidance sensitivity) critically involves the presence of hopelessness vs. fear about the future (Abramson, Metalsky, & Alloy, 1989; Ahrens & Haaga, 1993; Andersen, Spielman, & Bargh, 1992; Clark and Watson, 1991; Clark, Watson, & Mineka, 1994; MacLeod & Byrne, 1996; MacLeod, Byrne, & Valentine, 1996; MacLeod, Tata, Kentish, & Jacobsen, 1997; Miranda & Mennin, 2007).

Second, in the health psychology literature, approach-avoidance coping strategies are sometimes described in conjunction with the concept of future-directed thought. For instance, one can cope with illness by actively hoping that positive outcomes are likely or by reframing a situation to make a positive outcome seem attainable. On the other hand, one can also cope via avoidant strategies that may involve denying the potential for negative outcomes (Carver & Scheier, 1981; Rasmussen, Wrosch, Scheier, & Carver, 2006; Scheier & Carver, 1985, 2003). Relatedly, dispositional optimists are more likely

to use approach-oriented coping strategies and less likely to use avoidance-oriented coping strategies than are dispositional pessimists (Solberg Nes & Segerstrom, 2006) (for general reviews on approach-avoidance coping, see Gol & Cook, 2004; Gutierrez, Peri, Torres, Caseras, & Valdes, 2007; Suls & Fletcher, 1985).

Third, optimism biases are sometimes described with implicit reference to approach-avoidance. For instance, when a person reports that positive outcomes are likely, this may be viewed as the person cognitively "approaching" the possibility by verifying its chance of happening. On the other hand, when a person reports that negative outcomes are unlikely, this may be viewed as the person cognitively "avoiding" the possibility by rejecting its chance of happening (see similar arguments in Lench, 2009).

In sum, there are broad conceptualizations of approach-avoidance that directly reference the notion of future-directed thought or optimism (and vice versa). The critical question for my purposes was how approach- and avoidance- related cues from motor signals and chronic traits might specifically influence the optimism judgments people make about experiencing positive and negative future life events. In the next section, I provide more detail about the goals of this research, discuss the operationalizations of approach-avoidance, and outline the main hypotheses.

Current Research

Goals and Operationalizations

The goal of this research was to examine the relationship between approach-avoidance and people's optimism judgments. Approach-avoidance was operationalized in two different ways. The primary operationalization was to use arm flexion vs. extension motor movements as triggers for the approach vs. avoidance motivational systems. In these experiments, participants judged whether a range of positive and negative life events might happen while simultaneously engaged in an approach-related motor movement associated with bringing something positive toward oneself or an

avoidance-related motor movement associated with pushing something negative away from oneself. As stated previously, there has been a wealth of research showing that simply engaging arm flexion vs. extension can have a profound influence on cognitive and emotional processing, suggesting the triggering of approach vs. avoidance systems (for an overview see Neumann, Forster, & Strack, 2003).

A secondary operationalization of approach-avoidance involved chronic dispositions or traits that have been linked to these dimensions (Carver & White, 1994; Elliot & Thrash, 2001; Watson et al., 1999; Zelenski & Larsen, 2002). In particular, there were two core traits that were used in the current experiments, each of which could be orthogonally separated into general tendencies for approach vs. avoidance sensitivity. First, participants' general sensitivity to threats vs. rewards was assessed using the Behavioral Inhibition and Activation Systems measure (BIS-BAS; Carver & White, 1994). Second, participants' general tendencies to experience positive affect vs. negative affect was assessed using the Positive and Negative Affectivity Schedule (PANAS; Watson, Clark, & Tellegen, 1988).

The current experiments were designed to examine how the activation of approach vs. avoidance systems would impact people's likelihood judgments. In Experiment 1, participants judged their chances of experiencing a range of future life outcomes on 7-point likelihood scales (1=*not at all likely*; 7=*very likely*). Some of the events were positive in valence (e.g., "You will live past the age of 80"), some were negative in valence (e.g., "You will develop cancer"), and some were neutral in valence (e.g., "You will own a white car"). Critically, while making these assessments of likelihood, participants either flexed their arms toward their body by pulling up on a table, extended their arms away from their body by pushing down on a table, or were in a control condition (for similar manipulations, see Cacioppo et al., 1993; Forster, 2003, 2004; Friedman & Forster, 2002; Neumann & Strack, 2000; Riis & Schwarz, 2003; van Prooijen, Karremans, & van Beest, 2006). Participants also provided self-report ratings

on the aforementioned approach-avoidance personality traits. Although I have already alluded to the broad connections between approach-avoidance and optimism, the next section outlines specific hypotheses for this research.

Hypotheses

Although there has not heretofore been any systematic research fully addressing these issues, I will outline three theoretical accounts based on logic and relevant extant work. In particular, I will first outline the primary account for the results – the *compatibility-incompatibility account*. Although results following this account were expected, I also consider two competing accounts that also had some plausibility – the *general-outlook account* and the *effective action account*.

Compatibility-Incompatibility Account

The first possibility was that the activation of approach vs. avoidance systems would have very specific influences on likelihood judgments, based upon whether the valence of the event was compatible or incompatible with the underlying system. As alluded to in a previous section, approach and avoidance are often conceptualized as having valence-specific functions, where the approach system is most highly associated with processing and judgment for positive events and the avoidance system is most highly associated with processing and judgment for negative events (see Cacioppo et al., 1993; Centerbar et al., 2008; Forster & Friedman, 2008; Friedman & Strack, 2000). For the current research, this suggests that an active approach system should make people especially sensitive to the possibility for positive outcomes, but have no influence on responses to negative or neutral outcomes. Likewise, an active avoidance system should make people especially sensitive to the possibility for negative outcomes, but have no influence on responses to positive or neutral outcomes. The specific predictions based on this account can be described as follows.

First, consider the situation where there is high activation of the approach system via arm flexion. Activation of the approach system should make thoughts and evidence

relevant to positive outcomes much more salient than in other conditions in the experiment (i.e., arm extension and resting conditions), which should increase people's perceptions that such outcomes will occur. Likewise, activation of the avoidance system via arm extension should make thoughts and evidence relevant to negative outcomes more salient and hence increase people's perceptions that such outcomes will occur. In short, engaging in a motor action that is compatible, as opposed to incompatible, with the valence of the event should make the event particularly easy to think about and, hence, seem more certain to occur (cf. Koehler, 1991; Raune, MacLeod, & Holmes, 2005; Schwarz, 1998; Schwarz & Clore, 1996; Schwarz et al., 1991; Sherman, Cialdini, Schwartzman, & Reynolds, 1985). See Appendix A for a graphical display of this prediction.

Second, similar predictions can be formulated for the results involving chronic tendencies for approach-avoidance and their correspondence with likelihood judgments. For instance, consider someone who is chronically high in approach sensitivity, such as having high scores on positive affectivity. The *compatibility-incompatibility account* would suggest that someone high in approach sensitivity should be chronically sensitive to positive outcomes, which should make information about such outcomes more salient and hence seem more likely. This predicted pattern would emerge as a positive correlation between trait measures of approach and likelihood judgments for positive events. Critically for this account, trait measures of approach should be uncorrelated with likelihood judgments for negative and neutral events – events that are incompatible with the underlying approach dimension. The opposite pattern of results should be true when considering chronic avoidance sensitivity, such as having high scores on negative affectivity. In particular, someone high in avoidance sensitivity should be chronically sensitive to negative (but not positive or neutral) outcomes, which should make such outcomes more salient and hence seem more likely. This predicted pattern would emerge as a positive correlation between trait measures of avoidance and likelihood judgments

for negative events, whereas trait measures of avoidance should be uncorrelated with likelihood judgments for positive and neutral events. See Appendix B for a graphical display of this hypothesis.

To support this theoretical position, there is scattered evidence that is consistent with this account. For instance, a few studies have shown that approach emotions, such as curiosity, are more correlated with judgments about positive outcomes than negative outcomes. On the other hand, a person's experience of avoidance emotions, such as fear, have been shown to be more correlated with judgments about negative outcomes than positive outcomes (Maner & Gerend, 2008; Peters & Slovic, 2000; for related see DeSteno, Petty, Wegener, & Rucker, 2000). Conceptually similar evidence involves likelihood judgments made by anxious and depressed individuals. Critically for the current discussion, anxiety has been conceptualized as involving high avoidance emotions, whereas depression has been conceptualized as involving both high avoidance emotions and low approach emotions (Clark and Watson, 1991; Clark et al., 1994). Although both anxious and depressed individuals are more pessimistic than control participants, the *compatibility-incompatibility account* suggests that one's degree of anxiety should only correlate with likelihood judgments for negative events, whereas one's degree of depression should correlate with both likelihood judgments for positive events and negative events. This is precisely what has been found (Miranda & Mennin, 2007; see also Andersen et al., 1992; MacLeod & Byrne, 1996; Strunk, Lopez, & DeRubeis, 2006). Thus, consistent with most conceptualizations of approach-avoidance (see Elliot & Thrash, 2002; Watson et al., 1999), overall this account suggests that the activation of the approach system will be associated with increased sensitivity to, and likelihood judgments about, positive outcomes/rewards, whereas the avoidance system will be associated with sensitivity to, and likelihood judgments about, negative outcomes/threats.

General-Outlook Account

Although the *compatibility-incompatibility account* is the preferred theoretical account for the current research, there are also two additional accounts that seem plausible. The first of these is the *general-outlook account*. As the name implies, this account suggests that the activation of approach vs. avoidance systems will change people's outlooks or likelihood judgments about the future in a very general manner. More explicitly, this account suggests that the activation of the approach system will tend to bring up evidence or information relevant to the notion that both good things are likely and that bad things are unlikely. On the other hand, the activation of the avoidance system will tend to bring up evidence or information relevant to the notion that both bad things are likely and that good things are unlikely. The specific predictions based on this account can be described as follows.

First, consider the situation where there is high activation of the approach system via arm flexion. This account would suggest that the activation of this system should make experienced thoughts and emotions generally positive, which might cause likelihood judgments for positive events to be higher than in other conditions and likelihood judgments for negative events to be lower than other in conditions (i.e., relative to arm extension and relaxed arm conditions). On the other hand, high activation of the avoidance system via arm extension should make experienced thoughts and emotions generally negative, which might cause likelihood judgments for negative events to be higher than in other conditions and likelihood judgments for positive events to be lower than in other conditions (i.e., relative to arm flexion and resting conditions). See Appendix A for a graphical display of this prediction.

Second, similar predictions can be formulated for the results involving chronic tendencies for approach-avoidance and their correspondence with likelihood judgments. For instance, consider someone who is chronically high in approach sensitivity, such as having high scores on positive affectivity. The *general-outlook account* would suggest

that someone high in approach sensitivity generally experiences more positive thoughts and emotions, which might be associated with more optimism about experiencing good events and not experiencing bad events. This predicted pattern would emerge as a positive correlation between trait measures of approach and likelihood judgments for positive events and a negative correlation between trait measures of approach and likelihood judgments for negative events. The opposite pattern of results should be true when considering chronic avoidance sensitivity, such as having high scores on negative affectivity. In particular, someone high in avoidance sensitivity might chronically experience more negative thoughts and emotions, which might be associated with more pessimism about experiencing bad events and not experiencing good events. This predicted pattern would emerge as a negative correlation between trait measures of avoidance and likelihood judgments for positive events and a positive correlation between trait measures of avoidance and likelihood judgments for negative events. Likelihood judgments about neutral events would not be expected to relate to approach-avoidance trait measures. See Appendix B for a graphical display of this hypothesis.

To support this theoretical position, there is scattered evidence consistent with this account as well. For instance, there are many studies in which researchers have manipulated moods to be positive or negative and then measured the impact on likelihood judgment. A common finding is that approach-related mood inductions, such as happiness and anger, tend to inflate likelihood judgments about positive events and deflate likelihood judgments about negative events (relative to control conditions). On the other hand, avoidance-related mood inductions, such as sadness and fear, tend to inflate likelihood judgments about negative events and deflate likelihood judgments about positive events (relative to control conditions) (e.g., Johnson & Tversky, 1983; Lerner & Gonzalez, 2005; Lerner & Keltner, 2001; Salovey & Birnbaum, 1989; Wright & Bower, 1992). One explanation for such effects is that approach cues and moods (e.g., happiness) cause future-focused appraisals to be certain and controllable and hence

generally produce optimism. On the other hand, avoidance cues and moods (e.g., fear) cause future-focused appraisals to be uncertain and uncontrollable and hence generally produce pessimism (Lerner & Gonzalez, 2005; Lerner & Keltner, 2001; see also Lerner & Keltner, 2000). A conceptually similar result comes from Zelenski & Larsen (2002), where they showed that the degree to which people experienced approach-relevant traits, such as positive affect, had predictive utility for judgments about both positive and negative events. Likewise, the degree to which people experienced avoidance-relevant traits, such as negative affect, also had some predictive utility for judgments about both positive and negative events (see related result in Coats, Janoff-Bulman, & Alpert, 1996).

Effective Action Account

The second of the alternative accounts to the c*ompatibility-incompatibility account* is the *effective action account*. Like the *compatibility-incompatibility account*, this account presumes that the activation of approach vs. avoidance systems will have very specific influences on likelihood judgments, based upon whether the valence of the event is compatible or incompatible with the underlying system. Said differently, an active approach system should make people especially sensitive to the possibility for positive outcomes, but have no influence on responses to negative or neutral outcomes. Likewise, an active avoidance system should make people especially sensitive to the possibility for negative outcomes, but have no influence on responses to positive or neutral outcomes. However, the exact nature of the influence on likelihood judgments is somewhat different here than with the *compatibility-incompatibility account*. The specific predictions based on this account can be described as follows.

First, consider the situation where there is high activation of the approach system via arm flexion. This account suggests that the activation of the approach system should make desirable possibilities seem particularly attractive and attainable (relative arm extension and resting conditions), which should increase people's perceptions that such outcomes will occur. The underlying idea here is that sensory input associated with

"pulling" a positive outcome toward the self is quite effective in making people believe such an outcome is likely, perhaps because it now feels close to the self. On the other hand, activation of the avoidance system via arm extension should make undesirable possibilities seem particularly unattractive (relative to arm flexion and resting conditions), which should lead people to deny the possibility for such an outcome to occur. The underlying idea here is that sensory input associated with "pushing" a negative outcome away from the self is quite effective in making people believe such an outcome is unlikely, perhaps because it now feels distant from the self. This account is called the *effective action account* because engaging in an *action* that is compatible with the valence of the event will be *effective* at allowing a person to feel that they can procure desirable rewards (by pulling such rewards close) and avoid undesirable threats (by pushing such threats away). See Appendix A for a graphical display of this hypothesis.

Second, similar predictions can be formulated for the results involving chronic tendencies for approach-avoidance and their correspondence with likelihood judgments. For instance, consider someone who is chronically high in approach sensitivity, such as having high scores on positive affectivity. The *effective action account* would suggest that someone who is chronically high in approach sensitivity should find positive outcomes to be particularly attractive and attainable, which should inflate likelihood judgments about such outcomes. This predicted pattern would emerge as a positive correlation between trait measures of approach and likelihood judgments for positive events. As with the *compatibility-incompatibility account*, trait measures of approach would be expected to be uncorrelated with likelihood judgments for negative and neutral events. Now consider someone who is chronically high in avoidance sensitivity, such as having high scores on negative affectivity. The *effective action account* would suggest that someone who has high avoidance sensitivity should find negative outcomes to be particularly unattractive and attainable, which should lead to defensive denial and deflated likelihood judgments about such outcomes. This predicted pattern would

emerge as a negative correlation between trait measures of avoidance and likelihood judgments for negative events. As with the *compatibility-incompatibility account*, trait measures of avoidance would be expected to be uncorrelated with likelihood judgments for positive and neutral events. See Appendix B for a graphical display of this hypothesis.

To support this theoretical position, there is also scattered evidence consistent with this account. First, as previously mentioned, several studies have shown that participants engaging in arm flexion rate initially positive stimuli as even more desirable than participants in control conditions. On the other hand, participants engaging in arm extension rate initially negative stimuli as even less desirable than participants in control conditions. However, arm flexion does not change evaluations of negative stimuli relative to controls, and arm extension does not change evaluations of positive stimuli relative to controls (Cacioppo et al., 1994; Forster, 2004; although see Centerbar & Clore, 2006). This is important given that numerous studies have discussed the idea that people are prone to desirability biases, where people inflate likelihood judgments for an outcome as it increases in perceived desirability (Lench, 2009; Lench & Ditto, 2008; Price, 2000; Windschitl, Smith, Rose, & Krizan, under review; although see Krizan & Windschitl, 2007). If flexion vs. extension change perceptions of desirability for a relevant positive vs. negative outcome, respectively, then this might also change perceptions of likelihood for such outcomes. Moreover, descriptions of optimism or desirability biases appear to reference the concept of approach-avoidance by suggesting that people cognitively "approach" positive outcomes by inflating likelihood judgments but "avoid" negative outcomes by deflating likelihood judgments. Consistent with this logic, Lench (2009) recently showed that the activation of the approach system from incidental affect (e.g., subconsciously presented positive images) inflated likelihood judgments about experiencing positive events. On the other hand, activation of the avoidance system from incidental affect (e.g., subconsciously presented negative images) deflated likelihood

judgments about experiencing negative events (see related results in Lench & Ditto, 2008; Windschitl et al., under review). The logic here is that incidental positive affect should make positive events seem particularly attractive and produce greater desires to "approach" such events by acknowledging their chance of occurrence. On the other hand, incidental negative affect should make negative events seem particularly unattractive and produce greater desires to "avoid" such events by denying their chance of occurrence.

CHAPTER II

TESTING THE RELATIONSHIP BETWEEN APPROACH-AVOIDANCE TRAITS/ MOTOR SIGNALS AND OPTIMISM ABOUT FUTURE LIFE EVENTS

Overview

The primary goal of Experiment 1 was to examine the causal influence of approach-avoidance motor cues on likelihood judgment. Participants were first provided with a cover story involving brain hemisphere activity and cognitive processing, where they were told that a common way to engage hemisphere-specific brain activity was to manipulate motor movements. At a critical point in the experiment, participants either flexed their arms by pulling up on a table (an action associated with approach), extended their arms by pushing down on a table (an action associated with avoidance), or relaxed their arms by placing them across their laps (a control condition). Importantly, while engaged in the relevant motor movement, participants simultaneously made likelihood judgments about experiencing 6 positive, 6 negative, and 6 neutral events in the future. This primary analysis for the experiment was conducted on the mean likelihood judgments across a 3 (arm position: flexion, extension, or relaxed) X 3 (event type: positive, negative, or neutral) mixed design, with the last factor manipulated within subjects.

A secondary goal for Experiment 1 involved the relationship between people's chronic approach-avoidance tendencies and their likelihood judgments. After the main procedures described above were completed, participants provided self-ratings about their dispositional tendencies to experience the following approach and avoidance related emotions and motivations: 1) reward vs. threat sensitivity (i.e., BAS vs. BIS; Carver & White, 1994) and 2) positive vs. negative affectivity (Watson et al., 1988). This secondary goal involved an examination of correlations between these trait measures and likelihood judgments made for the 3 types of events.

As stated previously, the main hypothesis for the results followed from the *compatibility-incompatibility account*. This was tested against two additionally plausible accounts: the *general-outlook* and *effective action accounts*. Appendices A and B display graphical representations of these accounts.

Method

Participants and Design

125 students from an Elementary Psychology course at the University of Iowa served as participants in order to satisfy a class requirement. The design was a 3 (arm position: flexion, extension, or relaxed) X 3 (event valence: positive, negative, or neutral) mixed design, with the last factor manipulated within subjects.

Procedure and Dependent Measures

Upon arrival to the lab and after completing informed consent documents, participants were told they were in a study about the effects of left vs. right brain hemisphere activity on cognitive processing and judgment. Participants were also told that they had been "randomly assigned" to be in a right hemisphere condition and that a standard way to promote activity in this hemisphere was to assume a particular body position (participants in the relaxed arm conditions were told they were in a control condition). The experimenter then demonstrated the arm flexion, arm extension, or relaxed arm position (depending upon condition). For the arm flexion position, participants pressed their left palm underneath the table, keeping their arms at a 90 degree angle, and pulling upwards lightly. For the arm extension position, participants pressed their left palm on top of the table, keeping their arms at a 90 degree angle, and pushing downwards lightly. For the relaxed position, participants placed their left arms across their laps.[1]

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[1] This cover story and manipulation have been used in dozens of studies, by different research groups, and produce relatively healthy effects across a range of dependent measures (see e.g., Cacioppo et al., 1993; Centerbar & Clore, 2006; Centerbar et al., 2008; Forster, 2004; Friedman & Forster, 2002; Gawronski et al., 2005; Neumann & Strack, 2000; Riis & Schwarz, 2003; van Prooijen et al., 2006).

After reading basic instructions on the computer, participants were told that they would soon make judgments about a series of life events that may or may not happen to them in the future. Before beginning this judgment task, participants were prompted by the computer to place their left arms into the position demonstrated earlier by the experimenter and to use their free hand to operate the mouse. While assuming the relevant arm position, participants made likelihood and desirability judgments about experiencing 18 future life events. Six of these events were positive in valence (e.g., "You will have a long and happy marriage"), 6 of the events were negative in valence (e.g., "You will be injured in a car crash), and 6 of the events were neutral in valence (e.g., "You will go on a trip to Texas").[2] See Appendix C for all events.

For the main dependent measure, participants judged their likelihoods for experiencing the events. In particular, while maintaining the relevant arm position, participants judged how likely each event was to happen to them in the future on 7-point scales (1=*not at all likely*; 7=*very likely*). Likelihood judgments for the 18 events were made one at a time and in a randomly presented order. While still in the relevant arm position, participants also answered what might be considered a manipulation check for the valence of the selected events. More explicitly, participants judged the desirability of experiencing each of the 18 events on 7-point scales (1=*not at all desirable*; 7=*very desirable*). During this entire phase of the study, participants were encouraged to do their best to maintain the arm position but were allowed to rest their arms periodically.

Following the main task, participants returned to a comfortable arm position and answered a number of supplemental questions. The first set of measures included commonly used items to establish whether there are different experiences associated with arm flexion vs. extension. First, participants rated their current mood using the Positive

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[2] Note that the specific positive, negative and neutral events were derived from previous work (see Price, Smith, & Lench, 2006; Weinstein, 1980, 1987), where I attempted to select events that were balanced across the 3 valence types in terms of frequency and controllability.

and Negative Affectivity Schedule (PANAS; Watson et al., 1988). The PANAS is a self-report scale of mood with 20 items that assess the current intensity of positive (e.g., alertness, activity) and negative affect (e.g., anger, fear). More explicitly, participants rated the extent to which they were currently experiencing each mood term on 5-point scales (1=*very slightly or not at all*; 5=*extremely*). Second, participants estimated how much effort it took to maintain the arm position (1=*not at all effortful*; 7=*very effortful*). Third, participants estimated how comfortable the arm position was (1=*not at all comfortable*; 7=*very comfortable*).

For the second set of supplemental measures, participants answered questions about their personality traits. Specifically, participants' general sensitivity to reward vs. punishment was assessed using the Behavioral Inhibition and Activation Systems measure (BIS-BAS; Carver & White, 1994). The BIS-BAS is a self-report scale in which participants rate their extent of agreement to 20 statements related to their general orientation or sensitivity toward desirable outcomes (e.g., "When I want something, I usually go all-out to get it", "I go out of my way to get things I want") vs. undesirable outcomes (e.g., "Criticism or scolding hurts me quite a bit", "I worry about making mistakes"). For analysis purposes, the former set of responses was collapsed into an index of reward sensitivity (BAS; α=.62) and the latter set of responses was collapsed into an index of punishment sensitivity (BIS; α=.76). Second, participants indicated their general tendencies to experience positive vs. negative affect using the Positive and Negative Affectivity Schedule (PANAS; Watson et al., 1988). The PANAS is a self-report scale in which participants rate the intensity with which they generally experience a series of 10 positive (e.g., pride, determined) and 10 negative affect-related traits (e.g., nervous, scared). For analysis purposes, these items were collapsed into one index for positive affect (PA; α=.88) and one index for negative affect (NA; α=.84). Appendix D displays the intercorrelations among these subscales.

Finally, after answering all individual difference questions, participants provided demographic information, reported what they believed to be the purpose of the experiment, and were fully debriefed and dismissed.

Results

Preliminary Analyses

Desirability Judgments

For the first set of preliminary analyses, I examined whether the manipulation of event valence was successful by analyzing the desirability judgment data. After aggregating desirability judgments made for each valence type (positive, negative, and neutral), the resulting means were submitted to a repeated-measures ANOVA with event valence as the independent factor. The overall ANOVA detected a robust main effect of event valence, F (2, 121) = 1054.23, $p < .01$, confirming that the manipulation of event valence was successful. Indeed, the events that were pre-selected to be positive were judged as more desirable (M=6.50, SD=0.62) than events selected to be neutral (M=3.96, SD=0.88), t (124) =27.50, $p < .01$. And the events selected to be neutral were, in turn, judged to be more desirable than events selected to be negative (M=1.25, SD=0.56), t (124) = 30.42, $p < .01$. Furthermore, the robust effect of event valence did not depend upon the arm position, as the arm position X event valence interaction was not significant, F (4, 244) = .06, $p > .10$.

Effects of Arm Position on Mood, Effort, and Comfort

Next, I wanted to ensure that mood and comfort/effort did not differ across the arm positions used in the current study – with particular interest in comparing the arm flexion and extension conditions. When submitting overall mood scores (PA total minus NA total) to an ANOVA with arm position as the independent factor, there were no significant differences across the 3 arm positions, F (2, 122) = .71, $p < .10$. More important was the fact that there was no difference between the arm flexion and extension conditions, t (124) = .24, $p > .10$. When submitting the effort and comfort ratings to

individual ANOVAs with arm position as the independent factor, there were significant differences in both these variables (*F*s > 30, *p*s <.01). Not surprisingly, the relaxed arm position was rated as more comfortable and less effortful than both arm flexion and extension (|*t*s|>10, *p*s < .01). More important, however, was the fact that there were no significant differences between the arm flexion and extension conditions on effort or comfort (|*t*s|<.40, *p*s > .10). Overall, from these analyses I can be confident that any significant impact of arm flexion and extension on the main dependent measures was not due to changes in mood, effort, or comfort.

Primary Analyses

The main analysis in Experiment 1 involved examining whether likelihood judgments differed as a function of event valence and arm position. To analyze these results, separate mean likelihood judgments were first created for each of the 3 types of events. These means were then submitted to a 3 (arm position: flexion, extension, or relaxed) X 3 (event valence: positive, negative, or neutral) ANOVA with a repeated measure on the last factor. Table F1 contains the means and *SD*s across all 9 cells in the design and Figure F1 provides a visual display of these means.

The overall ANOVA detected a significant main effect of valence, F (2, 121) =200.42. As can be seen from Figure F1, participants reported the highest likelihood judgments for the set of positive events (M=5.06, SD=0.72), as compared to both the set of neutral events (M=3.84; SD=0.88) and the set of negative events (M=3.02, SD=0.84) (*t*s>11, *p*s<.01). Additionally, the set of neutral events elicited significantly higher likelihood judgments than did the set of negative events, t (124) = 9.42, p < .01. The main effect of arm position was not significant, F (2, 122) = 0.99, p > .10, suggesting that engagement in motor flexion vs. extension (vs. resting) had no general impact on likelihood judgment. Critically for the primary *compatibility-incompatibility account*, the arm position X event valence interaction was also not significant, F (4, 244) = 0.43, p > .10.

Secondary Analyses

This section reports on the association between the personality traits related to approach-avoidance and likelihood judgments. First, the BAS-BIS measure was used to create indices of reward sensitivity (BAS) and punishment sensitivity (BIS). Second, the PANAS measure was used to create indices of general experiences of positive affect (PA) and negative affect (NA). After creating these 4 indices, a series of zero-order correlations and regression analyses were conducted to test the relationship between these traits and participants' likelihood judgments about experiencing positive, negative and neutral events. Table F2 displays these correlations.

First, I consider the results involving the likelihood judgments for positive events. Table F2 shows that increases in PA and BAS were associated with increases in likelihood judgments for experiencing positive events. On the other hand, the tendency to be high or low on NA and BIS did not tend to correspond with likelihood judgments for positive events. Regression analyses confirmed this relationship, where the particular approach and avoidance measures were simultaneously entered as predictor variables (e.g., PA and NA) and the mean likelihood judgments for positive events were the criterion. Overall, these analyses showed that participants' reports of their approach-relevant traits accounted for more variance in likelihood judgments about positive events (all βs > .23, ps < .01; mean β for BAS/PA = .30, SE = .06) than did participants' reports of their avoidance-relevant traits (all βs < -.13, ps > .10; mean β for BIS/NA = -.09, SE=.06).

Second, I consider the results involving likelihood judgments for negative events. Table F2 shows that increases in PA and BAS tended to be associated with decreases in likelihood judgments for experiencing negative events, whereas increases in NA and BIS tended to be associated with increases in likelihood judgments for negative events (although only the correlations for PA and NA were statistically significant). Indeed, regression analyses conducted similarly to what was described above for positive events

showed that approach-relevant and avoidance-relevant traits accounted for similar levels of variance in likelihood judgments for negative events (mean β for PA/BAS = -.26, *SE* = .08 and mean β for NA/BIS = .16, *SE* = .08).

Third and finally, I consider the results involving likelihood judgments for neutral events. Generally speaking, these types of events were added as control events and were not expected to correlate with the relevant trait measures of approach-avoidance (see Appendix B). As can be seen in Table F2, this expectation was generally confirmed (with the exception of the correlation with NA).[3]

Discussion

Summary of the Results

Before presenting a deeper discussion of the findings, a brief summary of the main results is presented below:

- Participants provided the highest likelihood judgments about experiencing positive life events, which were significantly higher than likelihood judgments about experiencing neutral life events, which were in turn significantly higher than likelihood judgments about experiencing negative life events.
- Arm flexion and extension had no main or interactive effects on likelihood judgments.
- Trait measures of approach-avoidance did correlate with likelihood judgments for positive and negative (but not neutral) life events, although the specific nature of the relationship was complex. First, greater reports of approach-relevant experiences (PA, BAS) were associated with higher likelihood judgments about positive events and lower likelihood judgments about negative events. Second,

[3] I also conducted analyses for the interaction between the motor movement manipulation of approach-avoidance (arm flexion vs. extension) and the trait measures of approach-avoidance (PA/BAS vs. NA/BIS), in terms of the influence on likelihood judgments for positive and negative events. Overall, these analyses did not produce any interpretable or systematic patterns of results and will not be discussed further.

greater reports of avoidance-relevant experiences (NA, BIS) were associated with higher likelihood judgments about negative events but were unrelated to likelihood judgments for positive events. These two findings support conflicting accounts. Namely, they support the *general-outlook* and *compatibility-incompatibility accounts*, respectively (see Appendix B).

Are Approach-Avoidance and Optimism Related?

Approach-Avoidance Motor Signals and Optimism

The primary goal of Experiment 1 was to test whether approach- and avoidance-related motor signals had a causal impact on likelihood judgments. And, if so, what was the nature of this relationship.

In general, when considering their likelihoods of experiencing the various life events in Experiment 1, participants judged positive events to be significantly more likely to occur than neutral events, which were in turn judged to be significantly more likely to occur than negative events. This pattern is consistent with the oft-documented optimistic biases (for reviews see Armor & Taylor, 1998; Chambers & Windschitl, 2004; Helweg-Larsen & Shepperd, 2001; Krizan & Windschitl, 2007). However, it is notable that this pattern of results cannot conclusively be interpreted as evidence that the desirability of the event, per se, was the source of bias. Given that the events were handpicked from a seemingly endless set of real-world relevant outcomes, there could be numerous other differences in the events besides valence/desirability that could account for the results (see Krizan & Windschitl, 2007). Regardless, the more important result for the current research was that approach-avoidance motor signals did not have any main or interactive effects on likelihood judgments. This leads to the question of why approach-avoidance motor signals might have had a limited impact in Experiment 1. Two possibilities are considered.

First, it is notable that the desirability and likelihood judgments for the set of events were very extreme, where positive events were rated as highly desirable and very

likely and negative events were rated as not at all desirable and quite unlikely. This meant there was the possibility of ceiling and floor effects on the likelihood judgments, perhaps due to rather extreme affective reactions from thinking about very desirable positive events and very undesirable negative events (Lench, 2009; Lench & Ditto, 2008). Assuming this to be true, it was possible that the manipulation of event valence was so powerful to the point that it overwhelmed any minor effects from motor signals. Moreover, this logic seems consistent with extant work in the arm flexion-extension paradigm. Notably, much of the work examining the effects of arm flexion-extension on cognitive and emotional processing do not use stimuli (e.g., attitude objects) that are extremely strong in initial positivity or negativity (e.g., Cacioppo et al., 1993; Centerbar & Clore, 2006; Forster, 2004). The consequence of using stimuli that are inherently and strongly positive or negative in these paradigms is that, "With strong attitudes, [the] direct influence of prior attitude should overshadow any compatibility [effects from arm flexion-extension]" (pg. 28 in Centerbar & Clore, 2006; see also Forster, 2004). Instead, the majority of extant work in this paradigm has used stimuli that are viewed as slightly positive or negative initially, and become more strongly evaluated or attended to under conditions of arm flexion or extension.

A second possibility as to why approach-avoidance motor signals had no causal impact on likelihood judgments involves the dependent measure used in Experiment 1 to assess optimism. In particular, scaled likelihood judgments (relative to other types of uncertainty judgments) have been described as involving more effortful cognitive processing, a more elaborate consideration of evidence, and perhaps a heightened sense that a judgment is subject to accuracy evaluations (cf. Klein & Zajac, 2009; Krizan & Windschitl, 2007; Windschitl et al., under review; Windschitl & Wells, 1996; see also, Kirkpatrick & Epstein, 1992; Windschitl & Chambers, 2004; Windschitl, Martin, & Flugstad, 2002). Critically, this type of measure is quite different from commonly used dependent measures in studies involving arm flexion-extension. Notably, approach-

avoidance signals and their effects are typically discussed as having more of an affective, automatic, and reflexive influence on cognitive and emotional processing. Indeed, most studies in this paradigm use dependent measures like reaction time, categorization, recall, and affective evaluations. Hence, it was possible that the null results in Experiment 1 arose because the dependent measure was less theoretically related to the underlying concept of approach-avoidance systems.

These two possibilities were the primary impetus behind changes made for Experiment 2, where the main goal was to create conditions that were more conducive to assessing the potential relationship between approach-avoidance motor signals and optimism judgments. The specific elements of these changes to Experiment 2 are outlined below in Chapter III. However, before moving on to Chapter III, I briefly revisit the data relevant to the secondary goal from Experiment 1.

Approach-Avoidance Traits and Optimism

Results for the secondary goal of Experiment 1 provided evidence that trait measures of approach-avoidance corresponded with likelihood judgments. However, the specific pattern of results across approach-relevant vs. avoidance-relevant traits differentially supported the *compatibility-incompatibility* and *general-outlook accounts*. First, greater reports of PA and BAS were associated with both increased likelihood judgments about experiencing positive events and decreased likelihood judgments about experiencing negative events (see Table F2). This result is most consistent with the *general-outlook account*, which suggests that approach experiences should be associated with general positivity and inflated optimism (see Appendix B). Second, greater reports of NA and BIS tended to be associated with increased likelihood judgments about experiencing negative events, but were generally unrelated to likelihood judgments for positive events (see Table F2). This result is most consistent with the *compatibility-incompatibility account*, which suggests that high avoidance experiences should make people especially concerned about the possibility for negative events but have no impact

on sensitivity for positive events (see Appendix B). A discussion of the potential explanations for these divergent patterns will be delayed until Chapter IV.

CHAPTER III

CLARIFYING THE RELATIONSHIP BETWEEN APPROACH-AVOIDANCE MOTOR SIGNALS AND OPTIMISM JUDGMENTS

Overview

Experiment 1 provided limited evidence that approach-avoidance and optimism are connected. The main goal of Experiment 2 was to investigate the impact of approach-avoidance motor signals on optimism judgments under a new set of conditions designed to provide a more sensitive test of the initial hypotheses. Overall, Experiment 2 had the same basic structure as Experiment 1. The primary task involved participants making judgments about experiencing various life events while simultaneously engaged in arm flexion or extension, and a secondary goal examined the relationship between approach-avoidance traits and optimism judgments. However, there were two notable changes made to the design and procedure for Experiment 2. These major changes and the logic behind these changes are outlined in the next section.

Major Changes in Experiment 2

I previously provided two explanations as to why motor signals may have had a limited impact on likelihood judgments in Experiment 1. The first reason had to do with the extreme valence of the life events chosen for Experiment 1. Critically, participants' strong affective reactions to these events may have overwhelmed any minor effects of motor signals by producing ceiling and floor effects on likelihood judgments (cf. Centerbar & Clore, 2006; Forster, 2004; Lench, 2009). The second reason had to do with the type of dependent measure used to assess optimism in Experiment 1. Given that scaled likelihood judgments tend to involve careful, deliberative, and cognitively effortful processing, this seemed theoretically distant from approach-avoidance systems that are often described as automatic, reflexive, and affect-based. With these reasons in mind, two major changes were implemented to the general method of Experiment 2.

The first major change involved the selection of new events that were presumed to be less extremely positive (e.g., “You will try a new food or dish”) and negative (e.g., “You will get a paper cut”). This change served at least two purposes. First, it was assumed that these new events would be much less likely to produce ceiling and floor effects on optimism and desirability judgments. This was important because it would reduce the chance that extreme reactions to event valence would overwhelm or overshadow any subtle effects from motor signals. Second, using these types of events pushed the current research conceptually closer to extant work in the arm flexion-extension paradigm (cf. Cacioppo et al., 1993; Centerbar & Clore, 2006; Forster, 2004).

The second major change involved the specific measures used to assess participants’ optimism. In particular, some participants judged their optimism using the same scaled likelihood judgments as in Experiment 1, where participants used multiple response options to indicate their degree of uncertainty for experiencing an event (e.g., *not at all likely* to *very likely*). Other participants judged their optimism by making outcome predictions, where participants made dichotomous judgments about whether the life event would or would not happen in the future. Compared to scaled likelihood judgments that are more deliberative and effortful in their formulation, non-numeric uncertainty measures (similar to the outcome prediction measures used here) have been described as involving affective or gut/reflexive processing in their formulation (e.g., Kirkpatrick & Epstein, 1992; Lench & Ditto, 2008; Windschitl et al., under review; Windschitl & Wells, 1996). Moreover, the fact that people only have two response options for outcome predictions means that a person’s assessment can be much more flexibly pushed one way or the other – perhaps because there is less emphasis on accurately pinpointing one’s degree of certainty about an outcome. This flexibility permits a respondent to go with their gut feeling rather than relying on a cold assessment of evidence (Windschitl et al., under review). Each of these properties of outcome predictions are important for the current research because approach-avoidance systems

are often described as having automatic and reflexive influences on processing and judgment. If this is the case, then an optimism measure that potentially involves more affective or gut-level processing – that is, a non-numeric outcome prediction – may be most theoretically and empirically linked to approach-avoidance systems.

Moreover, in line with the second change and consistent with the idea that approach-avoidance systems are associated with reflexive and automatic processing, optimism response times were also measured in Experiment 2. I reasoned that perhaps much of the action in the influence from motor signals arises as a pre-cognitive preparation for evaluating a stimulus or possibility in the environment. Therefore, it might be the case that, whereas the optimism judgments themselves do not change as a function of approach-avoidance motor cues, perhaps the quickness of optimism responses would.

In summary, the central aspects of Experiment 2 were similar to Experiment 1, except for two major changes geared toward increasing the feasibility of illustrating an effect of approach-avoidance motor signals on optimism judgments. First, the life events used in Experiment 2 were newly selected to be less extreme in valence. Second, two types of optimism measures were used and response times for these judgments were measured. Overall, analyses for the primary goal involved a 2 (arm position: flexion or extension) X 2 (judgment type: scaled likelihood or outcome prediction) X 2 (event type: positive or negative) mixed design, with the last factor manipulated within subjects.[4]

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4 The arm resting conditions were removed from Experiment 2 for sake of efficiency and power. However, this change meant it was now impossible to distinguish between the *compatibility-incompatibility* and *general-outlook accounts*, in terms of the primary analyses involving motor signals. For instance, if arm flexion increased optimism for positive events (relative to arm extension) and extension increased pessimism for negative events (relative to arm flexion), this pattern of results is consistent with both the *compatibility-incompatibility* and *general-outlook accounts*, and it is impossible to distinguish without a control comparison. However, this result pattern could be compared to the *effective action account*. The secondary goal of Experiment 2 involving the correlations between trait measures of approach-avoidance and optimism judgments was still amenable to testing between all 3 hypotheses.

Method

Overview

Participants were first given a cover story involving brain hemisphere activity and cognitive processing and were shown one of the two arm positions. At a critical point in the study, participants flexed or extended their arms while making optimism judgments about experiencing each of 5 positive and 5 negative events – newly selected to be less extremely positive or negative. For half of the participants, the optimism questions were scaled likelihood judgments about their perceived chance of experiencing each event in the near future. The other half of participants made dichotomous outcome predictions about whether they would or would not experience the event in the near future. Following these main judgments, participants answered the same supplemental questions as in Experiment 1 – most notably the trait measures related to approach-avoidance.

Participants and Design

144 students from an Elementary Psychology course at the University of Iowa served as participants in order to satisfy a class requirement. The design was a 2 (arm position: flexion or extension) X 2 (judgment type: scaled likelihood or outcome prediction) X 2 (event valence: positive or negative) mixed design, with the last factor manipulated within subjects.

Procedure and Dependent Measures

Upon arrival to the lab and after completing informed consent documents, participants were provided with the same cover story used in Experiment 1 about the effects of left vs. right brain hemisphere activity on cognitive processing and judgment. Participants were then shown either the flexion or extension arm positions. In the main part of the study, all participants were prompted to assume the relevant arm position and then made optimism judgments about a set of 5 positive and 5 negative life events. As stated previously, these life events were newly selected for Experiment 2 to be moderately positive (e.g., “You will try a new food or dish”) and negative (e.g., “You

will use a very dirty public restroom”). Neutral events were not used because such events were thought to not be disctinct enough from the slightly positive and negative events that were actually used here. See Appendix E for all events.

First, in terms of the main dependent measure for these life events, participants were randomly assigned to make one of two types of optimism judgments. The first group of participants made scaled likelihood judgments about whether each event was likely to happen to them in the next 2 weeks (1=*not at all likely*; 7=*very likely*). The second group of participants made dichotomous outcome predictions about whether the event would (*Yes, the event will happen*) or would not happen (*No, the event will not happen*) in the next 2 weeks. Additionally, the computer recorded how long (in milliseconds) it took for participants to make their optimism judgments for each event.

Second, participants went on to answer the same manipulation check and supplemental measures used in Experiment 1. Participants first rated the perceived desirability of each of the 10 events on 7-point scales (1=*not at all desirable*; 7=*very desirable*). Next, participants completed the first set of supplemental measures, which included the mood (PANAS; Watson et al., 1988) and effort/comfort questions. Next, participants provided self-report ratings across the same trait measures of approach-avoidance used in Experiment 1. Specifically, participants answered questions about their reward and punishment sensitivity using the BAS-BIS measure (αs>.73) and their general experiences of positive and negative affect using the PANAS measure (αs>.89) Appendix D contains the intercorrelations among these measures. Finally, participants provided demographic information, answered an open-ended question about the purpose of the experiment, and were debriefed and dismissed.

Results

Preliminary Analyses

Desirability Judgments

In this section, I examine whether the newly selected positive and negative events were, in fact, perceived as differentially desirable. This analysis was important for confirming the success of the manipulation and to ascertain whether I was generally successful in selecting events that were perceived to be less extremely positive and negative than the events used in Experiment 1. After aggregating desirability judgments (1=*not at all desirable*; 7=*very desirable*) for each event valence, these means were submitted for analysis in a *t*-test. This analysis showed that positive events were rated as more desirable (M=5.75, SD=0.67) than negative events (M=1.77, SD=0.88), t (143) = 38.90, $p < .01$, confirming that the manipulation of event valence was successful. Additionally, a cursory examination of these ratings suggests these events were viewed as less extremely positive and negative than the events used in Experiment 1. In particular, the mean desirability judgment for the positive events was lower in Experiment 2 (M=5.75, SD=0.67) than in Experiment 1 (M=6.50, SD=0.62). Additionally, the mean desirability judgment for negative events was higher in Experiment 2 (M=1.77, SD=0.87) than in Experiment 1 (M=1.25, SD=0.56). Further, the effect size for the difference between desirability judgments for positive vs. negative events was approximately 1.5 times larger in Experiment 1 than in Experiment 2. Although cross-experiment comparisons can be problematic, this provides at least some indication that I was successful in choosing events that were perceived to be less extremely positive and negative than the events used in Experiment 1.

Effects of Arm Position on Mood, Effort, and Comfort

As in Experiment 1, I wanted to ensure that mood and comfort/effort did not differ across the arm positions. First, when submitting overall mood scores (PA total minus NA total) to an ANOVA with arm position as the independent factor, there were

no significant differences across the arm flexion and extension positions, F (1, 142) = .03, p > .10. Second, when submitting the effort and comfort ratings to ANOVAs with arm position as the independent factor, there were no significant differences in both these variables across the 2 arm positions (Fs < 2.7, ps > .10). In sum, any significant effects of arm flexion and extension on optimism cannot be easily explained via changes in mood, effort, or comfort.

Primary Analyses

Likelihood Judgments and Outcome Predictions

The main analysis in Experiment 2 involved examining whether optimism judgments – scaled likelihood and outcome predictions – differed as a function of arm position and event valence. Overall, the design was essentially a 2 (judgment type: scaled likelihood or outcome prediction) X 2 (arm position: flexion or extension) X 2 (event valence: positive or negative), with the last factor manipulated within subjects. However, to ease exposition and because a 2 X 2 X 2 ANOVA on optimism judgments with the aforementioned factors detected a significant 3-way interaction (F>7, p<.01), the results will be reported separately for scaled likelihood judgments and dichotomous outcome predictions. To briefly preview the nature of this 3-way interaction before going into the specific results, I note that the arm position X event valence interaction was significant for the dichotomous outcome prediction condition but not for the scaled likelihood condition.

First, I consider the results for participants making scaled likelihood judgments (1=*not at all likely*; 7=*very likely*). To analyze the data, I first calculated separate means for positive and negative events and then submitted these means to a 2 (arm position: flexion or extension) X 2 (event valence: positive or negative) mixed ANOVA, with a repeated measure on the last factor. Table F3 lists the means and *SD*s for these data and Figure F2 provides a visual display of the means across the event valence and arm position conditions. The overall ANOVA detected a significant main effect of event

valence, F (1, 64) = 76.65, $p < .01$. As can be seen from the figure, participants reported higher likelihood judgments for the set of positive events (M=4.94, SD=0.74) than the set of negative events (M=3.69, SD=0.94). The main effect of arm position was not significant, F (1, 64) = 1.72, $p>.20$, suggesting that flexing vs. extending one's arm had no general impact on judgments of an event's likelihood. Also, the arm position X event valence interaction was not significant, F (1, 64) = 1.25, $p >.10$. These results replicate what was found in Experiment 1.

Second, I consider the results for participants making dichotomous outcome predictions. For analysis purposes, participants' responses were coded as "0" when a participant selected the "No, it will not happen" response and as "1" when a participant selected the "Yes, it will happen" response for a given event. To analyze the data, I again calculated separate means for the positive and negative event types and then submitted these means to a 2 (arm position: flexion or extension) X 2 (event valence: positive or negative) mixed ANOVA, with a repeated measure on the last factor. Table F3 lists the means and SDs for this data and Figure F3 provides a visual display of the means across the event valence and arm position conditions. The overall ANOVA detected a significant main effect of event valence, F (1, 76) = 128.32, $p < .01$. As can be seen from Figure F3, participants more frequently responded with "Yes, it will happen" for the set of positive events (M=.79, SD=.20) than for the set of negative events (M=.43, SD=.19). The main effect of arm position was not significant, F (1, 76) = .10, $p > .20$, suggesting that flexing vs. extending one's arm had no general impact on judgments of whether an event would or would not happen. However, the arm position X event valence interaction was significant, F (1, 76) = 6.32, $p < .01$. As can be seen by Figure F3, the nature of this result was that negative events were judged to be more possible under arm extension (M=.47, SD=.17) than under arm flexion (M=.39, SD=.20), t (76) = 1.99, $p <$ .05. On the other hand, positive events were judged to be more possible under arm

flexion (*M*=.79, *SD*=.20) than under arm extension (*M*=.73, *SD*=.19), although this was only a directional effect, t (76) = 1.44, p = .15.

Response Times

After removing outliers that exceeded 3 standard deviations above the mean for a given event, I calculated mean response times (in milliseconds) for each event valence type. These means were then submitted to a 2 (arm movement: flexion or extension) X 2 (judgment type: scaled likelihood or outcome prediction) X 2 (event valence: positive or negative) mixed ANOVA, with a repeated measure on the last factor. Table F4 lists the means and *SD*s for these data. Perhaps not surprisingly, there was a significant main effect of judgment type, F (1, 140) = 17.09, $p < .01$, such that participants were faster to make dichotomous outcome predictions (*M*=2243, *SD*=916) than scaled likelihood judgments (*M*=2752, *SD*=806). The overall ANOVA also detected a significant main effect of valence, F (1, 140) = 9.25, $p < .01$, such that participants were faster to make their optimism judgments about positive events (*M*=2360, *SD*=804) than negative events (*M*=2602, *SD*=1005). No other significant effects emerged (all *F*s < 1, *p*s > .10).

Secondary Analyses

In this section, I report zero-order correlations between each of the trait measures of approach-avoidance (BAS, BIS, PA, NA) and the judgments of optimism for positive and negative events. Separate correlations were computed for participants making scaled likelihood judgments and participants making outcome predictions – where outcome predictions were dummy coded as “0” for responses of “No it will not happen” and “1” for responses of “Yes it will happen”. Table F5 displays these zero-order correlations. Surprisingly, unlike the generally healthy correlations found in Experiment 1, the correlations in Experiment 2 were much less robust. See Table F5 for all correlations.

First, as can be seen from the table, both approach-related traits (PA/BAS) and avoidance-related traits (NA/BIS) were generally not associated with optimism judgments about positive events, whether measured via scaled likelihood judgments (*r*s <

|.11|, *p*s > .10) or via dichotomous outcome predictions (*r*s < |.19|, *p*s > .09). Second, the correlations between approach-related and avoidance-related traits and optimism judgments about negative events were also generally paltry (all *r*s <|.22|, *p*s > .10, except for the correlation between BIS scores and scaled likelihood judgments about negative events). Thus, the overall conclusion from these analyses was that there was little connection between trait measures of approach-avoidance and optimism judgments in Experiment 2.[5]

Discussion

Summary of the Results

Before presenting a deeper discussion of the findings, a brief summary of the main results of Experiment 2 is presented below:

- Participants provided higher likelihood judgments and outcome predictions about experiencing positive events than about experiencing negative events.
- Approach-avoidance motor movements had a causal influence on optimism judgments. In particular, positive events tended to be judged to as more possible under arm flexion (as compared to arm extension), whereas negative events were judged as more possible under arm extension (as compared to arm flexion). However, this was only true for dichotomous outcome predictions. Motor movements did not have an impact on scaled likelihood judgments, replicating the null results of Experiment 1.
- Response times were faster for optimism judgments about positive events than negative events. However, there was no evidence that engaging in an approach-avoidance motor movement affected optimism response times.

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[5] As in Experiment 1, I also conducted analyses involving the interaction between flexion-extension and the trait measures of approach-avoidance, in terms of the influence on likelihood judgments. Again, these results did not produce any interpretable or systematic patterns of results and will not be discussed further.

- Trait levels of approach-avoidance were generally not correlated with optimism judgments about experiencing positive and negative life events.

Clarifying whether Approach-Avoidance and Optimism are Related

Approach-Avoidance Motor Signals and Optimism

The results of Experiment 2 showed that the causal role of arm flexion-extension on optimism judgments depends upon the type of optimism measure and/or characteristics of the events under consideration. First, when considering the results for scaled likelihood judgments, participants provided much higher likelihood judgments about experiencing positive events than about experiencing negative events. Critically, there were no main or interactive effects of arm position on likelihood judgments (see Figure F2). This result was consistent with Experiment 1 and with the logic that scaled likelihood judgments – because they may elicit more deliberative and effortful processing – might be less influenced by reflexive cues from approach-avoidance systems (Kirkpatrick & Epstein, 1992; Windschitl et al., under review; Windschitl & Wells, 1996). Moreover, the use of deliberative or careful processing strategies might not leave room for fleeting or subtle contextual cues to "leak" into one's optimism judgments (Clore & Gasper, 2000; Lerner & Gonzalez, 2005; Schwarz, 1990, 2006; Schwarz & Clore, 1983).

Second, when considering the results for dichotomous outcome predictions, participants also indicated that positive events would occur with greater frequency than would negative events. However, the frequency of these responses critically depended upon whether a participant was simultaneously engaged in arm flexion or extension. For positive events, participants tended to indicate that such events would happen with greater frequency while under arm flexion than arm extension. On the other hand, participants indicated that negative events would happen with greater frequency while under arm extension than arm flexion (see Figure F3). This interactive pattern is quite consistent with the *compatibility-incompatibility account*, which suggests that engaging

in an approach-avoidance motor movement that is compatible with the valence of stimuli present in the environment should increase sensitivity to, or thoughts about, experiencing the relevant outcome. The net effect would be that an outcome is easier to imagine, which should lead to inflated predictions that the outcome might occur. On the other hand, engaging in an approach-avoidance motor movement that is incompatible with the valence of stimuli may be associated with more difficulty in processing or a mixed/inconsistent set of evidence to suggest an event will occur. The net effect would be that an outcome is more difficult to imagine, which should ultimately lead to deflated predictions that the outcome might occur (Koehler, 1991; Raune et al., 2005; Schwarz, 1998; Schwarz & Clore, 1996; Schwarz et al., 1991; Sherman et al., 1985; see also Lerner & Gonzalez, 2005).[6]

Moreover, the effects of rudimentary motor movements may have been particularly strong for dichotomous outcome predictions because such measures may – at least relative to scaled likelihood measures and numeric judgments of uncertainty – tend to be more driven by affective, reflexive, and gut-level responding (Windschitl & Wells, 1996; Windschitl et al., under review). This property of dichotomous outcome predictions may encourage flexibility in responding, such as allowing people to freely guess according to their wants, desires, and feelings (Windschitl et al., under review) – precisely the conditions where fleeting or subtle contextual cues (e.g., from motor signals) might "leak" into a judgment.

Approach-Avoidance Motor Signals and Response Times

Approach-avoidance cues often have their most profound influence on automatic or reflexive aspects of cognition, such as attention, categorization, and evaluation. Thus,

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[6] Although this result pattern is consistent with the *compatibility-incompatibility account*, it is notable that the pattern is also consistent with the *general-outlook account*. As will be discussed in more detail in Chapter IV, the omission of a control/relaxed arm condition in Experiment 2 precludes a conclusive distinction between these two accounts.

it was reasoned that arm flexion and extension might not influence the optimism judgments themselves, but that they still might impact the speed at which people formulate their optimism. However, despite the intuitive appeal of this logic, there was no empirical evidence that arm flexion and extension had any impact on optimism response times. In considering why this hypothesized pattern did not emerge, it is notable that most response time experiments in this area of research typically report mean RT data that are less than 1000 milliseconds (cf. Chen & Bargh, 1999; Eder & Rothermund, 2008; Friedman & Forster, 2005; Koch, Holland, Hengstler, & van Knippenberg, 2009; Neumann & Strack, 2000). Due to the nature of the questions in this experiment and the way response times were measured in the computer program, average response times were between 2000 and 3000 milliseconds. Perhaps the typical response time gains or losses reported in studies involving perceptual-motor manipulations of approach-avoidance are only picked up in small windows of time with particular dependent measures – a window that was missed using these particular dependent measures in this paradigm.

Instead, the only significant effects that emerged for these analyses were main effect influences of judgment type and event valence. First, participants were faster to formulate optimism responses when making dichotomous outcome predictions than scaled likelihood judgments. This may be jointly due to the fact that there were fewer response options for dichotomous predictions and that scaled likelihood judgments involve more deliberative and effortful processing. Second, participants were faster to formulate optimism responses when making judgments about positive events than negative events. This result may be due to the fact that people devote more time to thinking about positive than about negative future events, and are therefore quicker to make judgments using information that is more accessible (see related result in Newby-Clark & Ross, 2003). Additionally, perhaps people have tendencies to “freeze up” in the presence of negative stimuli or possibilities (Baumeister, Bratslavsky, Finkenauer, &

Vohs, 2001), which would increase response times. These possibilities are admittedly speculative and only future research can establish more definitive evidence to account for such a result.

Approach-Avoidance Traits and Optimism

In this section I consider the failure in Experiment 2 to replicate the apparently stable correlations across the various trait measures of approach-avoidance and optimism judgments. Below I discuss two possibilities that may account for the inconsistency in findings between Experiments 1 and 2.

First, the failure to replicate could be explained via the moderately low sample sizes used to compute the correlations for the relevant dependent measure conditions. Indeed, using *N*s of 74 and 66 may have slightly reduced the power to detect significant correlations. However, it is notable that even when combining the data from both conditions into a large-scale analysis, there were no significant effects (all *r*s < .13, *p*s> .10). Regardless, it cannot be ruled out that issues of sample size and power may explain the inconsistent data patterns.

Second, it was possible that something about the new events selected for Experiment 2 reduced the extent to which trait measures of approach-avoidance were related to optimism. For instance, it may be the case that ingrained, chronic approach-avoidance tendencies are not implicated when people are exposed to the possibility of mundane, moderately positive (e.g., “You will try a new food or dish”) and negative events (e.g., “You will get a paper cut”). If this is the case, then trait measures of approach-avoidance – assessed using the PANAS and BIS-BAS measures – might not be expected to correlate with optimism judgments about these types of events. Instead, perhaps chronic approach-avoidance tendencies are most influential or active when there are consequences or outcomes in the environment that command prolonged attention, processing, and resources – that is, the types of serious and important events used in Experiment 1. Indeed, data collected in an unrelated study at the very end of Experiment

2 replicated the correlations found in Experiment 1. In particular, after completing all of the procedures for Experiment 2, participants went through another study that was separate from the main experiment that involved optimism judgments about life events that were similar to those used in Experiment 1 (e.g., cancer, academic accomplishments). When conducting correlations between the aforementioned trait measures of approach-avoidance (PA/BAS and NA/BIS) and optimism judgments for these new events, the findings more closely paralleled those of Experiment 1.[7] Thus, it was possible that the divergence in results from Experiment 1 to Experiment 2 was due to the selection of new events.

[7] More specifically, approach-related traits (PA/BAS) were predictive of likelihood judgments about experiencing positive events (mean r = .25) and negative events (mean r = -.24). On the other hand, avoidance-related traits (NA/BIS) were generally predictive of likelihood judgments about experiencing negative events (mean r = .14), but were less predictive of likelihood judgments about positive events (mean r = -.04).

CHAPTER IV

CONCLUSIONS AND IMPLICATIONS

Summary of the Main Findings

Two experiments examined the relationship between approach-avoidance and optimism. The primary goal was to examine the causal impact of approach vs. avoidance motor signals on people's optimism judgments for positively and negatively valenced events. A secondary goal was to examine the correspondence between participants' approach-relevant and avoidance-relevant traits (i.e., PA/BAS vs. NA/BIS) and their optimism judgments. The results revealed that the link between approach-avoidance cues and optimism judgments critically depended on how approach-avoidance was operationalized, how optimism was assessed, and the characteristics of events under consideration.

In Experiment 1, participants judged that positive events were more likely than negative events, but there was no main or interactive impact of arm flexion-extension on such judgments (see Figure F1). In secondary analyses, approach- and avoidance-relevant traits did predict likelihood judgments about both positive and negative (but generally not neutral) events (see Table F2). Specifically, PA/BAS scores were positively correlated with likelihood judgments for experiencing positive events, but negatively correlated with likelihood judgments for negative events. This portion of the results was most consistent with the *general-outlook account*. On the other hand, NA/BIS scores tended to be positively correlated with likelihood judgments for negative events, but uncorrelated with likelihood judgments for positive events (see Table F2). This portion of the results was most consistent with the *compatibility-incompatibility account*.

Experiment 2 followed up on the null findings from the primary analyses in Experiment 1. In particular, several changes were implemented to create conditions that were more conducive to producing an effect of motor signals on optimism judgments.

First, a new set of events was selected to be less extremely positive and negative in valence. This brought the current research closer to extant work in the arm flexion-extension paradigm (e.g., Cacioppo et al., 1993; Centerbar & Clore, 2006; Forster, 2004) and was intended to reduce the chance for ceiling/floor effects on the likelihood and desirability judgments. Second, optimism was measured in two distinct ways: 1) via scaled likelihood judgments and 2) via dichotomous outcome predictions. When considering the replicated scaled likelihood judgments condition, the results paralleled those from Experiment 1 (see Figure F2). When considering the novel outcome predictions condition, participants judged that positive events would happen more frequently than would negative events. However, this effect depended upon the specific motor signal (see Figure F3). In particular, participants tended to judge that a positive event would happen more frequently under arm flexion than arm extension. On the other hand, participants judged that a negative event would happen more frequently under arm extension than arm flexion. Although this result was consistent with the primary *compatibility-incompatibility account*, the omission of a control condition in Experiment 2 meant that this result was also consistent with the *general-outlook account* (a more thorough discussion of this issue appears later in the document). In secondary analyses for Experiment 2, approach- and avoidance- relevant traits (BAS/PA and BIS/NA) were generally not associated with optimism judgments (see Table F5).

Limitations and Future Directions

Despite some supportive findings for the notion that approach-avoidance and optimism are related, there were several inconsistencies in the results of Experiments 1 and 2 that seem noteworthy and may benefit from further investigation. Below I address limitations across two major areas and offer potential future directions that involve experiment-specific and/or theoretical aspects of these issues.

Connection between Approach-Avoidance Motor Signals and Optimism

There were differences between Experiments 1 and 2 regarding the causal influence of approach-avoidance motor signals on optimism. There are two notable limitations related to the patterns and interpretations of results across these experiments. First, although Experiment 2 did reveal an impact of motor signals on dichotomous outcome predictions, one consequence of removing the relaxed arm condition was that it was impossible to establish whether the results most fully supported the primary *compatibility-incompatibility account* or the alternative *general-outlook account*.[8] The first possibility was that approach and avoidance motor cues only affected optimism judgments for events with a compatible valence – whereas optimism judgments about events with an incompatible valence would be expected to be similar to a control condition (assuming a control condition had been included). However, a second possibility for the results pattern was that both approach and avoidance motor cues impacted optimism judgments about both types of events (in opposite directions), which would mean that optimism judgments in a hypothetical control condition would fall somewhere in between. See Appendix A for graphical displays of both of these hypotheses. Follow-up research that includes a control condition for the dichotomous outcome predictions condition (and not just the scaled likelihood judgments condition, as in Experiment 1) would be needed to distinguish between these accounts.

Second, as previously mentioned, Experiment 2 did find that motor signals had an impact on optimism judgments measured as outcome predictions. However, given that Experiment 2 made two changes simultaneously, it is difficult to identify the relative importance of these changes. One possibility was that the use of dichotomous outcome

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[8] It is notable that the *effective action account* could be more clearly ruled out in Experiment 2. In particular, in order for the results to be consistent with this account, outcome predictions for negative events would have needed to be lower – not higher – for the arm extension condition than the arm flexion condition (see Appendix A).

predictions alone was sufficient to account for the results. For instance, perhaps outcome predictions – due to their flexibility in responding and, perhaps, more affect-based processing – are always more susceptible to the effects of fleeting contextual cues, regardless of the type of event under consideration. For the current line of research, this means that optimism judgments about extremely positive and negative events might also be influenced by perceptual-motor signals when outcome predictions are solicited. A second possibility was that the combination of having participants make outcome predictions about moderately positive and negative events was critical to account for the results. This might be the case because the events in Experiment 2 were not only more moderate in terms of valence, but they also seemed lower in terms of personal control and certainty than the events chosen for Experiment 1 (e.g., "You will bump into an old friend on the street" vs. "You will travel to Europe"; see Appendices E and C). Importantly, events with low personal control and certainty may be particularly susceptible to the influence of fleeting contextual feedback or subjective experiences, perhaps because a respondent's lack of concrete evidence circumvents deliberative processing (cf. Lerner & Gonzalez, 2005; Lerner & Keltner, 2001). Moreover, as stated previously, outcome predictions – relative to other types of uncertainty judgments – may also be especially susceptible to the influence of fleeting contextual and subjective cues. Thus, the combination of making outcome predictions about a specific type of event may be critical for showing an influence of motor signals (or other fleeting contextual cues) on optimism judgments.

Of course, these possibilities about the relative importance of changes to Experiment 2 are speculative and future work is needed to develop more definitive conclusions. For instance, one potential follow-up study could involve separate groups of participants engaging in either arm flexion or extension, while simultaneously making dichotomous outcome predictions about the types of events from Experiment 1 (i.e., major life events and/or events with somewhat higher degree of personal control and

certainty) or the types of events from Experiment 2 (i.e., minor life events and/or events with somewhat lower degree of personal control and certainty). This experiment would clarify whether the effect is about the forecast type itself or whether it is the unique combination of making certain types of forecasts about certain types of events.

Connection between Trait Measures of Approach-Avoidance and Optimism

There were also inconsistencies involving the secondary goal of examining the relationship between trait levels of approach-avoidance and optimism judgments. When considering only Experiment 1, one inconsistency was that there was divergent evidence to support both the *compatibility-incompatibility* and *general-outlook accounts*. In particular, avoidance-related emotions and motives (NA/BIS) were associated with increased likelihood judgments about experiencing negative outcomes, but were not associated with likelihood judgments for positive events. On the other hand, approach-related emotions and motives (PA/BAS) were associated with both increased likelihood judgments about experiencing positive events and decreased likelihood judgments about experiencing negative events (see Table F2).

One potential set of explanations for these divergent results might involve the particular trait measures used to assess underlying approach vs. avoidance tendencies. Importantly, although the PA/BAS and NA/BIS measures have heretofore been differentially linked to approach vs. avoidance, it was possible that some of the measures were more construct valid than others – in terms of clearly and divergently assessing the underlying dimensions of approach vs. avoidance. In partial support of this notion, Appendix D shows there were substantial correlations between the PA/BAS and the NA/BIS measures – subscales thought to orthogonally represent approach vs. avoidance, respectively. This is potentially problematic for interpreting the correlations between these trait measures and people's optimism judgments about positive and negative events. For instance, if a particular subscale involves both approach and avoidance components, then we might predict one pattern of results – most logically following the *general-*

outlook account. On the other hand, if a particular subscale is more clearly identified as having strong approach or avoidance components (but not both), then a completely different pattern of results might be expected – most logically following the *compatibility-incompatibility account*. Future work that more clearly tests the adequacy of various trait measures to assess the underlying constructs of approach vs. avoidance would be useful for interpreting the mixed results in the current research and the extant literature (cf. Elliot & Thrash, 2002; Kambouropoulos & Staiger, 2004; Robinson et al., 2008; Watson et al., 1999).

A second set of explanations for this inconsistency in results in Experiment 1 involves the use of positive and negative events that might differ in their theoretical connection to approach vs. avoidance. For instance, the successful acquisition or withdrawal from particular desired and undesired outcomes may variably require 1) only the approach system, 2) only the avoidance system, or 3) a mixture of both (cf. Kambouropoulos & Staiger, 2004; Robinson et al., 2008). For instance, although some potential future outcomes (e.g., escaping a shock) may be most clearly associated with approach or avoidance, other potential outcomes (e.g., starting a romantic relationship) may be associated with both the opportunity for reward (e.g., sexual activity) and the threat of loss (e.g., heartbreak). Moreover, to the extent that the events selected in the current experiments differed in terms of their theoretical ties to these two systems, this would meaningfully impact the correlational patterns. For example, when an event involved elements of pain and pleasure, then perhaps both approach and avoidance systems/traits should have an impact on cognitive and emotional processing – including on judgments of optimism. Future research is needed to more clearly identify the specific properties of events that might be differentially connected to the underlying dimensions of approach and/or avoidance, and hence also to optimism judgments about such events.

A second inconsistency involving the secondary analyses was the divergent correlational patterns across Experiments 1 and 2. In particular, whereas Experiment 1

produced relatively healthy correlations (see Table F2), Experiment 2 revealed virtually no significant correlations (see Table F5). As stated previously, a couple possibilities may account for this inconsistency. First, the analyses in Experiment 2 (relative to Experiment 1) may have been underpowered due to conducting separate correlations for participants in the likelihood judgments and outcome predictions conditions. Second, the different types of life events used across Experiments 1 and 2 might have played a critical role in shaping the result patterns. In particular, the correlations were stronger when participants were asked about extremely positive and negative life events (in Experiment 1) than when they were asked about moderately positive and negative events (in Experiment 2). Future research might be useful for investigating the veracity of each of these possibilities.

First, whenever a researcher finds a null result, he/she must consider whether the analyses were underpowered and whether increases in sample size might be necessary. Thus, increasing the sample sizes in each condition of Experiment 2 would certainly help to evaluate the possibility that the analyses were underpowered. However, it is notable that data were collected on over 140 participants in Experiment 2, so the analyses were probably, at worst, only slightly underpowered.

Second, other work could examine why approach-avoidance systems might be differentially linked to psychological reactions for extremely positive/negative vs. moderately positive/negative life outcomes. For instance, it might be the case that chronic approach-avoidance emotions are at their most influential when an organism is faced with consequences or outcomes that are critical for long-term success or stability. On the other hand, perhaps responses to moderately consequential positive vs. negative possibilities are influenced by other, more temporary or fleeting factors. In support of this general idea, there is a wealth of research that has examined how qualitatively divergent events (e.g., serious/major events vs. everyday/minor hassles or uplifts) differentially influence a range of outcomes and processing, such as well-being, coping

strategies, and physical health (e.g., DeLongis, 1982; Kanner, Coyne, Schaefer, & Lazarus, 1981; see also Dohrenwend, Askensy, Krasnoff, & Dohrenwend, 1978; Holmes & Rahe, 1967). Future research might examine the connection between these different types of events and approach-avoidance, which would lead to the development of assumptions about how downstream judgment and decision making might be impacted differently depending on the type of event and activation of divergent motivational systems.

Broader Implications

This research has implications for our understanding of the theoretical connection between approach-avoidance and optimism, and has some practical implications for how we think about optimism/pessimism and approach-avoidance in everyday contexts. The next 2 sections consider the broad theoretical and practical implications of this research.

Theoretical Implications

From the current research, there are some conclusions we can draw about the theoretical connection between approach-avoidance and optimism, in terms of how approach-avoidance cues might be expected to shape optimism judgments. Scores of researchers have attempted to develop theoretical frameworks for understanding the various sources of influence in shaping people's optimism/pessimism about the future (cf. Armor & Taylor, 1998; Chambers & Windschitl, 2004; Helweg-Larsen & Shepperd, 2001; Klein & Zajac, 2009; Krizan & Windschitl, 2007; Weinstein, 1980, 1987). A principle goal of many approaches is to understand why people are frequently overoptimistic. Some perspectives focus on the role motives and desires (cf. Krizan & Windschitl, 2007; Kunda, 1990; Regan et al., 1995; Taylor & Brown; 1988), others focus on the role of cognitive heuristics and basic information processing (e.g., Chambers & Windschitl, 2004; Klein & Zajac, in press), and still others highlight the role of personality or individual differences (e.g., Harris, et al., 2008; see also Helweg-Larsen & Shepperd, 2001). Although complex, the results of the current research also highlight the

necessity to understand optimism in the broader context of fleeting and chronic subjective experiences (e.g., from moods/affect, active goals, ease of processing, and even bodily signals) (see Clore & Gasper, 2000; Lerner & Gonzalez, 2005; Schwarz, 1990, 2006; Schwarz & Clore, 1996), and offer some boundary conditions about when and how cues or experiences related to approach-avoidance will impact optimism.

First, it is clear that the influence of approach-avoidance cues on optimism in the current experiments was somewhat limited in scope and magnitude. However, when broadly characterizing the nature of the results that *were* significant, it can be stated that the approach system was associated with increased optimism whereas the avoidance system was associated with decreased optimism. Said differently, when approach-relevant actions and traits did predict optimism judgments in the current experiments, the results tended to reflect optimistic expectations – such as BAS/PA being associated with increased likelihood judgments for positive events and decreased likelihood judgments for negative events (see Table F2). On the other hand, when avoidance-relevant actions and traits did predict optimism judgments in the current experiments, the results tended to reflect more pessimistic expectations – such as arm extension producing greater expectations for negative events, relative to arm flexion (see Figure F3). This general characterization for the connection between approach-avoidance systems and optimism is most theoretically consistent with the *compatibility-incompatibility* and *general-outlook accounts*, and less theoretically consistent with the *effective action account*.

Second, however, the results were much more complex than this broad characterization and critically depended upon the specific operationalization of approach-avoidance, the type of optimism judgment, and characteristics of the events under consideration. One aspect of these complex results was that different measures of optimism were differentially sensitive to the influence of approach-avoidance cues, depending upon whether such cues were triggered reflexively or were measured as chronic traits. Notably, approach-avoidance that is activated temporarily via flexion-

extension seems much more compatible with the traditional conceptualizations of approach-avoidance that involve reflexivity and automaticity. On the other hand, chronic approach-avoidance tendencies may involve both reflexive elements and elements by which people are consciously aware and can report on. Critically, these two operationalizations appeared to interact with the manner in which optimism judgments were formulated. In particular, scaled likelihood judgments tended to be more highly related to chronically present approach-avoidance systems – measured via the PANAS and BIS-BAS scales. This suggests that people's chronic approach-avoidance tendencies might be more theoretically tied to effortful, deliberative, and cognitive judgments. On the other hand, outcome predictions tended to be somewhat more related to reflexive approach-avoidance cues – manipulated via rudimentary arm flexion-extension. In this case, temporarily activated approach-avoidance cues might be more theoretically tied to more reflexive or affective judgments.

Third, the theoretical tie of approach-avoidance to optimism judgments may also critically depend upon characteristics about which a person is making a forecast. In particular, it is possible that approach vs. avoidance systems might have very different functions for shaping how people think about, and react to, events that are extremely vs. moderately positive or negative. Furthermore, the influence of these systems may depend upon the specific operationalization of approach-avoidance. For instance, data from the current research is suggestive of the possibility that more temporary approach-avoidance feedback might be more relevant for processing and judgment about minor, short term, or moderately positive/negative events. On the other hand, chronic approach-avoidance might be more relevant to processing and judgment about major, long-term, or extremely positive/negative events.

Practical Implications

There are also some practical implications that can be derived from the current research. First, this work can be viewed in the broader context of research investigating

issues related to future-directed thinking. In everyday life, people constantly think about and evaluate their futures. Sometimes the outcomes under consideration are mundane, such as predicting whether one's favorite sports team will be victorious. Other outcomes are more serious, such as estimating one's chance of cancer. What's more is that judgments about future outcomes have been viewed as an important part of healthy psychological functioning (cf. Taylor & Brown, 1988) and play a significant role in guiding decisions and behaviors (Armor & Taylor, 1998; Fishburn, 1988; Janz & Becker, 1984; Kahneman & Tversky, 1979; Mellers & McGraw, 2001; Weinstein, 1988). Thus, because of the importance of optimism in everyday contexts (e.g., health, academics, and the workplace), researchers and professionals should be quite interested in knowing when and why people make over-pessimistic, over-optimistic, or accurate predictions (see Dunning, Health, & Suls, 2004). The current work provides some (albeit complex) empirical evidence and theoretical arguments that highlight the import of gaining a deeper understanding of how temporary and chronic cues from subjective experiences can influence judgments of optimism. Moreover, an improved understanding of these issues should aid in developing theoretical models that can be used to understand various aspects of judgment and decision making and to create interventions designed to aid such judgments and decisions.

Second, the current work also highlights the utility of using the theoretical relationship between the concepts of approach-avoidance and optimism to understand real-world relevant aspects of maladaptive psychological functioning (e.g., anxiety, depression, and high risk-seeking). For instance, recall that I had previously discussed depression and anxiety as being fruitfully conceptualized as involving differential aspects of approach-avoidance and pessimism about the future. Indeed, it is clear from an analysis of the literature that the underlying concepts of approach-avoidance and optimism/pessimism might be useful in defining, describing, diagnosing, and treating depression and anxiety (see e.g., Abramson et al., 1989; Ahrens & Haaga, 1993;

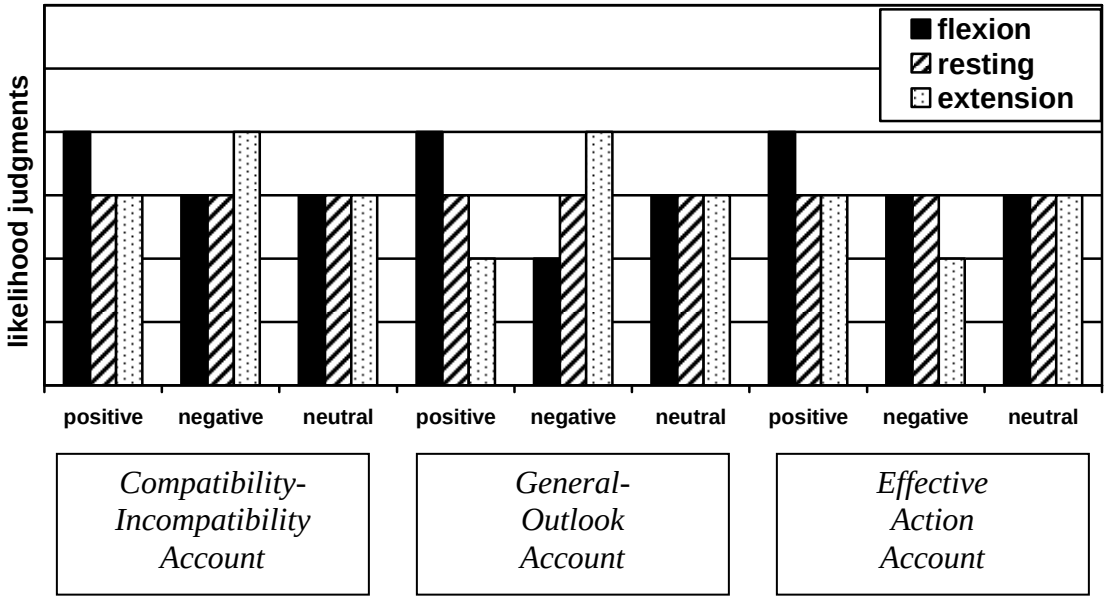
Andersen et al., 1992; Clark and Watson, 1991; Clark et al., 1994; MacLeod & Byrne, 1996; MacLeod et al., 1996; MacLeod et al., 1997; Miranda & Mennin, 2007). For example, diagnostic characteristics of an individual with anxiety involve their sensitivity to threat and an unrealistic focus on negative future outcomes, and treatment may involve changing either or both of these characteristics in the individual. Another real-world relevant example in which the concepts of approach-avoidance and optimism might be relevant is in the case of excessive risk taking behaviors (e.g., drug abuse, dangerous driving). Indeed, some work suggests that individual differences related to approach and avoidance may importantly predict patterns of risk-taking and risky decision making (Lauriola & Levin, 2001; Lauriola et al., 2005). Additionally, judgments of future outcomes have also been linked to risk-seeking behaviors (Kahneman & Tversky, 1979; see also Peters & Slovic, 2000). In short, researchers and practitioners might benefit by gaining a deeper understanding of how the concepts of approach-avoidance and optimism interface in the context of anxiety, depression and excessive risk-taking.

Conclusions

That we approach pleasure and avoid pain is one of the most fundamental principles guiding the behaviors of most living organisms. In humans, however, we can draw a distinction between the rather reflexive tendencies to approach and avoid (e.g., motor movements that propel an organism toward rewards and away from threat) and cognitive tendencies to approach and avoid (e.g., judging desirable outcomes as likely and undesirable outcomes as unlikely). Drawing on the connection between these two notions, the purpose of the current research was to examine how the activation of rudimentary approach-avoidance systems would impact higher-order optimism judgments about experiencing positive and negative future outcomes. The results revealed complexities based on how approach-avoidance were operationalized, how optimism was assessed, and the characteristics of outcomes under consideration.

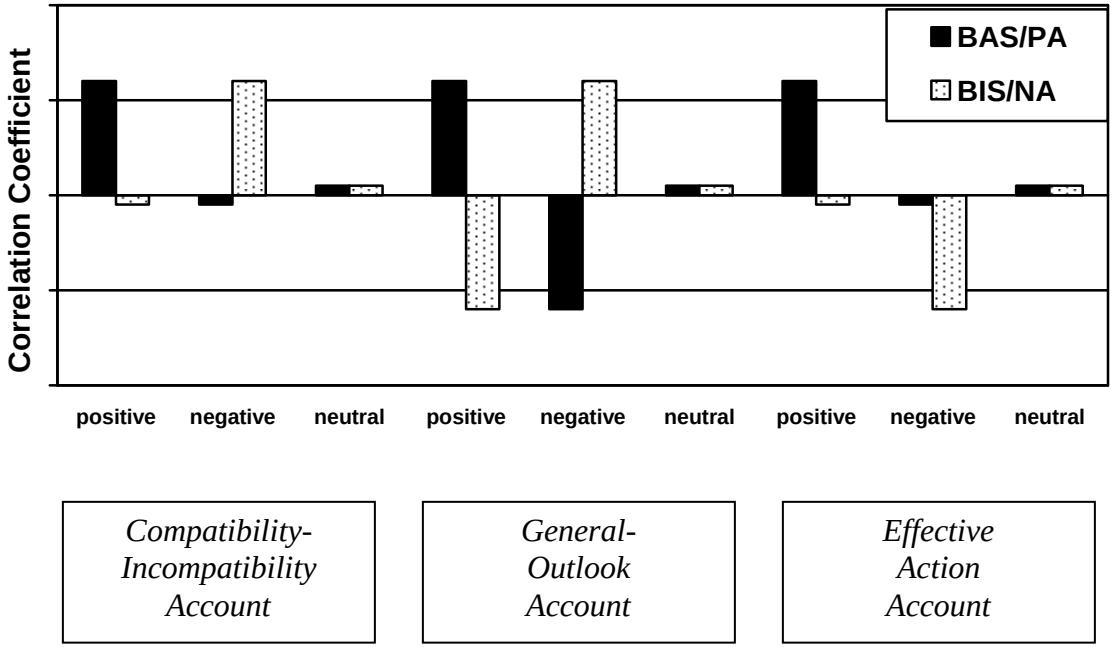
In returning to the opening quote, Anatole France noted that it might be unwise to focus our hopes and fears on a future that we can never fully predict or understand. However, the current research and other extant research suggests that chronic and fleeting subjective experiences that occur in the present can sometimes have an influence on the judgments we make about the future – perhaps illustrating a functionality in relying on what we are experiencing in the present to aid us in reaching or avoiding potential rewards or threats that lay on the horizon.

APPENDIX A. HYPOTHESES FOR THE PRIMARY GOAL OF EXPERIMENT 1



Note: This figure displays a graphical representation of the three accounts for the influence of motor movements (flexion, extension, or resting) on likelihood judgments for positive, negative, and neutral events. Higher bars mean greater likelihood judgments.

APPENDIX B. HYPOTHESES FOR THE SECONDARY GOAL OF EXPERIMENT 1



Note: These are the hypotheses for the secondary analysis involving the correlations between trait measures of approach (BAS/PA) and avoidance (BIS/NA) and likelihood judgments for positive, negative, and neutral events. Bars that appear to be no different from the middle line in the graph indicate a correlation of 0. Bars higher than this middle line indicate a large and positive correlation, whereas bars lower than this middle line indicate a large and negative correlation.

APPENDIX C. FUTURE LIFE EVENTS USED IN EXPERIMENT 1

Positive Events

You will get a desirable postgraduate job
You will have a long and happy marriage
Your will travel to Europe
You will graduate in the top 25% of your class
You will live past the age of 80
You will have your work recognized with an award

Negative Events

You will be injured in a car crash
You will not find a job for 6 months
You will develop cancer
You will have a heart attack before the age of 50
You will have your home burglarized
You will get fired from a job

Neutral Events

You will have a fish aquarium in your home
You will take up landscaping/gardening
You will own a white car
You will live in a town with fewer than 50,000 people
You will go on a trip to Texas
You will have more than two children

APPENDIX D. INTERCORRELATIONS AMONG TRAIT MEASURES OF APPROACH-AVOIDANCE

Experiment 1 (*N*=125)

Measure	PA	NA	BAS	BIS
PA	-	-.20*	.42**	-.18*
NA		-	-.15	.40**
BAS			-	.20*
BIS				-

(** $p < .01$; * $p < .05$)

Experiment 2 (*N*=144)

Measure	PA	NA	BAS	BIS
PA	-	-.09	.39**	-.12
NA		-	-.36**	.29**
BAS			-	.14
BIS				-

(** $p < .01$; * $p < .05$)

Note: “BAS” and “BIS” are measures of reward and punishment sensitivity, assessed using the Behavioral Activation System (BAS) and Behavioral Inhibition System (BIS) (Carver & White, 1994). “PA” and “NA” are measures of positive affectivity and negative affectivity, measured using the Positive and Negative Affectivity Schedule (PANAS; Watson et al., 1988).

APPENDIX E. FUTURE LIFE EVENTS USED IN EXPERIMENT 2

Positive Events

You will sleep peacefully for a night
You will bump into an old friend on the street
You will read a newspaper column that makes you laugh
You will try a new food or dish
You will be invited to a party

Negative Events

You will accidentally eat/drink something that is expired
You will use a very dirty public restroom
You will get a paper cut
You will lose an important computer file
Your neighbor will play his/her music too loud

APPENDIX F. TABLES AND FIGURES

Table F1. Likelihood judgments as a function of event valence and arm position in Experiment 1.

Arm Position	Positive Events		Negative Events		Neutral Events	
	M	*SD*	*M*	*SD*	*M*	*SD*
Flexion	5.08	0.62	3.10	0.79	3.79	0.77
Extension	5.01	0.74	2.88	0.87	3.83	0.81
Resting	5.12	0.80	3.12	0.85	3.93	1.08

Note: Likelihood judgments were made on 7-point scales (1=*not at all likely*; 7=*very likely*). The values in the table represent means for the 6 positive events, the 6 negative events, and the 6 neutral events across each arm position condition (flexion, extension, or resting).

Table F2. Zero-order correlations between trait measures of approach-avoidance and likelihood judgments in Experiment 1.

Trait Measure of Approach-Avoidance	Positive Events	Negative Events	Neutral Events
Approach-related			
BAS	.21*	-.18	.05
PA	.37**	-.34*	.07
Avoidance-related			
BIS	-.09	.15	.11
NA	-.11	.20*	.26**

(** $p < .01$; * $p < .05$)

Note: "BAS" and "BIS" are measures of reward and punishment sensitivity, assessed using the Behavioral Activation System (BAS) and Behavioral Inhibition System (BIS) (Carver & White, 1994). "PA" and "NA" are measures of positive affectivity and negative affectivity, measured using the Positive and Negative Affectivity Schedule (PANAS; Watson et al., 1988). Likelihood judgments were made on 7-point scales (1=*not at all likely*; 7=*very likely*).

Table F3. Scaled likelihood judgments and outcome predictions as a function of event valence and arm position in Experiment 2.

Arm Position	Scaled Likelihood Judgments				Outcome Predictions			
	Positive Events		Negative Events		Positive Events		Negative Events	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Flexion	4.96	0.79	3.86	0.81	0.79	0.20	0.39	0.20
Extension	4.93	0.70	3.50	1.05	0.73	0.19	0.47	0.17

Note. The values in Table F3 are averages of the relevant optimism measures (scaled likelihood or outcome prediction) for each of the 5 positive and 5 negative events, and as a function of whether participants engaged in arm flexion or extension. Scaled likelihood judgments were made on 7-point scales (1=*not at all likely*; 7=*very likely*). Outcome predictions were made by selecting between one of two options for each event (1= *Yes, it will happen*; 0= *No, it will not happen*).

Table F4. Optimism judgment response times as a function of event valence, arm position, and judgment type in Experiment 2.

Arm Position	Scaled Likelihood Judgments				Outcome Predictions			
	Positive Events		Negative Events		Positive Events		Negative Events	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Flexion	2698	730	2889	1085	2072	839	2243	859
Extension	2642	735	2810	601	2122	711	2547	1223

Note: The values in the table are averages of the time it took (in milliseconds) for participants to respond to the optimism questions, as function of event valence (positive or negative), judgment type (scaled likelihood or outcome prediction), and arm position (flexion or extension). Overall, there were only main effects of judgment type and event valence (Fs > 9, ps<.01). No other effects emerged (all Fs<1, ps>.1).

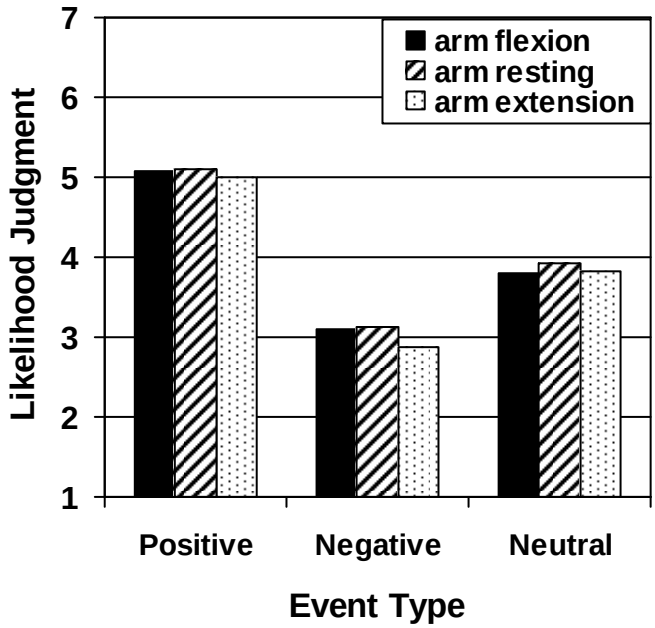
Table F5. Zero-order correlations between trait measures of approach-avoidance and optimism judgments in Experiment 2.

Trait Measures of Approach-Avoidance	Scaled Likelihood Judgments		Outcome Predictions	
	Positive events	Negative events	Positive events	Negative events
Approach-related				
BAS	-.04	.08	.07	-.06
PA	.05	-.22	.19	.06
Avoidance-related				
BIS	-.03	.24*	.06	.04
NA	.11	.16	-.07	.04

(** $p < .01$; * $p < .05$)

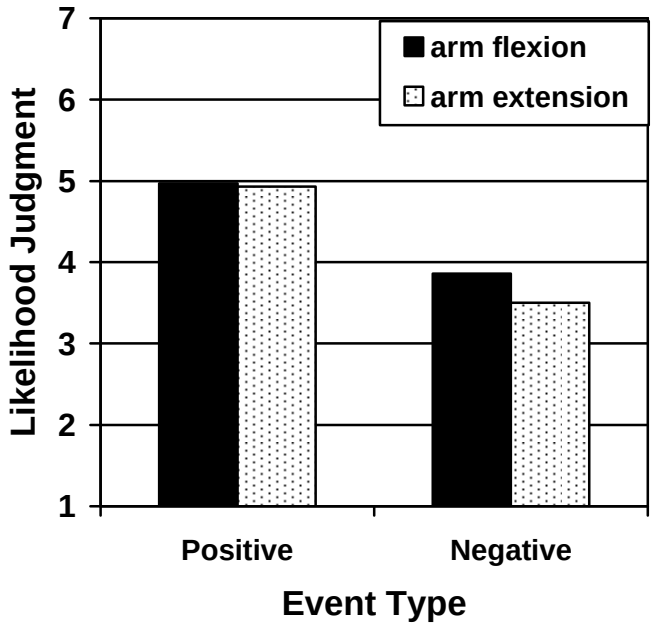
Note: "BAS" and "BIS" are measures of reward and punishment sensitivity, assessed using the Behavioral Activation System (BAS) and Behavioral Inhibition System (BIS) (Carver & White, 1994). "PA" and "NA" are measures of positive affectivity and negative affectivity, measured using the Positive and Negative Affectivity Schedule (PANAS; Watson et al., 1988). Participants (*N*=66) made scaled likelihood judgments about experiencing the various events on 7-point scales (1=*not at all likely*; 7=*very likely*). Participants (*N*=78) made outcome predictions by selecting between a response option indicating the event would happen (dummy coded as "1") and an option indicating the event would not happen (dummy coded as "0").

Figure F1. Likelihood judgments as a function of event valence and arm position in Experiment 1.



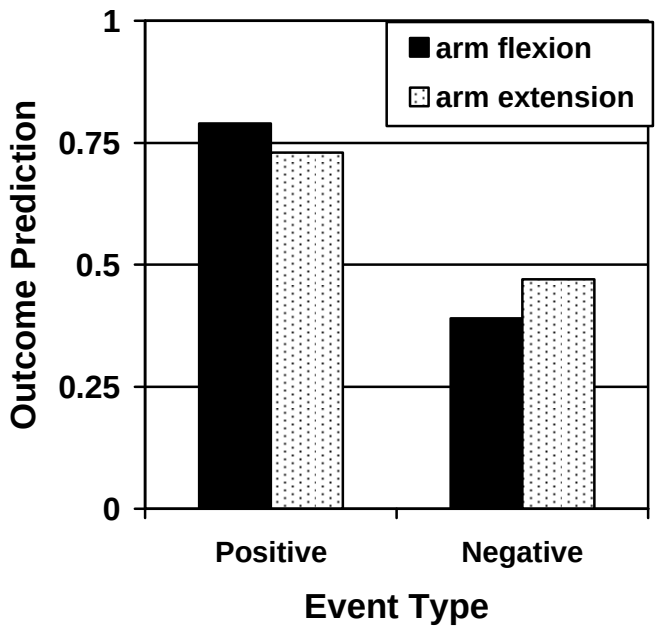
Note: Participants made likelihood judgments for each of the 18 events on 7-point scales (1=*not at all likely*; 7=*very likely*). The values in the figure represent means for the 6 positive events, the 6 negative events, and the 6 neutral events across each arm position condition (flexion, extension, or resting). There was only a main effect for event type ($F > 200$, $p < .01$). There were no main or interactive effects involving the manipulation of arm position (Fs<1, ps>.10).

Figure F2. Scaled likelihood judgments as a function of event valence and arm position in Experiment 2.



Note: Participants (*N*=66) made likelihood judgments about each of the 10 events on a 7-point scale (1=*not at all likely*; 7=*very likely*). Values represent means across each arm position condition (flexion or extension) for the 5 positive events and 5 negative events. There was only a main effect for event valence ($F>70$. $p<.01$). There were no main or interactive effects involving the manipulation of arm position ($Fs<2$, $ps>.10$).

Figure F3. Outcome predictions as function of event valence and arm position in Experiment 2.



Note: Participants (*N*=78) made outcome predictions for each of the 10 events (5 positive, 5 negative) by selecting between one of two options (1=*Yes, it will happen*; 0=*No, it will not happen*). These responses were aggregated to form mean responses for both positive and negative event types. These means are presented in this figure, where values approaching 1 indicate more "Yes" responses to the various outcome prediction questions, whereas values approaching "0" indicate more "No" responses to the outcome prediction questions. Overall there was a significant main effect of event valence ($F>100$, $p<.01$) and a significant event valence X arm position interaction ($F>6$, $p< .01$).

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