MOTIVATED VISUAL PERCEPTION:
HOW WE SEE WHAT WE WANT TO SEE

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In 2001, a U.S. nuclear submarine surfaced underneath a Japanese fishing vessel, causing it to sink—9 died. In 1999, 41 bullets fired by 4 New York police officers hit and killed Amidou Diallo, who pulled from his pocket a wallet rather than what the police thought was a gun. In both tragedies, one might ask how these central actors could have failed to see what was plainly visible. With this work, I ask how perceptual systems represent the surrounding world if not in a veridical manner. I propose that the perceptual representations of which perceivers are consciously aware are colored by nonconscious motivational forces. Motivations, including wishes, dissonance reduction, and visceral needs, bias visual perception.

Three streams of research examined the ways in which motivations constrain perceptual processing. The first stream demonstrated that people's wishes biased the resolution of visual ambiguity. In 5 studies, participants shown an ambiguous visual figure reported seeing the desired interpretation. This finding was affirmed by unobtrusive and implicit measures of perception including eyetracking, lexical decision response times, and experimental manipulations.

In the second stream, I explored whether the motivation to reduce cognitive dissonance biased perception and assisted in the regulation of psychological states. In 2 studies, participants performed an aversive task under high or low choice conditions. Participants saw components of their environment in less extreme ways in order to reduce dissonance. Those experiencing high choice perceived distances to travel as shorter and slopes to climb as shallower.

In the third stream, 5 studies showed that desires such as hunger, thirst, and general preferences led to a narrowed focus of attention on a desired object. Narrowly focusing attention reduced estimates of distance. Participants saw desired objects as closer than less desired objects.

I end by discussing the implications for marketing, self-screening in early cancer detection and relationship satisfaction among other applied domains. This work explores the limits of motivations, testing whether they cross the boundary separating how people think about their world and how they see it.

BIOGRAPHICAL SKETCH

Emily Balcetis was born in Omaha, Nebraska then traveled to the far reaches of the center of the state to attend the University of Nebraska at Kearney, where she earned a Bachelor of Arts in Psychology and a Bachelor of Fine Arts in Music Performance. Afterwards, she set her sites on a coastal state, pursuing a Ph.D. in social and personality psychology at Cornell University in Ithaca, New York. She will begin her professional academic career at The Ohio University in Athens, Ohio.

To My Best Friends:

Mom and Dad

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CHAPTER ONE

THE WINDOW THROUGH WHICH PEOPLE SEE THEIR WORLD: AN INTRODUCTION TO MOTIVATED PERCEPTION

Before a submarine surfaces, the surrounding waters are searched by sonar. If clear, the sub rises to periscope depth to visually survey the waters. After visual inspection, the submarine rises to the surface. Given this procedure, it was a surprising tragedy when, in 2001, a U.S. nuclear submarine surfaced underneath a large Japanese fishing vessel off the coast of Honolulu. The collision ripped open the boat's engine room, flooding the vessel, causing it to sink within minutes. Aboard the Japanese fishing trawler was a crew of 20 in addition to 2 teachers and 13 students from a fishery vocational school. Although many reached the lifeboats, 4 students, 2 teachers, and 3 crew members did not and died in the tragedy (Marquis, 2001).

In February 1999, 41 bullets were fired by 4 New York police officers that hit and killed Amidou Diallo, an unarmed immigrant from West Africa. When police officers ordered Diallo to stop, he reached into his pocket, producing an object that later turned out to be a wallet. The police defendants maintained that in this situation they acted on the information available to protect themselves from danger. In the end, the officers were acquitted as a jury was convinced these officers actually saw the object as a gun (McFadden & Roane, 1999).

In both tragedies, it is difficult to imagine how these central actors missed what can be considered such obvious signals of upcoming disaster. Given the regimented safeguards submarines employ for surfacing, how is it possible that the Japanese fishing ship,

half of the size of the US nuclear submarine, could have been overlooked by visual inspection? How could the Navy periscope operator have failed to see what was plainly visible? How could each of the 4 police officers have mistaken the leather wallet for a loaded weapon? How could they have seen the object for something so different than what it really was?

I. The Perceptual Dilemma

Perceptual systems face a dilemma: the world bombards perceptual systems with a wealth information at any given time, yet the systems' abilities to process this rich world are limited. To combat this dilemma, perceptual systems enlist the assistance of a regiment of tools and strategies. In doing so, systems often create perceptual experiences that are inaccurate reconstructions of reality. My interest is to survey some of tools and strategies perceptual systems employ to assist in information processing and examine the consequences for biased perceptions of reality. I explore one specific tool shown to shape, sculpt, and mold other experiences in profound ways; I examine the influence of motivation on perception.

To be sure, the environment showers sensory systems with much more input than limited attentional resources can process. To sort relevant information from less relevant types, one tool perceptual systems use are filters. Unfortunately, as might have happened for the submarine periscope operator, filters can fail, leading to blindness of key elements of the environment. For instance, pilots in a flight simulator crashed planes when they focused their attention on the multi-component console at the expense of information suggesting the

rapid approach of the runway (Haines, 1991). In addition, when engaged in a face-to-face discussion, approximately half of participants did not notice that the person with whom they were speaking was replaced by another person (Levin, Simons, Angelone, & Chabris, 2002). Given the wealth of information environments offer, the visual system must choose to attend to some types of information at the expense of others. What this suggests is that all information is not equal. Some information is powerful enough to pass through a filter, thereby capturing and holding attention while other information is missed.

The dramatic course of action that led to the shooting of Amidou Diallo prompted researchers to ask why the police officers saw only one interpretation—the wrong interpretation—of the object rather than recognize its ambiguity. Among other factors tested in experimental paradigms, active race-based stereotypes contributed to the miscategorization of objects; a tool was often misidentified as a gun when held by an African American target (Correll, Park, Judd, & Wittenbrink, 2002, 2004). In addition, contexts such as visual backgrounds impact the speed (Boyce & Pollatsek, 1992; Boyce, Pollatsek & Rayner, 1989) and accuracy (Biederman, Mezzanotte, & Rabinowitz, 1982) of object identification. Prior exposure to images (Bugelski & Alampay, 1961; Leeper, 1935) and previous strains of thought (Balcetis & Dale, 2003, 2006) also bias what people see when they view objects with multiple resolutions.

With this current work, I explore the tools perceptual systems use to make sense of a dense and taxing world. I investigate the

systematic biases on perception that lead people to see their surroundings without complete accuracy. Certainly, contexts and previous experiences play an active role in directing perception. However, I intend to expand this body of work to examine how psychological states shape perception in a similar manner. Specifically, I propose that psychological states such as motivations regulate perception. I explore such motivations as wishful thinking, the goal to reduce cognitive dissonance, and visceral need states.

In addition, I examine the downstream consequences of motivated perception. In doing so, I suggest why perceptual systems might organize information without complete precision. Biased perception, I argue, might allow people to regulate psychological states in addition to serving an adaptive function.

Beyond demonstrating that motivations sculpt perceptual processing, I explore a variety of tasks implicated in perception. Without a doubt, there are many tasks perceptual systems must undertake in order to make sense of the visual world. Such tasks include but are not limited to: the reception of afferent input, filtration of background noise from relevant foreground, directing attention, and categorization. All of these tasks and many more work in a dynamic and parallel manner to mold incoming information into a perceptual conclusion. I test the ability of motivations to shape 3 specific perceptual tasks including preperceptual activation of filters, the direction of attentional resources, and perceptual information processing.

This work enters into two key debates. First, the following

chapters suggest that perceptual systems are indeed penetrable and subject to influence by higher-order, social constraints including motivational states. Second, the following chapters will explore the boundaries of motivated cognition to test whether, how, and when it crosses the boundary separating how people consciously think about their world and how they literally see it.

II. History of Motivated Perception

Throughout history, the interest in and support for motivated perception has waxed and waned. Pockets of researchers beginning in the early 1900's have suggested that variance in perception cannot be accounted for by the interaction of the stimulus and the retina alone. Bartlett (1932), most remembered for his work on memory, forecasted this perspective on perception proclaiming that "what is said to be perceived is in fact inferred" (p. 33). Wertheimer's investigation into the illusion of motion in sequential presentation of static images, and his collaboration with Kafka and Kohler on gestalt principles of perception, included mechanisms outside of direct sensation.

Among those most notorious constructivists who proposed that motivations are a source of perceptual bias outside of direct sensation, Freud (1900/1953, 1899/1962; see also Erdelyi, 1990; Gilmore & Edward, 1999) argued that drives to defend oneself against impulses, to think favorably about one's past, and to maintain emotional integrity influence the ways people think about, see, and act in the world. However, the field grew frustrated with the lack of empirical rigor and testable hypotheses generated by such an approach. As a result, researchers outside of clinical practice largely abandoned the psychoanalytic approach. In the next sections, I will discuss the major eras critical for the rejuvenation of interest in examining the interface between psychological states and perception, each one taking strides towards overcoming the pitfalls of the generations that preceded them.

A. NEW LOOK 1

The New Look perspective that crested in the late 1950's (Bruner

& Minturn, 1955) is considered among the most dedicated historical eras of psychology interested in examining how psychological states bias perception. Proponents of The New Look argued adamantly that complex, higher order processes, not necessarily available to verbal report or direct observation, impinge upon lower level processes such as sensory experiences. New Look researchers proposed a constructivist approach where states of the organism and complex yet unconscious processes interact with the visual input. Reacting to an overemphasis of the objective stimulus, the New Look resolved to demonstrate that perceptual experience was subject to other concurrent processes. Their goal was "to rid psychology of the *pure percept*" (Bruner, 1992).

According to New Look theorists, perception is an active and constructive process influenced by many top-down, psychological factors. One primary class of such factors was the needs and values of the perceiver. For example, Bruner and Goodman (1947) asked children of diverse social economic conditions to estimate the size of monetary coins by manipulating the diameter of a beam of light. Children of poorer families, for whom the value of money was greater, overestimated the size of the coins compared with children of more affluent families who were presumed to place less value on the same coins. Similarly, adult participants were asked to estimate the size of a Swastika, coins, and a neutral disc (Bruner & Postman, 1948). As expected, after controlling for absolute size, the swastika, the object of most extreme valence, was the most overestimated of the items.

These initial demonstrations were met with much enthusiasm,

which was then followed by withering critiques. Given the lack of empirical rigidity and theoretical falsifiability, the New Look assertion that motivations constrain perception fell by the wayside (Eriksen, 1958, 1962; Eriksen & Browne, 1956; Goldiamond, 1958; Prentice, 1958; Wohlwill, 1966). For example, it is uncertain whether participants took longer to report offensive words because they simply did not perceive them, did not do so as quickly, or because it took longer to get over the surprise of seeing them or the embarrassment of saying them (Erdelyi, 1974, 1985). Additionally, the relative unfamiliarity with threatening words or strongly valenced objects, and not their motivational punch, may have slowed participants' recognition responses (Adkins, 1956; Howes & Solomon, 1950). For instance, children from lower socioeconomic status might have misjudged the size of coins not because they value them more, but because they have less experience with them (McCurdy, 1956). In addition, many designs lack baseline conditions and do not consider individual differences among groups of people. Consider that people with high anxiety recognized all words in a slower manner than those with low anxiety (Smock, 1956). Unfortunately, this group-based difference was rarely measured or corrected for within New Look research.

To be sure, much of what the New Look theorists proposed has lasted through today and informs contemporary cognitive and perceptual psychology in fundamental ways. Psychologists uniformly agree with the New Look tenet that much of cognition happens outside a person's awareness, monitoring, or control (Greenwald, 1992;

Wegner & Bargh, 1998). It is accepted that identification, recognition, and categorization are directed by perceivers' previous visual experiences as well as context (Biederman, Mezzanotte, & Rabinowitz, 1982; Boyce & Pollatsek, 1992; Li & Warren, 2004; Long & Toppino, 2004). That is, the conscious representation people form has omitted a good deal of information that the environment actually contains (Allport, 1989).

Indeed, New Look theorists have left their mark on contemporary cognitive and perceptual psychology. Although this literature initially engendered much support and enthusiasm, the problems that saturated this work produced a barrage of critiques that ultimately damned the enterprise. The empirical methodologies employed by these researchers, although state of the art at the time, allowed for too many alternative explanations. While the goal of New Look research was to demonstrate the role of nonconscious processes on the way people see and think about the world, the means to collecting this evidence required a conscious search strategy which undermined the conclusion that much perceptual work occurs without conscious awareness. As such, the influence of psychological states on perception was never firmly established (Dunning, 2001; Erdelyi, 1974; Gilbert, 1998; Jones, 1985; Nisbett & Ross, 1980).

B. NEW LOOK 2

Although generally declared insufficiently rigorous, methodologically flawed, and theoretically inconclusive by the field at large, the data generated by New Look I researchers continued to pique the interest of a small group of neo-Freudians. Proponents of

what is now called New Look 2 (Greenwald, 1992) returned to investigate the constructivist approach to perception but within a less introspective framework. In particular, these researchers investigated the functional goal constructed perception serves. New Look 2 predominately argued for motivated perception as an unconscious defense mechanism.

As a primary aim, New Look 2 attempted to define and explore the boundaries of unconscious biases. Erdelyi, spearheading the work of New Look 2, explored limens of consciousness and unconsciousness advocating for the position that such thresholds are moveable and dependent upon environmental and social variables (see Erdelyi, 1996 for a review). When an impoverished although affect-laden target becomes the focus of attention, a perceptual signal will be amplified (Kitayama, 1990, 1991). Similarly, a perceiver's negative emotional states and certain components of the environment intensify and exaggerate perceptual conclusions and memory. After watching an emotional movie, memory for subsequently presented letter matrices declines. This effect is strongest for those participants who describe the film as disgusting. This suggests that emotions, and disgust motivations in particular, bias recall in memory arguably because of perceptual processing strategies used when viewing the stimulus (Suedfeld, Erdelyi, & Corcoran, 1975).

Although the majority of work during this era was generated within and for the benefit of clinical practice, researchers began to address some of the largest criticisms of original New Look work. Primarily, New Look 2 attempted to document the situations that

would promote perceptual defense and those that would promote perceptual vigilance. This wave of research offered support for the interactionist perspective with increased rigor. However, its audience expanded little from its clinical base making it difficult for this work to achieve longevity.

C. NEW LOOK 3

Over a century after the initial interest, a new wave of research pushed the original New Look perspective back into the respected mainstream. Factions of current social cognition, dubbed New Look 3 (Greenwald, 1992), investigate what situational constraints, motivations, goals, and expectations impact the ways people see the world around them. Although the theoretical interests of all variants of the New Look perspective were similar, the process by which they were investigated transformed substantially. For instance, with the increased precision and versatility of reaction time recording and stimulus presentation techniques, New Look 3 can more accurately test complex theoretical constructs.

Offered as a central tenet by its predecessors, New Look 3 argues that perceivers can be blind to information passing right before their eyes. For instance, within a short window of time immediately after first viewing a different attention-capturing object, perceivers are blind to target or even goal-relevant objects (Raymond et al., 1992). The blindness that occurs during the window of time following a consciously processed target item is called an “attentional blink” (Loach & Mari-Beffa, 2003). Interestingly, there are a few items perceivers are not blind to even when they appear during the blink.

For instance, one's own name will capture attention while other nouns and other names are blinked out (Shapiro, Caldwell, & Sorensen, 1997). This suggests that not all information is considered equal or processed with equal resources. Instead, some information in some situations seems to be favored. One goal, then, of New Look 3 is to investigate which psychological constraints lead to the discrepant processing of various types of visual information.

One prevailing psychological constraint that predicts discrepant processing is culture. Certainly, the way that a person thinks about, judges, and reacts to others is highly dependent upon the culture in which that person has been raised and currently resides, but culture influences how people literally see the world, as well. Using a variation of the traditional rod-and-frame test, Kitayama, Duffy, Kawamura, and Larsen (2003) found that individuals immersed in Asian cultures attended to contextual information, while those enveloped in North American cultures ignored it. Japanese inhabitants were more accurate in the relative task and American inhabitants more accurate in the absolute task. Compared with Caucasian Americans, Chinese participants detected covariation in visual scenes through their increased field dependence or reliance on contextual information (Ji, Peng, & Nisbett, 2000). Data such as this suggests that culture constrains visual processing; individualists' myopic nature in social tasks may bleed into judgments at levels as fundamental as basic perception.

Just as chronic psychological constructs including culture influence perceptual judgments, perceiver's physical state also bias

attention and perceptual judgments in natural environments. For instance, thirsty people recalled more drinking related items from a previously visited room than did those whose thirst was sated (Aarts, Dijksterhuis, & De Vries, 2001). Thirst directed perceivers' attention to objects in the environment that might satisfy their current desire at the expense of attending to objects that were less relevant to this desire. Similarly, perceptions of a hill's slope were subject to influence by cumbersome additions to perceivers' weight, level of fatigue and physical fitness, health, and age (Bhalla & Proffitt, 1999). Added weight led to overestimates of distance (Proffitt, Stefanucci, Banton, & Epstein, 2003). Women, during periods of high fertility as opposed to low, recognized the male gender in photographs faster than the female gender (Macrae, Alnwick, Milne, & Schloerscheidt, 2002). Importantly, the same comparative enhancement was not present for women taking a contraceptive pill or those who were pregnant (Johnston, Arden, Macrae, & Grace, 2003). This suggests an enhanced sensitivity for reproductively relevant stimuli during states where the costs of inappropriate mate choice would be most high.

In sum, perception is not stable; rather it is highly malleable. It is dependent upon psychological and physical states among many other higher order constraints. These variables impinge upon visual processing quickly and outside of conscious awareness. Empirical investigations into such interests were a serious pursuit first by the original New Look researchers in the 1940s and 50s who proposed the role of needs, values, and desires as organizing factors in perception. Although current researchers maintain an interest in examining the

malleability of perception, the original interest in the constraining nature of desires has been subsumed under a larger goal. The main goal and the biggest contribution, arguably, of the current zeitgeist is the exploration of boundaries between and capabilities of conscious and unconscious processing. Importantly, the techniques used by New Look 3 researchers are increasingly rigorous. Thus, they offer answers to many of the perplexing questions left open by previous generations.

D. PRESENT INTERESTS

My interests represent the union between the interests of New Look researchers from the 1950s and the technologies available to study such phenomena marketed by current social cognition. I am interested in testing how psychological states, needs, values, and desires—or motivations more generally—infiltrate the ways in which people perceive the world around them. To date there have not been empirical demonstrations of motivated perception that focus on desires, hope, or wishful thinking that can withstand methodological criticisms. My work provides some of the first demonstrations that people see the world in a biased manner—that the world they see is the world they want to see and not the world as it really is.

In addition, I will explore why perceptual systems function in this manner. I start to address what role biased perception might play in self-regulatory strategies. Arguably, perception is filtered and biased to serve the end goal of allowing perceivers to act in the world in a way that allows them to manage their psychological states.

In demonstrating that motivations bias perception and suggesting why this might be the case, there is one question that

lingers in the background: what perceptual tasks are psychological states and motivations capable of touching? Is the impact of motivation limited to high-order tasks, such as categorization, or would it extend to relatively more primitive tasks the perceptual system faces such as defining perceptual thresholds? Of course, to begin to address this question, it will be necessary to address *how* psychological states accomplish this—that is, to investigate the mechanisms behind the phenomenon of motivated perception.

III. Where Does the Bias Reside in the Perceptual System?

Beyond the traffic ticket, talking on cell phones while driving is costly. A 20-year-old driver behind the wheel who is given a cell phone reacts with the same speed as a 70-year-old driver who is not using one (Strayer & Johnston, 2001). Drivers on cell phones react to brake lights 18% slower and take 17% longer to regain their original speed. In fact, chatty motorists perform worse in driving simulations than drunken drivers with blood alcohol levels exceeding 0.08.

The common assumption that the eye functions like a camera leads drivers to assume a false sense of security, relying on the notion that they see what is out there by merely opening their eyes and looking. However, perception does not work that way. Among the causes of these driving errors is the simple fact that perceivers have a finite perceptual and attentional capacity that must be distributed among many forms of sensory information. Perceivers cannot process all the sights, sounds, and other input that overwhelm the senses at any given moment. To avoid drowning in a flood of information, perception is filtered. Perceptual filters focus attention on important or

relevant raw information and decrease attention to less important information so that processing resources are devoted to the most relevant information in their environments. Effective perceptual filtering amplifies relevant input and attenuates irrelevant input. In this way, relevant sensory information becomes the perceptual foreground and the irrelevant sensory information recedes into the background. Unfortunately, rather than the traffic ahead, sometimes the most relevant information is the heated argument on the other end of the phone call.

Without a doubt, there are theorists and researchers who are less willing to state perception itself is filtered, or more generally, that it can be influenced by external, higher-order sources. Indeed, suggesting that perception lacks veridicality and positing when perception begins to lose its veracity has provoked major theoretical and empirical battles throughout many eras and continues to this day. Central to their critique, critics argue that higher-order constraints influence not basic perception but rather later stages of the perceptual process. Pylyshyn (1999), for example, asserts that perception occurs only during "early vision." In this stage, the visual system receives input then forms a 3-D representation of the external world. This stage, which he defines as perception proper, is immune to external influence. Simply put, he argues that motivations cannot penetrate perception. As a second stage, the mind filters, interprets, and categorizes the representation after early vision forms it. Pylyshyn (1999) refers to this manipulation of the raw data as post-perception or "perceptual decision making." Higher-order influences, such as

motivation, have an impact predominantly on this latter stage which he asserts is not perception but judgment.

Given recent evidence and debate (see the commentaries that accompany Pylyshyn, 1999), it is increasingly difficult for theorists to assert that perception is impenetrable. For instance, higher-order constraints, such as conscious attention, exert an influence on processing in areas even as early as V1, the most temporally primary region of visual cortex. When perceivers attend to one of two overlapping images, fMRI activity patterns in early visual areas, including V1, contain information that can predict conscious perception (Kamitani & Tong, 2005). Given the close proximity in space and time between V1 and the retina, it is almost illogical to claim higher order constraints infiltrate only later stages of perceptual decision making rather than the early stages Pylyshyn calls pure perception.

Although still an open interest and a contended issue, it is clear that motivations penetrate perceptual processing in many different ways, during many different tasks the perceptual system faces. In the sections that follow, I will discuss the specific ways in which motivations interact with a variety of tasks perceptual systems face. First, I will suggest that motivations begin to bias perception even before visual information is offered to the perceptual system. Before processing begins, motivations activate 'sets' through which perceptual information will be channeled. Incoming information congruent with or contained within the set will be processed further while incongruent information will not be picked up by the perceptual

system. Secondly, after an initial scan of the environment, motivations can direct attentional resources to some areas of a visual scene at the expense of others leading to blindness or a narrowed focus of attention on some types of information. Finally, motivations can bias the amount and degree of processing perceptual information receives after it is perceived. The amount of information required for categorizing an object might depend on whether the visual information presented suggests a favorable or disfavored outcome. The threshold for identifying a visual stimulus that resembles a preferred object might be lower than the threshold for identifying a stimulus that resembles a less preferred object.

A. MOTIVATED PRE-PERCEPTION

Psychological states can act as perceptual filters, thereby biasing perception very early on—even before information is presented to visual faculties. Filters, often called informational sets, sift perceptual information to shape perceptual experiences, sort the incoming stream of information, and assist in categorization and identification. Filters can be further distinguished by the type of information contained within the set (for a discussion of this distinction see Balcetis & Dale, 2006) but are generally comprised of expectations, past experiences, underlying assumptions, beliefs, attitudes, among many other types of information.

The first type of set is perceptual set. Perceptual set (Bruner & Minturn, 1955) is a form of filter that involves specific, directly relevant perceptual information immediately descriptive of upcoming visual stimuli. Classic work with ambiguous visual figures provides

clear examples of the role of perceptual sets. Leeper (1935) exposed participants to a simplified version of Boring's (1930) young/old woman ambiguous figure that emphasized characteristics of either the young or old woman. This perceptual filter biased subsequent identification of the original, truly ambiguous figure such that participants reported an interpretation that was congruent with their prior visual experience (see also Fisher, 1967). Pictures of animals led perceivers to see the rat/man ambiguous figure as a rat while pictures of human faces led to an interpretation of the figure as a man (Bugelski & Alampay, 1961; see also Crandall & de Lissovoy, 1977). Similarly, Epstein and Rock (1960) biased interpretations of the young/old woman figure by exposing participants beforehand to less ambiguous versions of the same figure.

A second type of set—conceptual set—contains incidental, loosely related information that is not perceptual in nature, which can subtly guide the perceptual system. For instance, relative spatial positioning is a type of conceptual set that biases object identification. Bar and Ullman (1996) showed participants pairs of objects that were either in the correct relative spatial positions (e.g., a hat above a leg) or in incorrect relative positions (e.g., a leg above a hat). Participants more accurately and more quickly identified the objects when the objects satisfied the correct position relation than when they violated it. In addition, conceptual sets assist in the resolution of visual ambiguity. Balcetis & Dale (2003, 2006) demonstrated that resolution of the Necker cube is biased by imagining looking up a tall building, down a deep canyon, or across the Great Plains. Participants were

more likely to see the Necker cube as an object they were standing underneath and looking up at after reading a description of a skyscraper seen from below.

Just as sets filter perception, psychological states such as preferences or desires might privilege one filter over another. The net effect of such filtration is that the perceiver tends to see information consistent with a desire (Pyszczynski & Greenberg, 1987; Sanitioso, Kunda, & Fong, 1990). Desires can serve as conceptual sets, leading perceivers to interpret an ambiguous figure in a manner that would bring about the desired outcome (Balcetis & Dunning, in press). During a lexical decision task just before participants viewed the ambiguous figure, participants were quicker to identify words associated with the desired outcome than words associated with the undesirable one, a pattern which suggests that desires activated a set associated with the desired outcome even before perceptual systems were exposed to the target object.

Importantly, the specific conceptual set participants might have used to disambiguate the stimulus was not closely tied to the stimulus. Perceivers were not given specific hints (i.e. seal) about what the upcoming stimulus might be (i.e. horse/seal ambiguous figure). Instead, broad categories (e.g., sea animal), even ones that that are composed of a set of features that is much too large to enact a specific feature search strategy, biased perception. Thus, desires can activate a conceptual set prior to exposure to stimuli. This conceptual set directs the identification of subsequently experienced objects with multiple interpretations.

One important note is that the distinction between perceptual and conceptual set should, perhaps, be appreciated for its descriptive ability rather than its truthful representation of the organization of mental contents. Although I have suggested perceptual and conceptual sets are distinct and separable forms of filters, it is most probable that both types of information play an active, equal, and simultaneous role in filtering incoming information. The activation of one type of set will activate the other in an interactive manner. In addition, the term 'set' may suggest that the contents of a filter are discrete—some concepts definitively excluded while others definitively included. However, it might be more accurate to describe both perceptual and conceptual filters as members of 'fuzzy sets' where membership is considered gradual and probabilistic. Rather than positing that discrete symbols are, in a binary sense, either members or not, fuzzy sets allow for graded inclusion of membership status. In this way, both perceptual and conceptual information can be activated to varying degrees within the same distributed representation.

B. MOTIVATED DIRECTION OF ATTENTION

Motivations infiltrate perceptual processing by directing attention to certain elements of the environment at the expense of others. When bar hopping on a Friday night, the clubs are usually packed with people talking, singing, and laughing. Yet, when it is time to start flirting with the bartender in order to get ahead in the drink queue, the background noise seems to subside and the bartender's voice becomes easier to hear. Although incessant, the coughs of the audience and squeaks of the chairs at a symphony concert usually slip

by the engrossed listener unnoticed. When New York Yankees pitcher Randy Johnson steps up to the mound, Red Sox fans shout, wave, and toss props about with the hopes of leading his pitches astray, yet they rarely accomplish their goal.

How does Randy Johnson's visual system make sense of the busy visual backdrop to focus on the catcher's glove when pitching at Boston's Fenway Park against the Red Sox? I suggest that psychological states act as perceptual filters, after input is received, to assist in deciphering of the complex visual environment. After an initial scan of the surroundings, attention might be directed to certain elements of the environment at the expense of others—a process called selective attention (see Yantis, 1996). This selection is often described as a spotlight that highlights a definite region (Posner & Petersen, 1990), like the Yankee catcher's glove, where perceptual processing is facilitated at the expense of information in other locations, like the enthusiastic Red Sox fans behind home plate. Again, I propose that motivational states can direct attention. For instance, when thirsty, perceivers focus their attention on objects in the room that might satisfy their thirst like a water bottle, increasing the likelihood that they will remember the object as having been in the room later on (Aarts, Dijksterhuis, & de Vries, 2001; Balcetis & Ferguson, in prep).

This focused attention, importantly, comes at the expense of attention to peripheral objects. Forster, Lieberman, and Higgins (2005) explain that a motivation to fulfill a goal, a powerful psychological state, increases the allotment of energy towards goal pursuit. Such prioritization helps to achieve the focal goal, but at the same time, it

could interfere with achieving other goals (Shah, Friedman, & Kruglanski, 2002). For example, the goal to find one's glasses when rushing off to the office increases the accessibility of "glasses" and its associates, but would most likely detract attention from simultaneously pursuing other goals such as locating one's keys.

Attention cannot and should not always be directed to a single stimulus in a single location. To accommodate this limitation, psychological states bias the scope of the attentional beam, adjusting its size in order to process all objects in all locations in a parallel manner. For example, when driving a car, attention needs to be directed to as much of the visual field as possible to guard against obstacles on all sides of the car. On the other hand, when trying to find a friend at an outdoor concert, it would be helpful to narrowly focus attention on likely locations, so that resources can be allocated to processing the faces, the voices, and other distinguishing features of people in those locations. In other words, processing resources can either be focused on a small region, allowing fast and precise processing in this restricted region, or they are distributed over a large region, allowing the processing of multiple stimuli in a less efficient manner.

Eriksen and St. James (1986; see also Eriksen & Yeh, 1985; Castiello & Umilta, 1990) have suggested a "zoom lens" model of visual attention to account for this type of expansive versus narrow beam of attention. The zoom lens can vary the size of the attentional focus continuously as environments and goals necessitate. Recently, neurophysiologists have sought support for the zoom lens model of

visual attention by using fMRI to measure activation patterns during visual tasks. In particular, researchers measure the Blood Oxygenation Level Dependent (BOLD) signal, which represents changes in the concentration of deoxygenated hemoglobin. BOLD signals correlate with changes in blood flow, observable electrical activity, and population synaptic activity. Measuring the BOLD signal using fMRI allows researchers to ask where activity occurs and what relative amount of resources the process requires.

Neurophysiological, eye-tracking, and behavioral data serves as a neurological analog supporting the zoom lens model of visual attention. Using fMRI, Mueller, Bartelt, Donner, Villringer, & Brandt (2003) observed that across V1, V2, primary visual cortex, and V4, the amount of visual cortical surface that was activated increased when attention had to cover a large region. Thus, when attention spanned a large surface area, a larger proportion of the visual cortex's surface area was activated. Importantly, the percent signal change in the BOLD signal within all 4 visual cortical areas dropped when the size of the attentional focus increased. This suggests then that as attention increased in span, fewer processing resources were allocated per square unit of visual cortex. When the amount of surface area that was attended to increased, the surface area of the neural correlates responsible for processing visual information also increased.

Importantly, this study tested the number and location of saccades in a pretest with the same participants while outside of the fMRI magnet. Eye movements were eliminated as a cause of the observed effects, as participants were able to suppress eye movements.

Indeed, it is not the case that a large cortical surface area was called upon to process visual information because the eyes were moving around more, but instead it was the expansiveness of the span of attention that called upon the greater amount of resources.

Additional support for the combined role of attentional spotlight and the zoom lens mechanisms comes from work on weapon focus. When experiencing a crime, witnesses maintain a poorer memory for important details about the crime, such as the perpetrator's face or clothing, if a weapon is used (Loftus, Loftus, & Messo, 1987). A weapon is looked at longer and more often than at a control object (Loftus, Loftus, & Messo, 1987) resulting in poorer performance in a line-up or recognition task to identify the perpetrator (e.g. Maass & Kohnken, 1989; Tooley, Brigham, Maass, & Bothwell, 1987). Although several mechanisms have been suggested for why people focus on the weapon, receiving most support is the proposition that weapons capture and hold attention at the expense of other objects in the scene because they are unusual (Pickel, 1998; Shaw & Skolnick, 1999). As explained by Loftus et al. (1987), a banana or a gun in the hand of the robber in a fast food restaurant might narrow the scope of attention to just that object.

Given the state of the literature at this point, I broadly conclude that attention will be differentially allocated to some forms of information at the expense of others. Some information captures attention when others types do not. Some environments will be scanned broadly and expansively, while others contain elements that will be scrutinized and fixated upon at the expense of other elements.

A key interest of mine is contemplating how these informational filters such as selective attention are developed—how an attentional filter might sort the stream of perceptual information as it enters.

C. MOTIVATED VISUAL INFORMATION PROCESSING

Motivations exert an influence over perception during a third perceptual processing task. Namely, motivations lead to differential styles of processing favored and disfavored perceptual information. A graduate student teaching assistant, endowed with 150 undergraduate essays to review and only a week to accomplish the task, might work quickly and with poor penmanship. An undergraduate, ever hopeful for a passing grade, receives his graded paper from this graduate student and might be convinced that the ambiguous squiggle at the top is a “B” rather than the “13” that it really is. That same graduate student (who is quite the defensive pessimist) might meet with her advisor later on. She will be convinced that when her advisor says he’s “somewhat glad to work with her” and says so with an unusual look upon his face, that he is really saying there’s room for improvement in the quality of her performance. And, without a doubt, she will certainly see the face he is making as a smirk rather than a smile.

People are motivated to come to a specific conclusion (see Kunda, 1990 for review), and the ways in which they process information come to reflect this bias. This is no less true in perception. Beyond pre-perception and the first tasks implicated in filtration, I propose that psychological states infiltrate other perceptual tasks as well. Motivations bias the manner in which perceptual information is

processed after it is perceived but still before people are consciously aware of the conclusion their perceptual system has reached.

Building support through a broad sample of research, Kunda's (1990) theory of motivated reasoning posits that "people rely on cognitive processes and representations to arrive at their desired conclusions, but motivation plays a role in determining which of these will be used on a given occasion" (Kunda 1990, p. 480). I suggest modifying this statement regarding social judgments to reflect biased perceptual judgments as well. Motivations play a role in determining the type and amount of perceptual processing that will be allocated to information consistent or inconsistent with the motivation.

In order to arrive at the preferred perceptual outcome, perceivers hold information to different levels of scrutiny. Other work in motivated reasoning has shown that information consistent with a favored conclusion is held to a lower standard of scrutiny than information consistent with an unwanted one (Dawson, Gilovich, & Regan, 2002; Ditto & Lopez, 1992; Trope & Ferguson, 2000). Schaller (1992) found that self-enhancement motives affect the type of reasoning style used to process information about the self and others. Logic and statistics are set aside in order to see one's in-group in a favorable light. Further, participants switch between simple and complex processing in order to find support for goal-enhancing evidence rather than goal-threatening evidence (Klaczinski, Gordon, & Fauth, 1997, p. 481). Complex reasoning is used to avoid accepting information that is threatening to current beliefs. However, flawed scientific evidence is accepted when it supports their beliefs

(Klaczinski, Gordon, & Fauth, 1997). Similarly, research in motivated skepticism found that people are less critical of information that supports a desired or existing belief (Ditto & Lopez, 1992). People are more likely to accept positive information without question, while they seek more evidence before accepting a conclusion that is inconsistent with prior beliefs (Ditto & Lopez, 1992).

Just as people consciously weigh and deliberate over favored and less favored pieces of information to different degrees, people also differentially allocate processing resources to visual scenes that offer positive and negative information. This type of motivated visual information processing manifests itself in several specific ways, none of which are at the exclusion of the others. It could be the case that perceivers scan the visual environment in a biased manner, searching for desired objects or favorable information rather than information that suggests the world is not as pleasant as one might wish. Alternatively, motivations might lower the threshold a visual feature must reach before the visual system allows it into consciousness. Desired components of the environment might be recognized faster or more easily because the perceiver requires less of a match between what he or she hopes to see and what is offered by the environment.

Importantly, regardless of what mechanism mediates psychological states and perception, it occurs preconsciously. Filters are engaged without requiring awareness, attention is directed without knowledge of that fact, and visual information processing occurs at different levels of intensity nonconsciously. That is to say, people are

not aware that they have come to see the world the way they have been set up to see it.

IV. Overview of Chapters

Johnny Nash famously said, "I can see clearly now – the rain is gone." As Nash's lyrics imply, people tacitly assume their perceptual experience of the world is a veridical representation of reality. People assume that only a downpour, typhoon, or other major calamity stands between them and an accurate perception of reality. Daily life experiences aside, the chapters that follow call this supposition into question and instead suggest the vantage is cloudy at best.

I explored one general psychological state shown to have a profound influence on the ways people come to judge themselves, evaluate others, and navigate their social world. That influence is perceivers' motivational drive to see the world as they want to see it, rather than how it actually is.

Indeed, people work diligently to see themselves in a favorable light. People expend much effort regulating their self-assessments and judgments of others to believe that they will achieve success while avoiding the pitfalls of life that others experience and to maintain high self-worth and esteem. Nestled among the literature on *motivated reasoning*, *self-affirmation*, and *defensive processing,* evidence indicates that people use these self-regulatory strategies to shape how they think about their physical, social, and mental worlds. Importantly, these forces impinge upon the judgments and decisions people reach with regard to information of which they are consciously aware.

I examined the scope of this type of deliberative motivated reasoning to see if motivations extend to levels of processing more primary than conscious, effortful judgment and decision-making. I investigated whether the motive to see the world through rose-colored glasses crosses the boundary between how people *think* about their world and how they *perceive* it. Chapter 2 offers evidence of times in which people see the world not how it is, but how they hope it would be. In Chapter 3, I examine the consequences of motivated perception and suggest that motivated perception might be used as a self-regulatory strategy. In Chapter 4, I investigate one possible mechanism by which they might accomplish this. That is, I test whether motivations bias the scope and direction of attention. In sum, I tested if people literally see what they want to see, arguing along the way the reasons why and how it might occur. Finally, in Chapter 5, I review the ways in which the previous chapters inform the understanding of what motivated perception is, why it is useful, and how motivations penetrate perception. In addition, I examine the ways in which motivated perception permeates daily life, exploring the applied nature of this enterprise.

A. CHAPTER 2: SEE WHAT YOU WANT TO SEE—MOTIVATIONAL INFLUENCES ON VISUAL PERCEPTION

In this chapter, I asked if perceiver's perceptual experiences could be molded, in part, by such psychological states as personal wishes and preferences. I examined if perceivers, when presented with ambiguous visual information, would resolve the ambiguity in such a way that they might see what they want to see. Across these studies, I

provided converging evidence to suggest that participants' desires, hopes, or wishful thinking led them to see information they desired over what they did not.

1. Overview

In all studies, participants knew they would perform either a desirable task, such as consuming orange juice, or an undesirable task, such as drinking a gelatinous, green slime labeled organic veggie smoothie. Participants learned that their assignment would be determined by what category of stimuli appeared on their computer screen. For all participants, I manipulated what type of stimulus would bring about the desired and undesired outcomes. Then, participants saw an ambiguous figure that could be interpreted as a member of both categories. I measured participants' immediate perceptual experience of that ambiguous figure. I predicted and found that desire led perceivers to resolve the ambiguous nature of the stimulus in the desired way. Perceivers saw what they wanted to see.

Overall participants interpreted an ambiguous visual stimulus in a manner that fit with their wishes and preferences over one that did not. By using nonconscious measures of perceptual experience, I eliminated the possibility that the bias resided at the level of response selection. In particular, a hidden video camera tracked gross eye movements without participants' awareness, lexical decision tasks measured concept accessibility, and paradigm variations suggested participants actually saw, rather than simply reported seeing, the favored interpretation. Wishful thinking constrained interpretations before perceptual judgments were made.

This motivated perceptual bias may be the byproduct of a broad-reaching mechanism that allows people to maintain overly favorable beliefs about the self. That is, to believe oneself as above average across the majority of domains, a logically implausible feat, it is necessary that the cognitive work it takes to get to that belief would have to stay behind the scenes—unconscious, in other words. This process may bleed over from cognition to perception, filtering the world before the information reaches conscious awareness so that people can see things as they wish to rather than how they really are. This self-regulatory strategy, whether occurring in cognition or perception, allows people to think of themselves as loveable and capable, and the world as benevolent and charitable.

B. CHAPTER 3: COGNITIVE DISSONANCE AND THE PERCEPTION OF NATURAL ENVIRONMENTS

Chapter 3 demonstrated that intrapsychic motivations like cognitive dissonance reduction influenced perceptual processes. This work suggested that motivated perception serves a self-regulatory function. Self-regulation can bias perception of the element of the environment one is interacting with at the time that such regulation is required. Perceivers see the world the way they want to see it so that they might feel good about themselves, their choices, and the world around them.

Cognitive dissonance theory assumes a drive-like motivation to maintain consistency among relevant thoughts and actions (Festinger, 1957). Although it is well documented that when attitudes and actions contradict one another, a drive-like motivation is produced that aims

to restore harmony by shifting beliefs to realign them with behavior. Most documented is the restoration of harmony via a change in judgments, decisions, or attitudes (Festinger & Carlsmith, 1959; Knox & Inkster, 1968; Sherman & Gorkin, 1980). In this research, I investigated whether restoration of harmony could prove successful through shifting perceptions. That is, I asked if this form of self-regulation could extend down to visual perception of natural environments when one is experiencing dissonance.

1. Overview

In both of the studies discussed in this paper, participants performed an aversive or embarrassing task. In each study, I manipulated participants' subjective feelings of choice about completing the task to be either high or low. Under high choice, people needed to resolve the dissonance caused by their voluntary agreement to perform an aversive action such as walking across a campus quad in a costume and rolling up a grass hill kneeling on a skateboard. Under low choice, this dissonance is easily resolved because participants can attribute their agreement to lack of choice (Linder, Cooper, & Jones, 1967). I found that participants resolved their dissonance in high choice conditions by altering their perception of the environment to make the task less aversive relative to perceptions reported by low choice and control condition participants. Across both studies, high choice participants saw the distance they had to walk as shorter and the hill as less steep than the other participants.

In this paper, I explored the consequences for perception of people's self-regulatory goal to reduce cognitive dissonance. In

particular, I investigated if the motivation to alleviate dissonance associated with psychological distress and mental turmoil can lead people to see their world in a way that allows them to feel better. Specifically, I investigated whether the drive toward dissonance reduction can bias the way people perceive an element of their environment that they are interacting with at the time of experiencing dissonance.

C. CHAPTER 4: DISTANCE AND THE FOND HEART—AN EXAMINATION OF HOW DESIRES CONSTRAIN DISTANCE PERCEPTION

Although the first two papers provide evidence that perceptual experiences do not accurately represent reality, the process by which motivation infiltrates perception is, as of yet, ill-defined. In this chapter, I propose that perceptual systems are tuned to positive information. I proposed that motivated perception occurs because perceivers narrowly focus their attention on positive information at the expense of comparatively less desired information. In addition, I examined the downstream consequences of such focused attention on other perceptual tasks such as estimating distances.

In these studies, participants estimated distances between themselves and an appealing object, like chocolate truffles, or a less appealing object, like dog poop. I predicted and found that distances to appealing objects appear shorter than distances to less appealing objects. In addition, I offered evidence that motivation influences perception via changing the expansiveness of attention span. In short,

perceivers tended to focus their attention on desired objects resulting in decreased perceptions of distance.

These studies again beg one to ask what perceptual tasks motivations penetrate. Across these studies, I provided convergent evidence suggesting that desires led participants to see what they want to see in their visual environment—to focus their attention on objects of their desire. Perceivers' attention was held by the object which led them to see the object of their desires as closer than it really was. Although not exclusively so, I suggest that motivations affect the allocation of attention.

D. THE FETTERS OF ONE'S DESIRES: A SYNOPSIS OF MOTIVATED PERCEPTION

The final chapter illustrates how each of the preceding ones offer unique insight into motivated perception. Certainly, the main goal of each of these chapters is to explore the variety of psychological and physical motivations that bias perception. However, in the final chapter, I explore the specific ways in which each takes this exploration further and in a slightly different direction. For instance, I discuss how each chapter argues that motivations infiltrate different processing tasks. In addition, I discuss how each chapter explores the downstream consequences of motivated perception on the self-regulation of goals and internal states in addition to suggesting that motivated perception is adaptive. Finally, I will discuss the various instances of motivated perception outside of the lab in such domains as self-screening for cancer, body image issues, and marketing strategies among others.

The final chapter also addresses an important theoretical concern—one that has circulated for several instantiations of interest in the New Look perspective. The traditional conception of perception is a stage-like, linear series of independent processes. However, just as preceding generations came to realize, there are problems with accepting this conception of perception. If one accepts the stage-like conception of perception, then one must accept that the mechanisms underlying motivated perception require that an object first be perceived before motivational filters can be employed. That is, by the time motivational forces know that the object in question is consequential, the object has already been perceived. To address this concern, I will discuss a new approach to perceptual processing (see Spivey, in press) that integrates higher and lower order constraints suggesting they work in tandem, in parallel, to produce a perceptual conclusion and promote action. I will use this approach to discuss the next steps in motivated perception research. I propose that the goal for motivated perception researchers is to eventually offer a complete picture of the mutually constraining, dynamic processes that are implicated in perception.

V. Conclusion

George Bernard Shaw (1903) accurately summarized a wealth of research suggesting inner, psychological states are a central determinant in perceptual experience when he admonished "better keep yourself clean and bright; you are the window through which you must see the world." Perhaps it is through such biased perception that, in fact, perceivers are able to continue feeling positive, clean, and

bright. Motivations lead people to see the world as they want to, and perhaps this is one strategy by which perceivers continue to maintain positive self-views, optimistic predictions for their future, and a rosy outlook on their surroundings. The distortions that result from seeing the world through motivated lenses might promote a sense of safety and happiness. In return, this general positivity continues to tint the lenses through which perceivers view the world. Certainly, the view we have of the world will depend on the window through which we see it. The goals of the following work are to explore the different ways people view the world, the downstream consequences of idiosyncratic perceptions, and one mechanism by which perceptual distortions arise. In general, I hope to offer insight into the architecture of the window through which people see their world.

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CHAPTER TWO

SEE WHAT YOU WANT TO SEE: MOTIVATIONAL INFLUENCES ON VISUAL PERCEPTION[*]

The world that people know is the one they take in through their senses. This is the world they react to—the one their conscious thoughts, feelings, and actions are predicated on. People act on the presumption that the world they are consciously aware of is a comprehensive and accurate representation of the environment that exactly copies the outside world as it truly is.

Decades of research in psychology, however, tend to undermine the assumption that what people see or hear is an exact replica of what is out in the world, in two different ways. First, perception is selective. People are not aware of everything that is going on around them. Consider, for example, recent studies of "attentional blindness." Of undergraduates asked to monitor how many times people in a videotape pass a basketball among themselves, 40% failed to see the woman in a gorilla suit saunter into the middle of the group, turn to the camera, beat her chest, and then walk out (Simons & Chabris, 1999). Second, perception is often biased. Hills are not as steep as they appear to be (Bhalla & Proffitt , 1999; Creem & Proffitt, 1998; Proffitt, Creem, & Zosh, 2001). Distances are not as short as they look (Baird & Biersdorf, 1967; Durgin, Proffitt , Olson, & Reinke, 1995;

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Galinsky, 1951; Tittle, Todd, Perotti, & Norman, 1995; Todd & Bressan, 1990; Todd & Norman, 1991). Large objects are not as tall as they seem (Yang, Dixon, & Proffitt, 1999). Everyone knows that the speck of a pebble at the bottom of one's shoe is never nearly the rock it feels like when one steps on it.

Moreover, perception is malleable. It is responsive to "top down" influences that flow from the perceiver's cognitive and psychological states or from environments (Henderson & Hollingworth, 1999). To be sure, much of perception is "bottom up," with sense organs and perceptual systems working inflexibly and automatically to form a representation of a stimulus that the perceiver passively accepts. The perceptual system pieces together the fine-grained bits of information the senses acquire to create a coherent percept, analyzing and synthesizing basic components of objects (Kosslyn & Koenig, 1992; Michelon & Koenig, 2002) including focal areas, critical features (Long & Olszweski, 1999), fixation points (Meng & Tong, 2004; Toppino, 2003), and spatial proximity or "crowding" (Pelli, Palomares, & Majaj, 2004).

But a substantial volume of psychological research reveals that top-down influences also inform perception. For example, context matters. Prior exposure to images of animals or people biases what people see when they view classic ambiguous figures, such as the "rat/man" and "old woman/young woman" figures so often featured in introductory psychology textbooks (Bugelski & Alampay, 1961; Leeper, 1935). Estimates of a man's walking speed are biased after thinking about fast animals like "cheetahs" or slow animals like "turtles" (Aarts

& Dijksterhuis, 2002). Interpretations of an ambiguous figure that can be seen as a woman's face or as a man playing a saxophone depend on whether perceivers have been recently primed with the concepts of *flirtation* or *music* (Balcetis & Dale, 2003). Perceptions of how steep a hill is become more extreme after participants jog vigorously for an hour (Bhalla & Proffitt, 1999). The distance to a goal seems longer if people strap on a heavy backpack (Proffitt, Stefanucci, Banton, & Epstein, 2003).

In this manuscript, we explore one possible top-down influence on perception that has been shown to have a profound and ubiquitous impact in other arenas of social cognition. That influence is the perceiver's motivational states—more specifically, the motivation to think of one's self and one's prospects in a favorable way, to believe that one will achieve positive outcomes while being able to avoid aversive ones, and to enhance self-worth and esteem. This motivation in the psychological literature has several names, such as *motivated reasoning*, *self-affirmation, wishful thinking*, and *defensive processing,* and has been shown to have a widespread influence in shaping how people think about their world—that is, how they interpret information of which they are consciously aware. This motive has been shown to influence such higher-order tasks as judging other people, evaluating the self, predicting the future, and making sense of the past (for reviews, see Baumeister & Newman, 1994; Dunning, 2001; Kunda, 1990; Pittman, 1998).

In the studies that follow, we examine the scope of motivated reasoning to see if it crosses the boundary between how people *think*

about their outside world and how they *perceive* it. Certainly, motivated reasoning influences conscious, deliberate, and effortful judgments, but we ask if it can constrain what information reaches consciousness in the first place? Does the impact of motivated reasoning or wishful thinking, more specifically, extend down to preconscious processing of visual information? We test, in essence, whether people literally are prone to see what they want to see.

The Impact of Motivational States

There exist some indirect hints that the motives underlying wishful thinking will have an impact on visual perception. Recent work focusing on more biologically-oriented motivational states shows that they influence the perception of visual stimuli. For example, Changizi & Hall (2001) demonstrated that participants who were thirsty perceived more transparency in ambiguous visual stimuli than do those who were not thirsty, presumably because transparency is a characteristic associated with water. Women during periods of high fertility were faster to categorize male photographs than female ones by gender, relative to those not in such a fertile state (Macrae, Alnwick, Milne, & Schloerscheidt, 2002). Importantly, the same comparative enhancement was not present for women taking a contraceptive pill or those who were pregnant (Johnston, Arden, Macrae, & Grace, 2003). Both of these examples suggest an enhanced perceptual sensitivity for features in visual stimuli that are relevant to biological drives or desires.

But would a drive toward wishful thinking similarly influence perception? In a sense, this question is a revisiting and a reopening of

one of the focal issues of the New Look approach to perception that arose in psychology during the 1940s and 1950s (Bruner & Minturn, 1955). According to New Look theorists, perception was an active and constructive process influenced by many top-down factors. One class of such factors was the needs and values of the perceiver. For example, Bruner and Goodman (1947) asked children in diverse social economic conditions to estimate the size of monetary coins by manipulating the diameter of a beam of light. Poorer children, for whom the value of money was greater, overestimated the size of the coins compared with more affluent children who were presumed to place less value on the same coins. In studies of *perceptual defense*, New Look theorists concluded that participants inhibited the recognition of threatening stimuli, such as troubling words (Postman, Bruner, & McGinnies, 1948).

These initial demonstrations of motivational influences on perception were met with much enthusiasm, which was then followed by withering critiques. To be sure, much of what the New Look theorists proposed has lasted through today and informs contemporary cognitive and perceptual psychology in fundamental ways. Psychologists uniformly agree with the New Look tenant that much of cognition happens nonconsciously—that is, outside a person's awareness, monitoring, or control (Greenwald, 1992; Wegner & Bargh, 1998). Many modern textbooks describe the New Look proposal that perception is filtered—that the representation of the environment that people have in consciousness has omitted a good deal of information that is actually in the environment (Allport, 1989;

Miller, 1987). Similarly, perception of an object is importantly influenced by the perceiver's expectations as well as the context surrounding that object (Biederman, Mezzanotte, & Rabinowitz, 1982; Boyce & Pollatsek, 1992; Li & Warren, 2004; Long & Toppino, 2004).

However, the specific New Look assertion that motivational states influence perception did not achieve the same stature and longevity as these other insights. It, instead, ran aground in the 1950s on the rocky shoals of methodological difficulties and theoretical controversies (Eriksen, 1958, 1962; Eriksen & Browne, 1956; Goldiamond, 1958; Prentice, 1958; Wohlwill, 1966). Critics pointed out that poorer children might misjudge the size of coins because they were not as familiar with them, or that their misjudgments might involve problems of memory rather than perception (McCurdy, 1956). Critics also noted in studies of perceptual defense that participants might have taken longer to report troubling words not because it took them longer to perceive them, but rather because it took longer to get over the surprise of seeing them or the embarrassment of saying them (Erdelyi, 1974, 1985). Others lamented that the relative unfamiliarity of threatening words, and not their motivational punch, was the key ingredient that slowed participants' recognition responses (Adkins, 1956; Howes & Solomon, 1950). As such, the influence of motivational states on perception was never firmly established. And as the 1950s closed the study of the relation between motivational states and perception, this pursuit fell by the wayside and ceased to have the major impact—if any at all—enjoyed by other insights from the New

Look tradition (Dunning, 2001; Erdelyi, 1974; Gilbert, 1998; Jones, 1985; Nisbett & Ross, 1980).

Perception of Ambiguous Figures

In the present research, we examine the impact of motivational states on perception by focusing on interpretations of ambiguous or reversible figures—visual stimuli, like the famous Necker cube, that people can interpret in two different ways but for which they tend to see only one interpretation at any given time (Long & Toppino, 2004; Rock & Mitchener, 1992).

In each of five studies, we told participants that they were about to be assigned to one of two experimental tasks, one being much more desirable than the other. We also told participants that a computer sitting in front of them was about to present them a stimulus that would indicate which task they were assigned to. In fact, in each study, the computer presented a figure that could be interpreted in two different ways—one way that would assign participants to their favored task and one that would assign them to the opposite. We expected that participants would tend to see the interpretation that assigned them to the outcome they favored.

Because our experimental stimuli, like much of the contents of our surroundings, lack clarity and contains multiple interpretations, potential interpretations of a visual stimulus can be likened to a hypothesis (Gregory, 1974). Given a constrained set of bottom-up features and top-down influences, the perceptual system considers certain ideas of what an ambiguous stimulus might be and ultimately selects one interpretation. For example, given the distinct features of a

four-legged shape in a distant field, one can entertain different hypotheses about the identity of the shape. For example, to test whether the shape is a cow, the perceiver might examine whether the shape has a stocky snout and black spots.

Just as expectancies and contexts can suggest a testable perceptual hypothesis, a preference or desire might privilege a favored interpretation or hypothesis over a disfavored one. Wishful thinking might shape the specific hypothesis that individual's tests when given such ambiguous information. In particular, the perceiver might scan the visual stimulus in a biased manner searching for features that match those of the desired animal rather than those that match an undesired one. The net effect of focusing on a hypothesis is that the perceiver tends to seek out information that would confirm it rather than disconfirm it (Pyszczynski & Greenberg, 1987; Sanitioso, Kunda, & Fong, 1990;).

Alternatively, a motivated preference might lower the threshold a feature must reach before the visual system decides it matches the favored interpretation. Other work in motivated reasoning has shown that information consistent with a favored conclusion is held to a lower standard of scrutiny than information consistent with an unwanted one (Dawson, Gilovich, & Regan, 2002; Ditto & Lopez, 1992; Trope & Ferguson, 2001). It could be then that those features most representative of the desired animal category are recognized faster or more easily because the perceiver requires less of a match between what he or she hopes to see and what is offered by the stimulus.

The key of whatever process is at play is that it takes place

preconsciously. People are not aware that they have selected one interpretation over another. Indeed, they are not even aware of the alternative interpretation. Whatever work the visual system has done to bias the interpretation that people see involves processes below the level of awareness.

Overview of Studies

Studies 1 and 2 demonstrated that participants tended to report seeing the interpretation of an ambiguous figure that fit with their wishes and preferences over one that did not. Studies 3 and 4 added implicit measures to ensure that participants truly saw the interpretation they reported rather than simply reporting the preferred interpretation. Study 5 added a procedural twist to affirm that participants saw only the interpretation they usually wanted to see as they viewed the stimulus—and that it was not the case that they saw *both* interpretations and then only reported the favored one. In short, people tended to honestly see only that interpretation that was suggested, in part, by their motivational state.

Study 1: Disambiguating an Ambiguous Figure

Study 1 was designed to provide an initial demonstration that wishful thinking could influence the interpretation of an ambiguous stimulus. Participants were brought into the laboratory and told that they would be assigned to one of two tasks. One was favored (i.e., drinking freshly-squeezed orange juice); the other was not (i.e., drinking a noxious-smelling and vile-looking health food drink). They were told that the computer would assign their beverage by presenting either a number or a letter. For roughly half of participants, a letter

would indicate that they were assigned to the desirable beverage. For the other half, the reverse was true. However, what the computer flashed very briefly was an ambiguous figure that could be interpreted either as a number or letter. Our prediction was that participants would tend to report seeing the interpretation that offered them in the coveted beverage.

Method

Participants

Participants were 88 undergraduates at Cornell University who earned extra credit in their psychology or human development courses for taking part in the study.

Procedure

In what was advertised as a taste-testing experiment, an experimenter explained that participants would predict taste sensations for 2 beverages, consume only 1 beverage, and describe their actual taste sensation of that 1 beverage. On the table in front of participants sat the two beverages. The first was the desirable one: freshly squeezed orange juice. The second was the less desirable alternative: a gelatinous, chunky, green, foul-smelling, somewhat viscous concoction labeled as an *organic veggie smoothie*[1]. The experimenter invited participants first to smell each beverage. Then, participants spent 3-min predicting what they might experience if asked to drink 8-oz of each beverage to heighten the appeal of the orange juice and strengthen their disgust with the veggie smoothie.

[1] Recipe available upon request.

Participants were seated in front of a 15-in G3 iBook. The experimenter then explained that a computer program would randomly select a beverage for the participant to consume. Specifically, the computer would select either a single letter or a single number from a set of 26 letters and 26 numbers. Roughly half of the participants, those in the number-desirable condition, were told that if the computer selected a number from the set, they would drink 8-oz of orange juice, and if a letter was selected, they would drink 8-oz of veggie smoothie. The remaining participants in the letter-desirable condition learned that a letter would result in their assignment to the orange juice and a number to the veggie smoothie.

After inviting the participant to review these directions on a computer screen, the experimenter stepped away to ostensibly complete some paperwork. Participants focused on the center of the monitor on which was displayed a static fixation point. After 3-sec, this fixation point was replaced with an ambiguous figure (1-in in height, 1-in in width) that could be interpreted as either the capital letter B or the number 13 (see Figure 2.1) for 400 msec. The presentation of this figure was followed by a 200 msec mask, then finally an image that was meant to look as though the computer program had crashed. The experimenter continued to focus on the paperwork until the participant called her attention to the computer crash. The experimenter feigned surprise, exclaimed that "this always happens to old Macs," and stated that she would have to ask the graduate student she worked for what she should do. As the experimenter approached the door to leave the lab, she asked if

Figure 2.1. Ambiguous B/13 Figure Used in Study 1.

the program displayed anything before crashing. At this point, most participants reported whether they saw a B or a 13. If participants did not offer a response, the experimenter asked again if *anything* was shown or if it immediately crashed. If at this point participants still refused an answer, the experimenter left the room, returned a few minutes later to ask a final time if anything was shown.

After offering an answer, the experimenter handed the participant a questionnaire to complete while she supposedly left to prepare the beverage. This questionnaire probed for suspicion of the purpose of the study, suspicion of the computer crash, and in a funneled manner queried participants to see if they realized the ambiguity in the figure shown before the computer crash.

Results

A priori, we established conditions for the inclusion participants' data. Participants were excluded if they recognized the figure was ambiguous, were able to explain the purpose of the study in debriefing, or mentioned they wished to be assigned to what was considered by most participants to be the less desired task (i.e. consumption of veggie smoothie). Given these criteria, 15 people were excluded for recognizing the ambiguity in the figure when viewing the

figure, 4 for explaining that we were interested in how their desires could influence the way they saw the figure, 3 for stating they hoped to consume the smoothie, and 3 simply refused to participate when they heard that they might be asked to consume the smoothie. This left data from 63 participants for analysis. Although a few participants indicated the computer crash was suspicious, none of these participants were able to describe the purpose of the study or the reason for the crash.

Responses from those 63 participants were coded using the following method. Reports of the letter B were given a score of +1, and reports of the number 13 a score of -1. Those who did not offer a response or indicated that nothing was shown before the crash received a score of 0. We then subjected these scores to an ordinal logical regression analysis (the constrained range of the coding system made more usual statistical procedures less appropriate) to see if participants tended to see different interpretations of the ambiguous figure depending on which interpretation was more desirable. As expected, participants' desire to see either letters or numbers influenced their interpretation of the B-13 ambiguous figure, $\chi^2(1) = 23.92$, $p < .001$. In particular, when hoping to see a letter, 72% ($n = 18$) of participants reported seeing the capital letter B while 0% reported seeing a 13. When hoping to see a number, 60.5% ($n = 23$) reported seeing a 13 and 23.7% ($n = 9$) reported seeing the B. Some people in each condition reported that in fact nothing was shown before the crash (28%, $n = 7$, in the letter-favorable condition; 15.8%, $n = 6$, in the number-favorable condition).

Our specific prediction focuses on the responses of those who offered an interpretation of the figure. When excluding those responses from participants who reported that nothing was shown before the crash, participants' desire to see either letters or numbers influenced their interpretation of the B-13 ambiguous figure, $\chi^2(1) = 23.96$, $p < .001$. Additionally, we can collapse across the specific character participants were motivated to see and look at just the reported interpretation for those participants who offered one. In fact, 82% ($n = 41$) of participants report the desired interpretation, $\chi^2(1) = 20.48$, $p < .001$.

In addition, including those people in the analyses who indicated that the figure was ambiguous does not change this pattern as similar numbers of participants across both motivational conditions reported the ambiguity of the figure ($n = 8$ when hoping to see letters, $n = 7$ when hoping to see numbers). That is, we gave a score of 0 to those people who indicated the figure was ambiguous and again conducted an ordinal logistic regression. Still, participants' desire to see either a letter or a number influenced their interpretation of the ambiguous figure, $\chi^2(1) = 22.95$, $p < .001$.

Discussion

In sum, Study 1 provided evidence that people's motivational states can influence their interpretation of ambiguous objects in their environment. When faced with an ambiguous figure that could be interpreted as either a number or letter, the interpretation that reached consciousness and was reported tended to be the one that

placed participants in a desirable circumstance rather than in an unwanted one.

However, it is possible that the participants' responses did not reflect their true percept. Instead of reporting what they saw, they instead just offered a report that assigned them to the orange juice. Put simply, participants may have lied about what they saw. Although we suspect this is not the case, we conducted a follow-up to assess this counter-explanation. In a design similar to Study 1, 28 participants were either motivated to see letters or numbers to avoid the veggie smoothie but were then shown unambiguous figures of *B* or *13*, rather than an ambiguous figure, during the computer assignment process. For half of the participants, a letter assigned them to the orange juice whereas for the other half a number assigned them to the veggie smoothie. Crossed with this, half of the participants were shown a *B* and the other half were shown a *13*, resulting in a 2 (desired character: letter or number) X 2 (character shown: *B* or *13*) factorial.

The alternative account predicts that participants' reports of the figure shown to them would be influenced by which character was desired as well as what character was shown to them. However, inconsistent with that account, we found that what participants reported depended only on the character shown to them. In all conditions, 100% of participants (n = 7 in every cell) reported the actual figure shown, regardless of what figure was shown to them and what participants were motivated to see.

Study 2: Replication

Study 2 was designed as a conceptual replication involving a different ambiguous figure and a different procedure. In addition, in Study 1, we noted that a small but notable minority of participants was able to spot the ambiguity of the figure we showed them. In Study 2, we used a figure whose ambiguity was more opaque, and thus not as likely to be noticed by participants.

Method

Participants

Participants were 52 undergraduates at Cornell University who received extra credit in their psychology course for taking part.

Procedure

Participants completed a task ostensibly about differences in predictions of and actual taste experiences. The experimenter explained that participants would be experiencing and describing different taste sensations. Participants would predict taste sensations for 3 food items but actually consume only one of them. First, participants predicted what each of the following items would taste like: a bottle of Aquafina water, a bag of Jelly Belly candies, and a bag of gelatinous and partially liquefied canned beans.

After participants predicted taste sensations of each item, participants were seated in front of a 17-in iMac 64 desktop computer. Again, supposedly to eliminate bias from the selection process, a computer program would randomly assign the item participants would consume. The experimenter explained that participants would play a game, their score at the end of which would determine what item was

consumed. In this game, the computer displayed pictures of animals worth positive and negative points. On the top of their response sheet was a table listing every animal that could be selected and the specific number of points each animal was worth. For half of the participants, farm animals were worth positive points while sea creatures were worth negative points. For the other half of participants, this was reversed. Black and white drawings of the full bodies, heads, and artistic renditions of animals were displayed in the rounds that preceded the final round.

Although the computer would be keeping an ongoing tally of the points accumulated, participants recorded the animal shown to them, the points that animal was worth, and their ongoing score ostensibly to corroborate the computer program. If their score at the end of 15 cards was zero, participants would consume the water. If their score was positive, they would consume the candies, but if their score at the end was negative, participants would consume the canned beans. Although participants were told that the program randomly selected animals from a set of 4 farm animals and 4 sea animals, the program was actually rigged such that every participant experienced one of two sequences of animals and point tallies, depending on what category of animal was worth positive point values.

As the game progressed, ongoing scores, predetermined and consistent across participants, fluctuated between positive and negative. However, the last 3 rounds brought increasingly negative point totals. That is, ongoing scores became evermore suggestive that participants would consume the canned beans. Ongoing scores at the

end of the penultimate round were such that only 1 animal was worth enough positive points to be able to pull participants from the negative and bring a positive final score, thus avoiding the canned beans. For half of the participants, this animal was a horse; for the other half, it was a seal. The animal displayed during the final trial was in fact an ambiguous figure (2.75-in wide, 3.75-in tall) that could be interpreted as either the head of a horse or the full body of a seal (see Figure 2.2). All animals including the last figure remained on the screen for 1000 msec.

Figure 2.2 Ambiguous Horse/Seal Figure Used in Studies 2 through 4.

After the game, participants completed a funneled debriefing that probed for suspicion of the purpose of the study, possible alternate interpretations of the figure, and asked if they had seen the figure before.

Results

Given the criteria we established a priori, 5 participants were excluded for articulating the purpose of the study and 4 for mathematical errors that precluded them from desiring the target animal. No one reported seeing both interpretations of the ambiguous figure. These omissions left data from 43 participants for analysis.

We used the same type of coding scheme for interpretations as in the previous studies. Given the natural bias of this ambiguous figure was to see a horse, those who reported a horse received a score of +1. Because the less common interpretation of the figure was as a seal, those who reported a seal received a score of -1. Using an ordinal logistic regression, we found that participants' interpretations depended upon what category of animal was worth positive points, $\chi^2(1) = 6.89$, $p = .009$. When hoping to see a horse, 66.7% ($n = 14$) of participants saw the figure as a horse, and 33.3% ($n = 7$) saw a seal. However, this bias reversed when hoping to see a seal. Only 27.3% ($n = 6$) of this group sees a horse, but 72.7% ($n = 16$) reported a seal, $\chi^2(1) = 6.70$, $p = .01$.

Discussion

In sum, Study 2 replicated the findings of the first study with a different figure and experimental procedure. Participants tended to see the interpretation of the figure that they desired to see, rather than

one they wished to avoid. In addition, no participant, either spontaneously or in debriefing, noted the ambiguous nature of the figure they saw.

However, a reader can propose one counter-explanation for these findings, one that we decided to test in a control study. Given that the 3 rounds preceding the ambiguous figure included animals that brought participants' scores down, it is possible that participants' expectations about the next type of animal and not their desire predisposed them to see an animal worth positive points. That is, participants fell prey to a gambler's fallacy, assuming that a run of negative scores made positive-scoring animals more likely to appear next.

To test this alternative explanation, we reran a version of Study 2, asking participants to follow along with the computer game and to record their points on a response sheet. However, we made clear to them that they would not be consuming any products after the game and that there would be no consequence for the final score they earned. Instead, they were to act as proofreaders, reading the directions thoroughly and evaluating the clarity of them. As was the case in Study 2, half of the participants encountered a game that made the horse the most valuable animal while the other half were led to believe the seal as the most valuable animal. Thus, this group of participants, aware of the point structure and the progression of animals, too would be susceptible to the gambler's fallacy but have little reason to be motivated to see the most valuable animal in the final round.

In this control study, interpretations of the figure were not biased by what animals were most valuable. Those for whom farm animals would have been the most valuable were not more likely to see a horse than were those for whom sea animals would have been the most valuable, $\chi^2(1) = .11$, $p = .74$. When farm animals were the most valuable, 65% ($n = 13$) of participants saw the figure as a horse and 35% ($n = 7$) saw it as a seal. When sea creatures were the most valuable, 70% ($n = 14$) saw the figure as a horse and 30% ($n = 6$) as a seal.

The results of this study can be compared with those of Study 2 to suggest that reducing desire to see a particular animal can reduce the bias in interpretations. Because we are making comparisons across studies, it is necessary to use a Stouffer's *Z*-test (see Darlington & Hayes, 2000, for a review) to test if the effect of desire in Study 2 is sufficiently different from the effect of desire in this control study. That turns out to be the case, $Z = 2.58$, $p < .005$.

Study 3: Adding an Unobtrusive Measure

Study 3 was designed to provide convergent evidence that the interpretations participants reported were, indeed, the sole interpretations that came to consciousness as they viewed the ambiguous stimulus. One can propose, instead, that participants saw both interpretations and then simply chose the one to tell the experimenter that placed them in a happier circumstance.

One way to test whether participants saw only one versus both interpretations is to collect more unobtrusive measures that participants would not suspect were designed to test which

interpretation they had seen—if they knew the measure was being taken at all. As was the case in the previous studies, we asked participants to provide a verbal or written report of whether they had seen a horse or a seal after being shown a figure that could be interpreted as either. However, in addition, we also measured participants' eye movements to see if they would give clues as to how participants had interpreted the figure. Recent evidence suggests that initial eye movements upon presentation of a stimulus are not influenced by conscious processing (Allopenna, Magnuson & Tanenhaus, 1998; Richardson & Spivey, 2000; Tanenhaus, Spivey-Knowlton, Eberhard & Sedivy, 1995). Thus, we examined whether the first saccade (eye movement) after presentation of the ambiguous figure would be to a label on the computer screen marked "farm animal" or one marked "sea creature." We expected that such saccades would indicate that participants had interpreted the figure in a way that placed them in a favorable circumstance.

Participants

Participants were 79 undergraduates at Cornell University completing the study in exchange for extra credit.

Procedure

Participants came into the lab alone and were seated approximately 20-in from a 21-in Apple cinema display monitor (17-in viewable). As was the case in previous studies, participants completed a task ostensibly about differences in predictions of and actual taste experiences of Aquafina, orange juice, and veggie smoothie. After participants predicted taste sensations of each item, the experimenter

explained that in order to eliminate bias from the selection process, a computer program would randomly assign the item they would consume based on their score at the end of a game similar to the one used in study 2. As described in the previous study, the computer displayed pictures of farm and sea animals counterbalanced between participants to be worth either positive and negative points. Participants kept a record of the animal shown to them, the points that animal was worth, and their ongoing score ostensibly to corroborate the computer program.

Participants were told that although the computer would be keeping an ongoing tally of the points accumulated, they would still categorize the animal as either a farm animal or sea creature by clicking on a box on the computer screen to advance the computer to the next animal. The program displayed each animal for 1000 msec, followed by a 500 msec blank screen, and finally a request to categorize the figure, remaining on the screen until participants responded. On the extreme left side of the categorization screen was a box labeled “farm animal” and on the extreme right was a box labeled “sea creature.” Participants were instructed to categorize the animals on the computer correctly to avoid point penalties. In addition to losing points for incorrect categorization, participants learned that a portion of their final score would be determined by the speed of their categorization, thus they were advised to categorize animals as quickly as possible.

Unbeknown to them, a video camera was hidden approximately 15-in behind the monitor and trained on participants’ eyes. Thus every

time the categorization task appeared on the cinema-display monitor, we were able to capture participants' initial eye movements. As practice to familiarize them with the task of viewing and categorizing animals, participants categorized filler animals 8 times. After this practice session, participants completed 15 trials, the last of which displayed the ambiguous figure. Thus, participants were well-acquainted with the 3-step process to complete a single trial: 1) view animal, 2) categorize animal on the computer screen, and 3) record animal and points on written response sheet.

We were interested in the way in which participants interpreted the ambiguous figure. Their interpretation was measured in 2 ways: the written self-report and participants' eye movements immediately upon perceiving the categorization screen. Given that initial eye movements are not influenced by conscious processing (Richardson & Spivey, 2000), we can suppose that immediate looks either the "farm animal" or "sea creature" box are representative of participants' interpretations of the figure without concern for conscious, calculated response selection.

We expected then that desire to see a particular animal would influence the way that the ambiguous figure was reported on the response sheet. Specifically, we expected that participants, hoping to drink orange juice, would see the most valuable animal. In addition, we expected that participants' eye movements would corroborate their self-reports such that initial saccades would be towards the box labeled as the most desired animal.

Coder Reliability

A coder, blind to condition, hypotheses, and purpose of the study watched the videotaped eye-movements and noted the initial direction of movement for half of the data set. For the other half of the data set, a second coder, blind to condition, coded the videotaped eye movements. A third coder, blind to condition, randomly selected 18 participants from the complete data set and noted the initial direction of eye movement. Eye movements recorded by this third coder then served as a measure of interrater reliability. Across 213 individual trials from the 18 randomly selected participants, the third coder and the original coder agreed in 92% of the cases. If there was disagreement, the direction of eye movement as indicated from the original coder was used in analyses.

To assess the validity of our nonconscious measure of initial eye movement, seeing whether eye movements corresponded with participants later reports, we randomly selected 48 participants and coded their eye movements in response to the 10 unambiguous animals that preceded the ambiguous figure. Across 480 trials, initial eye movements went to the correct categorization box 86% of the time.

Results

Explicit Reports

Using the same coding scheme as in the previous studies that used the horse/seal ambiguous figure, we ran an ordinal logistic regression. As expected, desire facilitated the disambiguation of the figure, $\chi^2(1) = 5.62$, $p < .02$. When hoping to see farm animals, 83.7% ($n = 36$) of participants saw the figure as a horse, and 16.3% ($n = 7$)

saw a seal. However, the pattern changes when hoping to see sea creatures. That is, 58.3% (n = 21) of this group saw a horse, 33.3% (n = 12) reported a seal, and 8.3% (n = 3) of participants did not indicate their interpretation. When looking only at the interpretations of those who offered one, it appears that desire influenced the disambiguation of the figure. Those who were motivated to see farm animals were more likely to report seeing a horse than were those who were motivated to see sea animals, $\chi^2(1) = 4.02$, $p < .05$.

Eye Movements

We used the same coding scheme in analyzing the interpretations gathered from participants' eye movements. Again, those whose initial look was to the farm animal box received a score of 1, to the sea creature box received a score of -1, and those participants who looked down to their response sheet and not to either the farm animal or sea creature box received a score of 0.

We conducted an ordinal logistic regression and found that desire facilitated the disambiguation of the figure, $\chi^2(1) = 10.24$, $p < .001$. When hoping to see farm animals, 62.8% (n = 27) of participants looked to the farm animal box, 14.0% (n = 6) looked to the sea creature box, and 23.3% (n = 10) looked down to their score sheet. However, the pattern changes when hoping to see sea animals. That is, 30.6% (n = 11) looked to the farm animal box, 41.7% (n = 15) looked to the sea creature box, and 27.8% (n = 10) looked down to their score sheet. When looking only at the interpretations of those who looked to either box, it appears that desire influenced the disambiguation of the figure. Those who were motivated to see farm animals were more likely to look

to the farm animal box than were those who were motivated to see sea animals, $\chi^2(1) = 9.90$, $p = .002$. We should note that scores on our eyetracking measure significantly correlated with the score participants received from their explicit reports, Spearman's rho = .42, $p < .001$.

Study 4: Converging Evidence from Lexical Decision Data

Study 4 served as a conceptual replication of Study 3 but employed a different type of indirect measure of perception. A good deal of research (e.g. Neely, 1991) suggests that a picture of an object serves as a prime for concepts associated with that object—even if people are not aware that they have seen the object (e.g., Loach & Mari-Beffa, 2003; Raymond, Shapiro, & Arnell, 1992). Thus, in Study 3, we motivated participants to interpret an ambiguous figure as either a horse or a seal. Participants again provided an explicit report of the interpretation they saw.

However, we also collected reaction time data to gain an additional measure of whether participants had specifically seen the interpretation they had reported—and only that interpretation. Just after viewing the figure, participants completed a lexical decision task (LDT) in which they were presented letter strings and had to decide whether those letter strings formed English words. Each participant saw a word related to the concept of *horse* (e.g., *cowboy*) or *seal* (e.g., *blubber*). We predicted that participants would more quickly respond to a word in the LDT exercise when that word was related to the interpretation they preferred to see rather than to the opposite interpretation. If participants actually saw both interpretations, no

such difference should be seen in participants' decision speed to words related to desired versus undesired interpretations.

We also wanted to make sure that participants' interpretations of the ambiguous figure were, indeed, responsible for priming their reactions in the lexical decision task, rather than an overall desire to see a farm animal or sea creature. Thus, as a control condition, roughly half of the participants responded to the lexical decision task just before they saw the ambiguous figure rather than just afterward. If participants responded more quickly to desired-concept words to a greater degree after they viewed the ambiguous figure, that fact would suggest that the interpretation participants saw was the one influencing the speed of their lexical decisions. However, if just a desire to see one type of animal over the other is enough to prime performance in the lexical decision task, then desired-concept words should be facilitated in both before and after conditions to an equal degree.

This design also allowed us to investigate one mechanism by which participants' perceptions were influenced. Collecting lexical decision task reaction times just before participants viewed the ambiguous figure allowed us to gauge whether people's preferences suggested a perceptual set (Bruner & Minturn, 1955)—a preparedness to see the ambiguous figure as the desired object rather than the alternative. If participants provided quicker reaction times to words associated with the desired object than they did to words associated with the undesirable object, that pattern would be suggestive of a perceptual set.

Method

Participants

Participants were 166 undergraduates at Cornell University who received extra credit in their psychology courses for taking part.

Procedure

Participants came into the lab in groups of 2 to 4 to complete a task ostensibly about differences in internal and external evaluations of vocal abilities. The experimenter explained that approximately 75% of participants would evaluate various aspects of a person's vocal performance, while the remaining 25% would be asked to perform a tune as if in a karaoke bar. The experimenter clarified that these percentages mean that approximately 1 person in each session will be the singer and subject of evaluation while the remaining people will be observers. After performing a tune, singers will evaluate their own vocal abilities on rhythmic ability, skill, and general appeal. The experimenter explained that these scores would be corroborated against those provided by the observers on the same dimensions. At this point, participants were shown a 60-sec video clip ostensibly of past participants and observers completing the performance evaluation portion of the experiment to heighten anxiety about the potential assignment to the singer role. In this video, a stocky Italian man in his early 20's held a microphone while singing and dancing along to Gloria Gaynor's rendition of "I will survive."

Participants were seated approximately 24-26-in from a 17-in iMac G4 or a 17-in eMac desktop computer. As was the case in previous experiments, the experimenter explained that in order to

eliminate bias from the selection process, a computer program would randomly assign participants to either the role of singer or observer. Participants played the same animal game as described in Study 3 ostensibly to determine whether they danced or observed. Again, participants kept a record of the animal shown to them, the points that animal was worth, and their ongoing score ostensibly to corroborate the computer program. Additionally, participants categorized the animal as either a farm animal or sea creature on the computer.

Finally, participants completed a number of lexical decision tasks (LTD) during the animal categorization task, supposedly meant to impair their ability to categorize the animals. That is, participants categorized strings of letters as words or nonwords. In a "go-no go" paradigm, participants hit the space bar if the string of letters was a word and did nothing if the string of letters was not a word. All strings of letters disappeared from the screen if no key was hit within 2000 msec.

Participants randomly assigned to the control condition completed the LDT at the beginning of each trial, that is, before seeing each animal. Participants randomly assigned to the experimental condition completed the LDT at the end of each trial, after seeing each animal but before categorizing it on the computer or recording it on their response sheet. Participants completed between 1 and 3 lexical decisions during each trial for the first 12 trials. In the last round, participants responded to 3 strings of letters. In this last trial, all participants responded to one word related to farm animals, one

related to sea animals, and one nonword, the order of which were counterbalanced between subjects. Although for each participant only a single farm and sea-relevant word was included in the last trial, the particular word selected was counterbalanced between subjects. Specifically, there were 4 words related to farm animals (*cowboy, saddle, stallion, pasture*), 4 words related to sea animals (*blubber, flipper, ocean, whale*), and 4 nonwords (*blevre, yaver, dreas, puli*) that were varied between subjects. That is, a participant would react to a single word from each of these sets.

Again, the ongoing score at the end of the penultimate round were such that only 1 animal was worth enough positive points to produce an assignment to the observer role. For roughly half of the participants, the only animal capable of this was a horse, while for the other half, it was a seal. The last animal displayed was again the horse/seal ambiguous figure.

We presumed that participants, going into the final trial with a negative score, would be hoping to see the animal worth the greatest number of positive points. We expected then that desire to see a particular animal would influence the way that the ambiguous figure was interpreted. Additionally, we expected that the desire to see a particular set of animals would influence the speed at which the target words was categorized—but only after participants had viewed the ambiguous figure. In particular, we expected that the control group that completed the LDTs before seeing the ambiguous figure would be equally likely to categorize the horse-relevant fragments and seal-relevant fragments as words. However, we expected that the

experimental condition that completed the LDTs after having seen the ambiguous figure and interpreted it as the desired animal would be faster to categorize words related to the desired animal type. Specifically, those participants in the experimental condition for whom farm animals were worth positive points were expected to categorize the farm-relevant words faster than sea-relevant words.

Results

Although a small number of participants questioned why they had to play a computer game to determine their role, no participant was able to explain the purpose of the study. Additionally, in debriefing some indicated disbelief that the performance evaluation component of the experiment would take place. Again, these people were unable to explain the purpose of the study. Thus no participant was excluded for either of these reasons.

Explicit Reports

Omitting the one participant who did not offer an interpretation, we calculated the proportion of participants who had reported seeing a horse in each cell in a 2 (desired animal type: farm or sea) X 2 (task order: LDT before or after figure) design. Performing arcsin transforms on these proportions, using the procedure outlined by Langer and Abelson (1972), allowed us to assess all main effects and interactions inherent in the design. This analysis indicated that desire facilitated the disambiguation of the figure. Whether or not participants saw a horse or a seal depended on whether participants were motivated to see farm animals or sea animals, $Z = 4.15$, $p < .001$. No other effects were significant. When hoping to see farm animals, 97.2% ($n = 69$) of

participants saw the figure as a horse, and 2.8% (n = 2) saw a seal. However, the pattern changed when hoping to see sea creatures. That is, 76.0% (n = 73) of this group saw a horse, 22.9% (n = 22) reported a seal, and 1.0% (n = 1) of participants did not indicate their interpretation.

Lexical Decision Task

However, we were most interested in the speed with which strings of letters are categorized as words. The complete design was a 2 (word type: related to farm or sea animals) X 2 (desired animal: farm or sea) X 2 (task order: LDT before or after the ambiguous figure) with the first variable being within-subjects.

Two participants (1 in the farm animal control condition, 1 in the sea animal experimental condition) made errors on categorizing during the LDT talk; their data are omitted. Given the skewed nature of the reaction time data, we conducted all analyses on natural log transformations. However, note all means reported in the text and tables are the original reaction times. In general, participants were no faster at responding to farm or sea words, $F(1, 159) = 2.14$, $p = .15$. Likewise, participants were no faster to respond to words when motivated to see either farm or sea animals, $F(1, 159) < 1$, $p = .54$. However, unexpectedly, it appears that those who completed the LDT task before seeing the figure were generally faster (M = 778 msec) to respond than those completing the LDT task after seeing the figure (M = 890 msec), $F(1, 159) = 13.97$, $p < .001$. Presumably, after viewing the ambiguous figure, participants were slowed somewhat knowing that

they would soon have to report the category of the creature they had seen.

More interestingly, the 2-way interaction between word type and desired animal was significant, $F(1, 161) = 4.00$, $p = .05$, but this interaction was qualified by the predicted 3-way interaction between word type, desired animal, and LDT time, $F(1, 159) = 5.99$, $p = .02$. As seen in Table 2.1, when completing the LDT task before seeing the figure, the motivation to see a particular type of animal influenced the speed at which participants reacted to the words, as confirmed by a

Table 2.1.
Reaction Times (in msec) to Identify Word as a Function of Timing of Lexical Decision Task and Desired Interpretation of the Ambiguous Figure.

	Target Word		
Timing of LDT Task/ Desired Interpretation	Farm-Related	Sea-Related	Difference
Before			
Horse	746	819	-73
Seal	815	730	85
After			
Horse	716	1034	-318
Seal	958	853	105

Note. Reaction times depicted are average original times.

significant desired animal X word type interaction that focused only on participants in the before condition, $F(1, 91) = 5.49$, $p = .02$. Participants more quickly responded to words associated with the desired category more than they did words associated with the undesired category. However, this advantage for words associated with desired categories was significantly stronger for participants completing the LDT after viewing the ambiguous figure, as evidenced by a significant desired animal X word type interaction, $F(1, 68) = 25.05$, $p < .001$. That is, those motivated to see farm animals responded faster to farm related words than sea related words by some 318 msec. Those motivated to see sea animals were faster to respond to sea related words than farm related words by some 105 msec[2]. Unlike Study 3, for participants in the group who viewed the ambiguous figure before completing the LDT task, scores on this implicit measure (reaction time to farm words minus reaction time to sea words) did not correlate with their explicit reports, point-biserial $r = .05$.

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[2] The effects and conclusions reported in the text remain virtually the same if we control for the specific words participants reacted to in the lexical decision task. We should also note that all participants in a particular session, when multiple participants were run, were assigned to the same condition. Thus, although participants were assigned randomly, they were not assigned independently. This led cell sizes to differ somewhat. We should note that we ran supplemental analyses to gauge whether any of our results were due to session effects. When we control for the particular session participants were run in (by conducting analyses in which session is added as a random variable nested within our conditions), we find our findings remain intact.

Summary

In sum, Study 4 provided more convergent evidence that participants were more likely to interpret an ambiguous figure in line with their preferences. Participants again were more likely to explicitly report seeing a horse or a seal when they preferred to see that animal relative to when they did not. Their performance on a lexical decision task also indicated that they had interpreted the ambiguous figure in a manner consistent with their desires. After seeing the ambiguous figure, participants more quickly recognized those words associated with the desired animal than they did words associated with an undesired animal—indicating that they had seen only the interpretation consistent with their desires. This performance advantage for words associated with desired animals was not as evident when participants completed a lexical decision task before they viewed the ambiguous figure.

However, participants who completed the lexical decision task before they viewed the ambiguous figure still classified words associated with the desired interpretation more quickly than they did words associated with the opposite, although this tendency was much more muted relative to participants completing the lexical task after viewing the figure. This last result suggests a hint of a perceptual set: Participants showed some preparation or bias to see the desired interpretation over the undesired one before viewing the stimulus. However, this result is preliminary and tentative, and there is much more to explore regarding the processes that lead people to see what they want to see.

Study 5: Ruling Out Participant Deception

This study was also designed to reduce suspicions about participants' possible construction of responses to ensure favorable outcomes. If participants saw both interpretations and selectively reported the favorable interpretation, then both percepts in previous studies (e.g., horse vs. seal) would have to be accessible to them, in that participants would have to have seen both interpretations and selected only one when asked for an interpretation. To test this possibility, we again told participants that they were here to predict and describe taste sensations of freshly squeezed orange juice and organic veggie smoothie. They were shown an ambiguous figure, but before they could report what they had seen, the experimenter reported that he or she had made a mistake—that the participant would be assigned to the orange juice condition if the computer had shown him or her the *other* category of animal.

Of key importance was what interpretation participants would report—the one they desired at the time they viewed the ambiguous figure or the one desired at the time they had to report what they saw. If participants saw only one interpretation in consciousness as they viewed the figure and if that interpretation was influenced by their motivational state, they should be more likely to report the figure they desired at the time the figure was presented to them. However, if they saw both interpretations and just reported the one that was desired when the experimenter asked for their report, then they should more likely report the figure that ran counter to their desires at the time they viewed the figure.

Method

Participants

Participants were 27 undergraduates at Cornell University who received extra credit in their psychology courses for taking part.

Procedure

The procedures for this experiment were modeled closely upon those used in Study 1. Again, the computer would assign the participant to drink freshly-squeezed orange juice or an off-putting veggie smoothie based on the single item that it randomly selected from a database. In this study, though, for half of the participants, if the computer displayed a farm animal, participants would consume the orange juice while a sea creature would bring the veggie smoothie. For the other half of the participants, this was reversed. After these instructions were explained to participants, the experimenter supposedly "calibrated" the computer program. In a practice phase, the program displayed 4 animals as examples of what would be shown. Two of these examples were farm animals, and 2 were sea creatures. Crossed with this, two of the animals were drawings of the full bodies of animals while 2 were just of animal heads.

Following the examples, participants fixated on a red dot flashing in the center of a 15-in G3 iBook screen for 3 sec. This fixation points was then replaced by the horse/seal ambiguous figure (3.75-in in height, 2.75-in in width) displayed for 1000 msec followed by the same staged computer program crash. The experimenter remained preoccupied with paperwork until the participant got her attention.

Unlike the previous study, the experimenter did not ask the participant at this point if anything was displayed before the crash. Instead, she immediately offered that the crash was most likely because she made an error during the calibration. For those participants for whom farm animals were valued, she continued by saying the error was that in fact sea creatures were supposed to signal the consumption of orange juice. For those valuing sea creatures, she said the error was that farm animals were in fact supposed to signal the consumption of orange juice. To rephrase, after the crash, the experimenter switched which animals were desired. After explaining this confusion and making the switch, the experimenter asked if anything was shown before the crash.

Results

The procedure of Study 5 put two accounts for our data in opposition. Our guiding hypothesis is that participants' motivational states influence the interpretation of the ambiguous figure that is presented to consciousness at the time the figure is viewed. If motivational states help to disambiguate the figure during the time it is viewed, we would expect that after the switch participants would tend to report seeing the animal from the desired category at the time of viewing the object even though this animal, after the switch in instructions, ultimately consigned them to drink the veggie smoothie. However, if participants see both interpretations and then just report the one that they favor, then we would expect that participants would be more likely to report seeing an animal from the category that is desirable after the switch.

We used the same type of coding scheme for interpretations as in the previous studies. Using an ordinal logistic regression, we found that participants were more likely to report the animal that was originally the most desired even when this meant they would complete the less desirable task, $\chi^2(1) = 9.48$, $p = .002$. When participants originally hoped to see farm animals, 100% ($n = 13$) reported seeing a horse even when the horse ultimately meant drinking the veggie smoothie. When participants originally hoped to see sea creatures, 28.6% ($n = 4$) reported seeing a seal, 57.1% ($n = 8$) saw a horse, and 14.3% ($n = 2$) said nothing was shown before the crash. Focusing on only those participants reporting an interpretation, we again find that participants were more likely to report a horse or a seal when they were originally motivated to see that type of animal, Fischer's exact $p = .039$. Although a larger percentage of participants reported seeing a horse than a seal when originally hoping to see sea creatures, what is important is that the percentage who saw a seal is biased between conditions based on original desire. That is, when originally hoping to see a horse, none saw a seal, but when originally hoping to see a seal, nearly 30% saw one.

General Discussion

The world people know is the one they take in through their senses. In these studies, we examined the extent to which what people take in could be guided by such top-down constraints as personal wishes and preferences.

Across these studies, we provided converging evidence to suggest that participants' desires, hopes, or wishful thinking led them to

perceive a representation of the visual environment they desired. Studies 1 and 2 demonstrated that participants tended to interpret an ambiguous figure in a manner that fit with their wishes and preferences over one that did not. Studies 3 and 4 added implicit measures to ensure that participants actually saw the interpretation they favored and not just what they chose to report seeing. Specifically, for a clear majority of participants in Study 3, their first saccade after presentation of an ambiguous stimulus tended to be to the favored category label rather than to the disfavored one. In Study 4, after viewing an ambiguous figure, participants reacted more quickly in a lexical decision task to words consistent with a preferred interpretation than to words consistent with the less preferred one. Importantly, this facilitation after seeing the ambiguous stimulus was greater than it was for those performing the lexical decision task before viewing the stimulus—indicating that the ambiguous figure primed concepts associated with the preferred interpretation more than it did the less preferred one.

Study 5 added a procedural variation to affirm that participants did not see *both* interpretations in our experiments and then just report the one that brought about the favored outcome. Participants viewed an ambiguous stimulus while hoping for one outcome, but then the experimenter switched which interpretation was the favored one before participants reported what they had seen. Participants tended to report seeing the interpretation they favored at the time they viewed the stimulus, even though that report, after the switch, assigned them to a less desired task. Importantly, Study 5 demonstrated that wishful

thinking constrains perceptual processes preconsciously—before the products of those processes become available to conscious awareness.

Alternative Accounts

A critic might argue that the paradigms we used might have taken advantage of other psychological processes, instead of motivational states, that could influence participants' interpretation of ambiguous stimuli. For example, participants' interpretations of ambiguous figures could have been due to differences in expectation. In Studies 2, 3, and 4, participants were exposed to a series of stimuli they did not want to see just before they viewed the critical ambiguous stimulus. Participants' might have fallen prey to the "gambler's fallacy" and expected that a favored animal was bound to show up after a string of unwanted ones. However, Study 1, the control study associated with Study 2, and Study 5 all argue against this explanation. For example, Studies 1 and 5 presented participants with a single stimulus, and still found that people tended to see the interpretation they wanted to see over the one they did not. In addition, the control study associated with Study 2 specifically tested whether a gambler's fallacy alone would influence what they saw in the ambiguous figure when participants had no motivation to interpret the ambiguous figure in a certain way. Further, it is implausible that our results are explained by cognitive or perceptual salience. That is, one could argue that the desired interpretation was highlighted and more easily seen by participants because that perceptual outcome was paired with a desirable event. However, in our experiments we were careful to pair both the favored and less favored interpretations with

salient events. In Study 1, for example, seeing a number might be associated with drinking delicious orange juice but seeing a letter was associated with an event—drinking a foul smelling and looking concoction—that was at least as salient. Thus, salience is not a viable alternative explanation for the pattern of responses we observed.

Notes on the Mechanism Underlying Biased Perception

Our results suggest that people's desires for a particular outcome bias their perceptual set, such that they are more prepared to see what they hope for rather than what they fear. In fact, in a funneled probe for suspicion, one participant offered, *"I kept getting +5 and –5 over and over, making me worry about eating the beans. At the last minute, I was sure I would have to eat the heinous beans and I prayed for the horse to give me a +5. I got it! Yes!"* Of course, prayer may not always be the precise mechanism biasing all participants' interpretations, but we do feel this illustrates a possible chain of events leading to differences in what participants saw. A desire to see one stimulus over the other led to the formation of a perceptual set that included features and concepts related to the desired stimulus over the undesired one. Indeed, in Study 4, we discovered initial evidence of a perceptual set biased toward the favored hypothesis. Just before viewing the ambiguous stimulus, participants were slightly—but significantly—faster at recognizing words associated with the favored interpretation than they were words associated with the disfavored interpretation.

Two notes are in order concerning this finding and the potential role of perceptual set in motivational influences on perception. First,

the specific perceptual hypothesis that participants might be using to disambiguate the stimulus need not be closely tied to the nature of the stimulus. To be sure, in Studies 2, 3, and 4, participants were given a rather narrow hypothesis (i.e., the desirable stimulus will be either a horse or a seal) about what the computer might show them. In this way, our work is reminiscent of previous work concerning contextual effects on visual perception of ambiguous figures, in which participants are given primes whose appearance is quite close to that of the ambiguous stimulus (i.e., they are shown drawings of women) before they view that stimulus (e.g., one seen as either a man or woman) (Long & Toppino, 2004). However, in Studies 1 and 5, participants were not given such specific hints about what the stimulus might be. Instead, they were given broad categories (e.g., a letter versus a number; a farm versus a sea animal). As a result, they were not necessarily able to look for features of a specific stimulus but rather had to search for any number of possible stimuli to satisfy these broad categories. Even in this circumstance, participants tended to see what they wanted to see. This suggests that the top-down influences on perception inspired by motivation can be quite diffuse and nonspecific—that when disambiguating an ambiguous figure people do not need concrete features specified *a priori*. Instead, the "clues" or context surrounding the perceptual judgment can be quite vague, indirect, abstract, or higher-order. This conjecture is consistent with other recent evidence showing that priming people with abstract categories (such as *flirting* or *music*) has an impact on

how they interpret ambiguous figures they subsequently view (see Balcetis & Dale, 2003).

Second, these studies left open one ambiguity about perceptual set that future work could profitably address. Across five studies, we found that people tended to see an interpretation they favored over one they did not. But did this bias arise because the perceptual set associated with their motivational state was an "approach" one, facilitating processes associated with seeing the favored interpretation, or a "avoidance" one, inhibiting processes that could lead them to see the disfavored interpretation? Any route—facilitation of the favored interpretation, inhibition of the disfavored one, or a mixture of the two—could lead to the pattern of responses we observed. Future work could potentially tease apart whether the phenomenon we uncovered is one in which people are biased toward seeing wanted stimuli or biased against seeing stimuli they wish to avoid, or both.

Where Does the Bias Reside in the Perceptual System?

One remaining question that this work leaves open is determining the stage in the perceptual process at which motivational factors, begin to guide perception. Such a question is relevant not only to work on motivation, but also to work on other higher-order constructs (e.g., stereotypes, expectations, frames) that have been at the focus of social cognitive work. Is the impact of motivation limited to later stages of perception, such as categorization, or does its influence extend to earlier and more primitive tasks the perceptual system faces (e.g., noticing lines and edges in a visual scene)? This question became a major theoretical battle during the New Look period, one that

continues to this day. In particular, Bruner and Goodman's (1947) theory of perceptual defense was criticized by opponents who asked how a perceiver could selectively defend against a particular stimulus unless the stimulus is first perceived (Eriksen & Browne, 1956; Howie, 1952; Spence, 1967). Critics of Bruner and Goodman (1947) and more recent ones, argue that higher-order constraints influence not early perception but rather later stages of the perceptual processes that could be termed "post-perceptual" or "perceptual decision making." Pylyshyn (1999), for example, asserts that the act of perceiving an object contains at least two processes. One process, termed "early vision" works, immune to higher-order influences, to provide 3-D representations of the surfaces of objects. A later process takes any created representation and then identifies or categorizes it. Pylyshyn (1999) argues that higher-order influences have an impact predominantly on this latter stage[3].

However, this assertion is a contentious one (see the commentaries that accompany Pylyshyn, 1999), and more recent evidence suggests that higher-order processes can impose their influence on perception very early in the perceptual process. Emerging evidence, for example, suggests that higher-order influences can be detected as early in the visual system as V1, which is a mere two synapses away from the eye (Boynton, 2005). For example, when perceivers are asked attend to one of two overlapping orthogonal line patterns, fMRI activity patterns in early visual areas, including V1,

[3] Pylyshyn (1999) also allows for the possibility that higher-order processes might guide attentional mechanisms that guide "early vision."

contain information that can predict what the participant consciously perceives (Kamitani & Tong, 2005). Perceptions of patterns in V1 also occur even if participants are clearly unaware that a pattern has been shown to them (Haynes & Rees, 2005).

Implications for Self-Deception

The data from these five studies also have implications for another enduring issue in psychology. Over the decades, social, personality, clinical, and cognitive psychologists have catalogued a myriad of ways in which people engage in wishful thinking (for reviews, see Baumeister & Newman, 1994; Dunning, 2001; Kunda, 1990; Mele, 1997; Pittman, 1998). However, people remain seemingly unaware that they do all this cognitive work; they remain innocent of the fact that their fears and desires have shaped how they view themselves and think about the world around them (Ehrlinger, Gilovich, & Ross, 2005; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998; Mele, 1997; Pronin, Gilovich, & Ross, 2004).

Indeed, for people to reach their motivational goals, it is imperative that they remain unaware of the distortions they place on their thinking. If they knew that they believed some pleasant thought merely because they wanted to believe it, they would also know, at least in part, how illegitimate that thought was. How, then, do people pull off the self-deception crucial to the execution of motivated reasoning?

Our data provide one answer to this riddle. People fail to recognize such self-serving biases if those processes remain outside of conscious awareness, monitoring, or control. If those processes take

place preconsciously, before any content of perception and cognition reaches consciousness, people can construct pleasant thoughts yet remain unaware of the construction. The only content that would be available in consciousness would be the product and not the process of motivated reasoning.

There exist some shards of evidence that motivational processes operate on a nonconscious level (e.g., Arndt, Greenberg, Pyszczynski, & Solmon, 1997; Fein & Spencer, 1997). The present studies enlarge the types of nonconscious processes that motivational states may influence, and it may be profitable to consider other automatic or nonconscious processes that might be molded, in part, by the motivation toward believing in a masterful self in a congenial world.

One also wonders about the full range of nonconscious processes that might be tainted by motivational pressures. The world people know is the one they take in through their senses, but it is also formed by other preconscious processes. To what extent is the representation of the world furnished to conscious awareness by all these processes one that reproduces the outside world faithfully versus the one that people just wish they could inhabit?

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CHAPTER THREE

COGNITIVE DISSONANCEC AND THE PERCEPTION OF NATURAL ENVIRONMENTS

People commonly assume that they perceive the external world the way it really is. However, considerable research challenges this intuition. A walker does not move as fast as a perceiver may think (Jacobs & Shiffrar, 2005), and objects fail to be as big (Wesp, Cichello, Gracia, & Davis, 2004) or as tall (Yang, Dixon, & Proffitt, 1999) as they seem.

In recent years, research has increasingly demonstrated that an individual's internal states can influence perception of the external world. Thirsty people find their attention drawn to thirst-quenching objects in the environment (Aarts, Dijksterhuis, & de Vries, 2001), and see objects as more transparent, a property characteristic of water (Changizi & Hall, 2001). Spider phobics misperceive the direction of moving spiders, seeing those creatures as approaching themselves rather than approaching others who are equally close to the spider (Riskind, Moore, & Bowley, 1995).

In two studies, we explored whether a different internal state could influence the perception of natural environments. That internal state is cognitive dissonance. Cognitive dissonance theory assumes a drive-like motivation to maintain consistency among relevant thoughts and actions (Festinger, 1957). When attitudes and actions contradict one another, discomforting arousal results, leading to a drive-like motivation to restore harmony by shifting beliefs to realign them with

behavior. This motivation maintains a widespread influence, changing attitudes (Festinger & Carlsmith, 1959), likelihood estimates (Knox & Inkster, 1968), and perceptions of self (Sherman & Gorkin, 1980). In this research, we asked if the impact of cognitive dissonance could extend down to visual perception.

Participants performed an aversive task. In Study 1, participants walked across a campus quadrangle while wearing a costume inspired by Carmen Miranda, the Brazilian singer, dancer, and actress of the 1940's and 50's invariably clad in a large fruit-basket headdress. In Study 2, participants knelt on an all-terrain skateboard and pushed themselves up a grassy hill.

Our tasks and measures were modeled after work by Proffitt and colleagues (e.g., Bhalla & Proffitt, 1999), who argued that conscious perception serves the regulation of physical behaviors. Key to their argument is the notion that the amount of effort a person must expend to complete an action influences their perception of the relevant environment. When people must expend more effort to complete some physical action, the perceptual system portrays the environment as more challenging, presumably to guide the individual toward what actions to take (or to avoid) as well as how to execute those actions successfully. Distances to walk seem longer after strapping on a heavy backpack (Proffitt, Stefanucci, Banton, & Epstein, 2003). Hills appear steeper when perceivers wear a backpack, are fatigued after a long run, suffer from low physical fitness, or are in poor health (Bhalla & Proffitt, 1999). Here, we examined whether a different sort of

regulation, one associated with dissonance reduction, produced similar changes in perception of natural environments.

In each study, we manipulated participants' subjective feelings of choice about completing the task to be either high or low. Under high choice, people must resolve the dissonance caused by their voluntary agreement to perform an aversive action. Under low choice, this dissonance is easily resolved because participants can attribute their agreement to lack of choice (Linder, Cooper, & Jones, 1967). We predicted that participants would resolve their dissonance in high choice conditions by altering their perception of the environment to make the task less aversive, relative to perceptions reported by low choice and control condition participants. In Study 1, high choice participants would see the distance they had to walk as shorter. In Study 2, they would see the hill as less steep.

Study 1: Perceptions of Distance

Method

Procedure

In exchange for course credit, participants (n = 44) were taken outside to a highly trafficked, grass quadrangle at the center of campus and were randomly assigned to high choice, low choice, or control conditions. In both choice conditions, participants were told that because emotional reactions are difficult to predict, they would report their reactions to a real emotion—namely embarrassment. At this point, the experimenter handed participants a bag containing a Carmen Miranda costume, including a grass skirt, coconut bra, a hat adorned in plastic fruit, and a flower lei.

To those participants in the high choice condition (n = 22), the experimenter explained that in lieu of the emotion test, there were other options available, although none were ever discussed with any participant. The experimenter continued by sating that although other options were available, it would be preferable if he or she could choose to perform the emotion test. The experimenter ended by asking if the participant would choose to do the emotion task. After verbally agreeing, the experimenter asked participants to complete a waiver labeled "freedom of choice." Participants signed their name indicating that they had freely chosen to perform the emotion task.

Participants assigned to the low choice condition (n = 12) learned that other tasks were available but that a supervisor had selected the emotion task for them. Participants completed a similar waiver this time labeled "experimenter choice." Participants signed their name indicating that they had not chosen the emotion task.

Participants then walked across the width of the quad from one statue to another and back (365-ft each way) and completed a survey asking them to estimate the one-way distance from one statue to the other. Before providing a response, the experimenter showed participants a ruler, explained that this was the length of 1-ft. To complete the distance estimate, participants wrote down a number that represented the distance in feet between the statues. Additionally, participants indicated on a 9-point Likert scale the degree to which they felt like they chose to perform this task.

The remaining participants were randomly assigned to the

control condition (n = 10)[1]. Control participants were not informed about the emotion test involving the Carmen Miranda costume nor alternative choices to the emotion test. Instead, they accompanied the experimenter outside to the quad ostensibly as a part of a survey of natural object perception.

Results

Perceptions of Choice

The choice manipulation left participants in the high choice condition feeling more choice (M = 7.1) than those in the low choice condition (M = 5.5), $t(32) = 2.09$, $p = .05$, $p_{rep} = .92$ $d = .75$.

Distance estimates

Across conditions, participants tended to underestimate the distance between the statues (M = 142.0-ft), one-sample $t(43) = -16.86$, $p < .001$, $p_{rep} = .99$, $d = 2.54$. Importantly, this underestimation was moderated by the choice manipulation, $F(2, 41) = 3.18$, $p = .05$, $p_{rep} = .88$, $h_p^2 = .13$. Participants in the high choice condition estimated the distance to be shorter (M = 111.1-ft) than did those in the low choice condition (M = 182.5-ft), $t(32) = 2.71$, $p = .01$, $p_{rep} = .97$, $d = .97$. Estimates between those in the high choice and control condition (M = 161.5-ft) were not significantly different, $t(30) = 1.63$, $p = .11$, $p_{rep} = .87$, $d = .62$, although they trended in the expected direction.

To test the specific prediction that those in the high choice condition would estimate a shorter distance than either the low choice

[1] Due to the sometimes inopportune nature of random assignment, the cell counts in Studies 1 and 2 are unequal. This inequality was neither intentional nor the product of varying attrition rates in each condition.

or control condition, we performed a linear contrast. Assigning weights of -2, +1, and +1, respectively, the contrast was significant, $F(1, 41) = 4.62$, $p < .04$, $p_{rep} = .92$, $h_p^2 = .10$. This specific contrast accounted for over 91% of the total between-group variance associated with participants' estimates[2].

Study 2: Perception of Slope

Study 2 was designed to replicate the finding that the motivation to resolve cognitive dissonance could influence perception of a hill's slope. We used a dependent measure that relied less on conscious judgments and explicit reports of estimates but was instead more perceptual in nature. Rather than assigning a number to reflect their perceptual experience, participants drew an angle and manipulated the arm on a protractor to estimate slope. Additionally, Study 2 addressed the alternative that distance estimates were a result of memory biases rather than perceptual processing. Thus, participants estimated the slope of the hill before they performed the task.

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[2] One might speculate that it is the physiological arousal that accompanies dissonance and not the psychological motivation to reduce dissonance that biased perception of environments (Zanna & Cooper, 1974). Arousal may have been energizing, thus leading people to perceive the environment as not as much of a challenge. Data from Study 1 speak against this alternative explanation. If dissonance arousal in the high choice condition enhanced energy and performance, then high choice participants should have walked faster (Ozel, Larue, & Dosseville, 2004). Walking speed did vary across conditions, $F(2, 40) = 3.19$, $p = .05$, $p$rep = .88 $h_p^2 = .14$, but high choice participants took more time ($M = 61.2$ sec), not less, to walk than low choice participants ($M = 55.0$ sec), $t(31) = -2.34$, $p = .03$, $p$rep = .94 $d = .94$. Participants in high choice and control conditions took the same amount of time ($M = 60.0$-sec), $t(30) = -.42$, $p = .68$, $p$rep = .68 $d = .18$.

Method

Procedure

In exchange for course credit, an experimenter accompanied participants (n = 51) individually outside to the foot of a hill (47-ft in length, 19 degree incline) to complete a test of strength. The experimenter explained that participants would kneel on an all-terrain skateboard and push themselves up a hill using their hands. Participants were randomly assigned to the high choice (n = 12) or low choice condition (n = 15), which was manipulated in the same manner as Study 1[3].

Participants estimated the incline of the hill using perceptual measures rather than explicit judgments. They did this in two ways, the order of which was counterbalanced. In the drawing measurement, participants saw a 4-inch line labeled on one end with an "X". Participants drew a diagonal line emanating from the X to represent the slope of the hill. In the protractor measurement, participants were handed a protractor with an attached arm. They moved the arm until the angle formed by the arm and the bottom of the protractor was equal to the slope of the hill. Additionally, participants indicated on a 9-point Likert scale the degree to which they felt they chose the task. Participants in the high choice and low choice conditions then completed the strength test (or attempted it for 3-min if it was too difficult to complete) by pushing themselves up the hill while kneeling to avoid promoting suspicion in our participant pool.

[3] All but 1 participant performed the strength test in the choice condition.

Participants in the control condition (n = 24) were not informed about the strength test. Instead, they accompanied the experimenter outside to the hill to complete the two measurement estimates ostensibly as a survey of natural object perception.

Results

Perceptions of Choice

The choice manipulation left participants in the high choice condition feeling more choice (M = 4.8) than low choice participants (M = 3.4), $t(25) = 2.22$, $p = .04$, $p_{rep} = .93$, $d = .95$. We suspect, although do not have data to conclude, that subjective feelings of choice were lower in this study than the previous because, in addition to being embarrassing, this task was also difficult.

Distance Estimates

Drawing and protractor measurements were significantly correlated, $r(51) = .45$, $p = .001$, $p_{rep} = .99$. Thus, we averaged both estimates to form a composite measure. Overall, participants tended to overestimate the steepness of the hill (M = 29.2 degrees), one sample $t(50) = 9.30$, $p < .001$, $p_{rep} = .99$, $d = 1.30$, a result replicating past work. However, choice moderated this overestimation, $F(2, 48) = 4.10$, $p = .02$, $p_{rep} = .93$, $h_p^2 = .15$. Participants in the high choice condition estimated that the hill was less steep (M = 23.9 degrees) than did those in the low choice condition (M = 31.0 degrees), $t(25) = 3.50$, $p = .002$, $p_{rep} = .99$, $d = 1.14$, or the control condition (M = 30.8 degrees), $t(34) = 2.45$, $p = .02$, $p_{rep} = .95$, $d = .86$.

To test whether those in the high choice condition would estimate that the slope of a hill was less steep than either the low

choice or control condition, we performed a linear contrast, assigning weights of -2, +1, and +1, respectively, which was significant, $F(1, 48) = 9.36$, $p = .003$, $p_{rep} = .98$, $h_p^2 = .15$, accounting for over 99% of the total between-group variance in participants' estimates.

General Discussion

Two studies demonstrated that the motivation to resolve cognitive dissonance influenced perception of natural environments. Taken together, these studies demonstrate that motivational pressures, including higher-order, intrapsychic motivations like cognitive dissonance reduction, can have an influence on perceptual processes. In doing so, this work adds to an emerging body of literature in cognitive and social psychology demonstrating that internal states influence perception. For example, previous work has shown that perceptions of distance and slope can be influenced by the need to regulate the amount of effort one will expend (Proffitt et al., 2003; Witt, Proffitt, & Epstein, 2004). Here a different type of regulation biased perception. People, wishing to maintain consonance in their beliefs, tended to perceive an environment that would help them avoid dissonance.

In a sense, the studies here constitute a revisiting of the classic proposal by New Look theorists that values and needs influence perception (e.g., Bruner & Goodman, 1947), a proposal that ultimately sank into a morass of theoretical and empirical controversies (e.g., Eriksen, 1958). However, these findings, combined with the recent observation that wishful thinking influences how people perceive ambiguous stimuli (Balcetis & Dunning, in press), suggest that

intrapsychic motives may, indeed, have a significant impact on what people perceive in the physical world around them.

One could speculate what other intrapsychic motives might influence what people perceive. People commonly possess a fundamental need to belong (Baumeister & Leary, 1995). Could this motive influence how they perceive the expressions they see on other people's faces when conversing with them? Or might this need, when threatened, bias perceptions of physical distance between oneself and others? People who are risk averse tend to avoid making judgments and acting in uncertain situations (Baron, 1994). Could risk aversion bias judgments of temporal distance to decision-making deadlines? Since the collapse of the New Look approach to motivation and perception in the 1950s, such hypotheses have largely been avoided, but the time might be ripe to explore these hypotheses with theories and methods that are more nuanced and sophisticated than what was available fifty years ago.

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CHAPTER FOUR

DISTANCE AND THE FOND HEART: AN EXAMINATION OF HOW DESIRES BIAS DISTANCE PERCEPTION

People assume that they see the outside world the way it really is. However, research aside, even anecdotal evidence undermines this assumption. Perceptual experiences rarely represent reality completely and accurately. First, environments often offer far more data than limited perceptual capacities can process. As a result, a great deal of information is pushed to the side. When speaking to a large although deadpan audience, does the lecturer attend to the sea of sullen faces or the captivated lone wolf nodding away in agreement? In addition to information overload, environments offer information that maintains more than one possible interpretation. A patron might ask if the Starbucks barista is smiling at her as she again orders her usual "chantico hold the whipped cream" or smirking at her for not being able to pronounce it correctly.

Perceptual systems have developed a number of strategies to cope with the barrage of information they receive. First, the stream of perceptual input is filtered. Some information is put aside perhaps for later processing or might be overlooked entirely, as evidenced by the fact that people are not aware of everything around them. When spring arrives, an allergy suffer is quite likely to notice the display of 24-hour fast-acting Claritin promising same-day, non-drowsy allergy relief on the drugstore shelf without even realizing the many other pills, tablets, ointments, and creams the same shelves carry. In an empirical test of a similar type of blindness, data indicates that even a brief exposure to

a gory or an erotic photo can preoccupy or distract perceivers such that they are blind to subsequently displayed salient and important stimuli appearing in plain sight (Most, Chun, Widders, & Zald, 2005).

Second, when it is possible to perceive information in multiple ways, perceptual conclusions that resolve the ambiguity are reached quickly, effortlessly, and often outside of awareness. These conclusions are, however, often biased by top-down, social constraints such as expectations, current cognitions, and active goals (Aarts & Dijksterhuis, 2002; Burton, 2002; Long & Toppino, 2004). For example, attempting to detect deception in a couple's conversation increases the likelihood that a subsequently viewed, ambiguously drawn figure will be interpreted as the word "liar" written in script rather than the outline of a man's face (Balcetis & Dale, 2003).

In a series of studies, we explored whether a different type of top-down, social constraint might act as a filter on perception. In particular, we investigated if and how a social constraint known to bias many other facets of social cognition—namely the motivational state of desire—might also penetrate perception of the surrounding world. We explored how desires allow perceivers to see the world as they want to see it. In particular, we asked if desire changes how much distance perceivers feel the world has placed between them and the objects of their desire. In doing so, we test the extent to which motivations can penetrate basic visual processing of the external world.

Motivated perception

As of late, researchers have renewed interest in systematic biases in perception; of particular interest in this paper is the search for those that are motivational in nature. Certainly, motivational forces have played a staring role in the theater of social judgment. The desire to think well of one's self and one's prospects leads people to faulty judgments about themselves, others, and the world. For instance, lottery ticket purchasers do not believe they are nearly as likely as are others to experience negative outcomes if they won the jackpot (i.e. increased extravagance, greedy extended family members) (Nelson & Beggan, 2004). People are prone to take credit for personal successes but blame failures on external causes (Moon, 2003) and assume they are more likely than their peers to experience the positive outcomes in life while steering clear of the bad (Weinstein, 1980). But of course, people believe that when they make these types of judgments, they are less prone to bias than when others reach similar conclusions (Ehrlinger, Gilovich, & Ross, 2005).

The desire to think well of oneself and see oneself in a positive light are motivations that reside within conscious judgment processes. In this paper, we ask if such forms of motivation can penetrate perception of the physical world, as well. The motivated strategy that allows people to look fondly upon their own skills, traits, abilities, and outcomes is the result of biased cognition. In studies that follow, we explore the limits of this type of positivity. We ask if judgments of one's social world are overly rosy, favorable, optimistic, and flattering not just because people process the information of which they are

consciously aware in a biased manner. We ask if motivation can bias not only how people think about their world but how they perceive it, as well.

As an analog or theoretical framework in which to ground our theory of motivated perception, work within motivated cognition suggesting that desires filter how people think about their world, only entertaining thoughts related to the desire. Desires lead to a type of tunnel vision that focuses cognition solely on activities associated with the desire and objects that might satisfy the desire (see Lowenstein, 1996 for a discussion). Cocaine addicts report that virtually all thoughts are focused on cocaine during binges at the expense of eating, sleeping, money, maintaining relationships with others, and personal responsibility (Gawin, 1991).

Just as motivations filter cognition and action, desires lead people to literally see the world through rose-colored glasses—to watch the reactions of the attentive student or see the Starbucks barista as smiling rather than smirking. In an empirical test of the role of desire in perceptual tasks, Balcetis and Dunning (in press) demonstrated that perceivers' interpretations of ambiguous visual information were molded by their motivations, and specifically wishful thinking. In these studies, participants knew that they were about to be assigned to one of two experimental tasks, one being much more desirable (i.e. acting as an evaluator of vocal abilities) than the other (i.e. performing as a karaoke singer who would be judged by the evaluator). The computer presented a visual stimulus that would assign them to either the desirable or undesirable task. Unbeknown to participants, this visual

stimulus could be interpreted in two different ways—one way that would assign participants to their favored task and the other to the less favored one. As expected, desire led participants to preconscioulsy reach a perceptual conclusion that allowed them to literally see what they wanted to see at the expense of a less desirable alternative.

Perception of the natural world

In recent years, research has increasingly demonstrated that motivations, mostly visceral in nature, can influence perception of the external world. Thirsty people find their attention drawn to thirst-quenching objects in the environment (Aarts, Dijksterhuis, & De Vries, 2001), and see objects as more transparent, a property characteristic of water (Changizi & Hall, 2001), suggesting a perceptual sensitivity to objects and qualities of objects that might satisfy a need. Visceral fear such as that experienced by spider phobics leads to misperception of motion direction whereby phobics see spiders as approaching themselves rather than approaching others who are equally close to the spider (Riskind, Moore, & Bowley, 1995).

In the studies that follow, we were particularly interested in investigating how states of the perceiver bias perception of specific elements of the natural environment—namely distance. Certainly, there is a precedent for this interest. In a pair of studies, Balcetis & Dunning (2006) investigated how a need to regulate internal states biases perception of slope and distance. In each study, participants' either experienced high or low subjective feelings of choice about completing an embarrassing task. Under high choice, people are motivated to resolve the dissonance caused by their voluntary

agreement. Under low choice, this dissonance is easily resolved because participants can attribute their agreement to lack of choice (Linder, Cooper, & Jones, 1967). These studies predicted and found that participants resolved their dissonance in high choice conditions by altering their perception of the environment to make the task less aversive. High choice participants estimated using objective measures that the distance they walked was shorter and the hill was less steep relative low choice and control condition participants.

In addition, Proffitt and colleagues investigated the effect of a different form of regulation on perception of natural environments. Proffitt and others argued that perceptual systems distort the manner in which environments are perceived in order to dissuade the organism from taking action that would be costly or effortful. In particular, they argued that a need to regulate physical efforts and stores of energy bias perceptions of egocentric distances and slant. That is, perception of natural elements is a function of both the actual distance, as specified by optics, and the effort required to maneuver within that physical space. When resources are depleted, and the anticipated effort to climb a hill is great, as is the case when tired, encumbered by wearing a heavy backpack, in poor physical condition, or elderly (Bhalla & Proffitt, 1999; Proffitt, Bhalla, Gossweiler, & Midgett, 1995) hills appear steeper. Similarly, resource depletion and increased anticipation of effort leads to exaggerated perceptions of distance (Proffitt, Stefanucci, Banton, & Epstein, 2003).

In addition, when the visual system relies on anticipated effort in perceptual judgments, it is often tricked. For instance, removing

optic flow when walking forward on a treadmill leads the visiomotor system to recalibrate (Stefanucci, Proffitt, Banton, & Epstein, 2005). In the zero optic flow condition, perceptual systems learn that more effort needs to be expended in order for the body to move a certain distance. This type of recalibration leads people to overestimate distances. When anticipated effort increases, whether because resources have been taken away or because the visual system has been duped, estimates of distance increase.

We propose that motivations like desire serve a similar regulatory function guiding efforts while allocating energies. When need states arise, it would be wise for an organism to ensure that the resources required to satisfy that need are plentiful. Thus, motivational regulatory systems can serve an adaptive function.

There are two ways in which a motivational regulatory system might accomplish this functional goal. First, motivations might actually open the doors to the stores of energy, restoring or topping off energy reserves such that perceivers feel that the resources they have are sufficient to undertake the task of reaching for or approaching the desired object. Secondly, a motivational regulatory system might trick the perceptual system. Consider a situation where perceptual systems see a desired object as further away than it really is, or at least further away than a control object. Seeing the object as further away may lead the organism to simply give up because the distance it must travel or the hills it must traverse appear overwhelming. A distance that appears insurmountable might actually become so. However, a perceptual system that under-represents the actual distance, or at

least makes the desired object appear closer than a control, might motivate the system to take on the task of approaching the object as the distance appears reachable.

Given these pockets of research, we propose that desires influence perceptions of the surrounding world allowing perceivers to see the world as they want to see it. Desires tune perceivers to elements of the environment that are favorable, flattering, or positive. In this manuscript, we ask if the motivations fostering desire can also change how much distance perceivers feel the world has placed between them and desired objects.

Thus far, we have suggested that perceptual systems are tuned to positive relative to negative information—perceivers see information in their surroundings that they want to see. However, the process by which motivation infiltrates perception is, as of yet, ill defined. It is also our goal to investigate the second of the two proposed motivational regulatory system mechanisms. That is, we will investigate how the motivational regulatory system might trick or bias perception in order to assist in achieving the desired end state. We chose to investigate one proximal mechanism among what might be many routes to such regulation via motivated perception.

With support from Easterbrook (1959), I propose that desire narrows attention, leading to a focus on fewer items and only the most important items in the environment. Perceivers see what they want to see because they narrowly focus their attention on positive information, and specifically desired objects, at the expense of comparatively less desired forms.

Overview of Studies

In the studies that follow, we asked participants to estimate distance between themselves and a desirable or less desirable object predicting that distances to desired objects will appear shorter than distances to less desired objects. In study 1A, participants estimated the distance to a plate of chocolates or a neutral object, while in study 1B they did the same to either chocolates or dog feces. In study 2, we captured people's naturally occurring state of hunger as they entered a dining hall in contrast with their state as they exited a dining hall after dinner and asked them to estimated distance to 2 slices of fresh cheese pizza or a control object. In studies 3 and 4, we manipulated participants' visceral need to satisfy thirst by asking them to consume a large portion of dry, salty pretzels or to drink 4 8-ounce glasses of water then estimate the distance to a bottle of water.

Across these studies, we predicted that participants would see the objective distance separating themselves from the more desired object as smaller than the distance to a less desired object. Specifically, we expected that participants would see the distance between themselves and the chocolates as smaller than the distance to either the control object (Study 1A) or the feces (Study 1B). Hungry participants entering a dining hall would see the distance to the pizza as smaller than participants in any of the other 3 conditions (Study 2). Finally, we predicted that thirsty participants would see the distance to the bottle of water as smaller than control or quenched participants (Studies 3 and 4).

In addition, we intended to offer evidence that motivation

influences perception by changing how narrowly focused attention is on elements of the environment (Study 4). We predicted that a narrowed focus of attention on the desired object would decrease perceptions of distance. Studies 5A and 5B used an "experimental chain" methodology (Spencer, Zanna, & Fong, 2005) to further affirm that desire leads to decreased perceptions of distance. We predicted that visceral states lead to changes in the ratings of an object's desirability which narrows the focus of attention on that object (Study 5A). Then, we predicted that when attention is manipulated to be narrowed as opposed to expanded on a toaster oven baking fresh chocolate chip cookies, perceptions of distance would decrease (Study 5B). With this work, we argue that people see distances to desired objects as smaller than distances to less desired objects. This occurs because people narrowly focus attention on the desired object.

Study 1A: Demonstrating that Desire Decreases Distance Estimates

Study 1A provided an initial demonstration that desired objects in the environment appear closer than objects that are relatively less desired. Participants estimated the distance between themselves and one of two objects—either a pile of chocolates covered in attractive, shiny wrappers or a neutral object created by stacking 3 red plastic cups in a pyramid. Our prediction was that participants would estimate that objective distances separating themselves from an object were smaller when that object was the desired pile of chocolates rather than the neutral object.

Participants

Seventy Cornell undergraduates participated in exchange for candy.

Procedure

The experimenter recruited participants from the hallways and sidewalks outside of the lab asking if they might participate in a short experiment in exchange for candy. After agreeing, participants were seated at a desk inside a small lab room. Participants sat in front of a short podium, the back of which was nestled up to the edge of a table. On the table, 35-in away from the participant, sat an object. For half of the participants this object was a plate piled with shiny, individually wrapped candy bars (n = 37). For the other half of participants sat 3 red plastic cups (n = 30) stacked in a pyramid to reflect the general shape assumed by the pile of chocolates.

While seated at the podium and after having directed participants' attention to either the candy or the cups, participants completed a survey. Embedded within this survey were a few questions of interest. First, on their survey participants saw a 1-in long line to be used as reference. They estimated, without measuring in any way, how many inches separated themselves and the object. After estimating the distance, participants rated how appealing, satisfying, and tempting the object was. Participants indicated their impression on a 1 (not at all) to 7 (a great deal) Likert-scale. After completing these few questions, participants were debriefed before being escorted out of the lab.

Results

Exclusions and transformations

Data from one participant were excluded by her request and from one other because of experimenter error. In addition, data from one participant who voluntarily offered that she was fasting was excluded. In this and all but one of the studies that follow, participants' estimates of distance were skewed. To account for the non-normality of this data, we performed nonparametric tests on the rank order all distance estimates. Specifically, we conducted Mann-Whitney tests on participants' distance estimates when the design used 2 independent conditions and Kruskal-Wallace tests when the design used 3. However, the means reported represent the original, non-transformed distances.

Objects' desirability

We asked participants how appealing, satisfying, and tempting the object was. We averaged responses to these 3 questions to form an overall measure of the object's desirability (a = .81). As expected, participants rated the plate of chocolates as more desirable (M = 3.5) than the pyramid of cups (M = 2.0), $t(66) = 4.34$, $p < .001$.

Distance estimates

We expected that participants estimating the distance between themselves and chocolate would see the object on the table as closer than did participants estimating the distance between themselves and the cups. As expected, participants saw the object as closer to when it was chocolate (M = 24.4-in) than when it was a stack of cups (M = 29.2-in), $U = 4.26$, $p = .05$.

Study 1B: Testing an Attitude Accessibility Alternative Explanation

Study 1B served as a replication and addressed the alternative argument that objects about which people hold a strong attitude regardless of whether they are either positive or negative will automatically attract attention (Pratto, 1994; Pratto & John, 1991; Rothermund, Wentura, & Bak, 2001; Schimmack & Derryberry, 2005; Wentura, Rothermund, & Bak, 2000). That is, objects toward which individuals hold attitudes that are highly accessible, presumably because they are firmly established and strongly felt, are more likely to attract attention (Roskos-Ewoldsen & Fazio, 1992). A critic might argue that attitude-laden objects regardless of whether positive or negative will attract attention and, as a result, appear closer. Thus, in this study participants estimated the distance to one of 2 objects that both hold an affective charge an about which participants hold strong attitudes. Participants either estimated the distance to chocolates or to dog feces.

In addition, we gathered distance estimates using a different, nonverbal dependent measure. Instead of asking participants to report the number of inches that separated them from the object, participants performed a distance-matching task. The experimenter showed participants two pieces of tape on the wall behind the object. Participants were told to approach the object until the distance that separated themselves from the object was equal to the distance that separated to two pieces of tape. We again predicted that participants would see the distance to the desired object, a pile of chocolates, as smaller than the attitude laden and affectively charged yet less desired

object, dog feces. Because the distance that separated themselves from the chocolates would appear comparatively smaller, we predicted that participants would stand further back from the chocolates than they would from the feces.

Pretest

To test the idea that chocolates, in this case Lindt chocolate truffles, were more desirable than feces, we asked a separate group of participants (n = 20) to view and describe their reactions to both objects. Participants were seated individually at a table upon which sat the truffles and the feces that was ostensibly freshly collected just that morning. Participants described the object using a 1-7 Likert scale where higher numbers indicated greater endorsement of the adjective.

To gauge general desirability, participants rated how appealing, positive, likable, attractive, and interesting the object was. Obviously, the truffles were described as more desirable (M = 5.5) than the feces (M = 2.1), paired $t(19) = 17.44$, $p < .001$. To account for the alternative explanation that desired objects hold attention only because the strength of the attitude people hold towards them exceeds that of alternative objects, we examined desirability ratings in comparison to the midpoint of the scale marked as “no opinion.” The desirability of the chocolates was significantly greater than the midpoint, one sample $t(19) = 14.99$, $p < .001$. In addition, the desirability of the feces was significantly less than the midpoint, $t(19) = -5.47$, $p < .001$, suggesting not only less desire for the feces than the chocolates but an absolute as opposed to relative negative attitude.

Again, to address the alternative explanation that objects with a strongly associated attitudes hold attention, we measured the strength of each attitude object. We computed the absolute value of the difference between desire and the midpoint of the scale as a measure of the strength of the attitudes perceivers hold towards both feces and truffles. It is not the case that the desired object is associated with a stronger attitude than the less desired object. In fact, the absolute value of the difference score is actually marginally larger for the feces (M = 1.94) than for the truffles (M = 1.45), paired $t(19) = 1.79$, $p = .09$. This evidence does not support the attitude strength alternative explanation.

Participants

Sixty-one Cornell undergraduates participated in exchange for extra credit in their psychology or human development class.

Procedure

The experimenter escorted participants individually into a medium sized room and asked each to stand behind a piece of tape on the floor. On the opposing wall, 150-in away from participants, were two strips of tape separated by 90.5-in of white wall. Just below the tape and nestled against the wall was a shallow table that supported a small object covered by a towel. The experimenter directed participants' attention to the opposite wall and pointed out the pieces of tape and the object on the table. The experimenter explained to participants that they would estimate distance. Then participants learned that they would estimate the distance between the two pieces of tape, but instead of offering an estimate in inches or feet, they

would perform a matching task. As explained by the experimenter, participants would move themselves closer to or further away from the object on the table until the distance between themselves and the object was equal to the distance between the two pieces of tape. After offering these instructions, the experimenter removed the towel to uncover the object on the table.

Unbeknown to participants, the object participants approached or receded from varied. For approximately half of the group (n = 31), the object on the table was a shining package of Lindt chocolate truffles, while for the other half (n = 30), the object was a plastic, Ziplock bag containing what was explained to be a freshly collected sample of dog feces. After uncovering the object on the table, the experimenter asked participants to perform the distance-matching task. When participants completed the task, the experimenter placed a piece of tape just in front of the toes of participants' shoes. Participants were debriefed before being escorted out of the lab. After participants left, the experimenter measured the distance from the tape to the spot on the ground directly below the object on the table. This measurement was used as participants' distance estimates from the matching task.

Results

There were no main effects, $F(1, 57) = 1.11$, $p = .30$, or interactions with gender, $F<1$, thus the reported means represent the estimates collapsed across participant gender.

Distance estimates

We expected that participants estimating the distance between

themselves and truffles would see the object on the table as closer than did participants estimating the distance between themselves and the feces. That is to say, participants should see the distance between themselves and truffles as comparatively smaller than the distance between themselves and feces. Thus, we specifically predicted that participants estimating the distance to truffles would stand further away from the object than participants estimating the distance to feces. As expected, participants positioned themselves closer to the object when it was feces (M = 96.0-in) than when it was truffles (M = 105.9-in), U = 310.0, p = .03.

Discussion

Perception of distance depended upon what item perceivers were asked to approach. Perceivers estimating the distance between themselves and truffles saw the object on the table as closer than did perceivers estimating the distance between themselves and the feces. Importantly, this data argues that biased perception is not a result of attitude strength. Because perceivers estimated distance to either a positively or negatively valenced item about which participants held approximately equally strong attitudes, we can more firmly suggest that it is positive information and not simply the absolute value of the affective charge of the object that decreased perceptual estimates of distance. Indeed, we argue that positive information holds attention when negative information does not, and as a result, distances appear shorter.

As additional support for our position that positive information holds attention, we asked a separate group of participants to gauge the

attention-holding nature of both objects. Participants (n = 20) rated how fixated they were on the object, how eye-catching and attention capturing the object was, and how much they avoided looking at and wanted to look away from the object (the last two were reverse coded). We averaged responses to each of these ratings to form aggregate measure of the objects' ability to hold attention. Importantly, the truffles were described as more capable of holding attention (M = 6.0) than were the feces (M = 4.8), paired $t(19) = 3.56$, $p = .002$.

Study 2: Testing Real World Desires

Although the previous studies argued that desired objects appear closer than less desirable objects, they relied upon objects that naturally varied in their desirability. Study 2 served as a conceptual replication, but in this study, we varied the visceral state of the perceiver expecting that the desirability of an object should vary systematically as visceral states change. For instance, when hungry, a juicy slice of pizza hot from the oven will be more desirable than after having just finished a full meal. Thus, we took advantage of a naturally occurring variation in visceral states of a perceiver. In particular, we captured perceiver's state of hunger as they entered a campus dining hall for dinner or their state of satisfaction as they exited the dining hall after finishing dinner.

In this design, we crossed this variation in visceral state with object type. That is, we asked hungry and satisfied participants to estimate the distance that separated themselves from either a plate holding 2 slices of fresh, glistening cheese pizza or a pyramid of clear plastic cups. We expected that hungry participants would find the

pizza more desirable than the cups and more desirable than satisfied participants find both the pizza and the cups. In addition, we expected that distances would appear shorter for hungry participants estimating the distance to pizza in comparison to perceptions of distances in each of the other 3 cells of the design.

Importantly, this design allows us to test an alternative explanation as of yet not addressed. That is, one might argue that distances to any object regardless of its ability to satisfy a need will appear shorter when in a state of arousal such as hunger. By including a condition where participants were experiencing arousal produced by a need state but estimating the distance not to an object of desire but a control object, we can test the viability of this alternative explanation.

Participants

Sixty-four Cornell University undergraduates participated in exchange for candy.

Procedure

The experimenter asked students outside of two Cornell University dining halls to complete a short survey in exchange for candy. Participants sat at one of two tables near the entrance to the dining hall. Across the table from where participants were seated was an object about which the experimenter explained the survey would ask. Embedded within this survey were a few questions of interest. First, participants saw on their survey a line that was labeled as 1-in long. They were asked to estimate quickly and without measuring in any way how many inches away from where they were seated the

object was. After estimating the distance, participants rated how appealing they thought the object was. Participants indicated their impression on a 1 (not at all) to 7 (a great deal) Likert-scale. In addition, participants were asked their general opinion of the object on a 1 (very negative) to 7 (very positive) Likert-scale.

What we manipulated, though, was both the timing of when participants completed this survey but also the object to which participants estimated distance. Approximately half of participants were recruited as they entered the dining hall while the other half were recruited as they exited the dining hall. Crossed with this timing variable, approximately half of participants estimated the distance to 2 slices of pizza while the other half estimated the distance to a control object, a pyramid stack of three cups. In all conditions the objects were exactly 28.5-in away from the edge of the table closest to the participant. After completing these few questions, participants were debriefed and were compensated with candy.

Results

Exclusions

Data from one participant were removed as the distance estimation was greater than 5.2 standard deviations from the mean leaving data from 63 participants for analyses.

Hunger

Participants reported levels of hunger depended upon whether they were entering or exiting from the dining hall, $F(1, 56) = 207.36$, $p < .001$. Although there was not a significant main effect of item on reported hunger levels, the interaction between timing and item was

significant, $F(1, 56) = 5.13$, $p = .03$. Although not significantly so, participants tended to report experiencing more hunger when entering the dining hall and seeing pizza ($M = 5.7$) in comparison to when they were entering and saw cups ($M = 5.1$), $t(26) = 1.53$, $p = .14$. Participants tended to report experiencing less hunger when exiting the dining hall and seeing pizza ($M = 1.3$) in comparison to when they were exiting and saw cups ($M = 1.9$), $t(30) = 1.70$, $p < .10$.

Distance estimates

We expected that distance estimates would depend upon both the object to which they were estimating distance and the timing of their estimate. In particular, we expected that participants entering the dining hall who were most hungry would see the pizza as closer than participants who were estimating the distance to pizza when leaving the hall or estimating the distance to cups when both entering and exiting the hall. To test the specific prediction that the distance estimate to pizza when entering the hall should be smaller than the 3 other conditions, we conducted a linear contrast with weights of -3 to rank order of the estimates made by those entering and estimating the distance to pizza, and +1 to the other 3 conditions. Our specific prediction was confirmed by this linear contrast, $t(56) = 1.98$, $p = .05$. In particular, participants estimated that the pizza was 20.7-in away when entering and 26.9-in away when exiting. Participants estimated that the cups were 28.4-in away when entering and 27.8-in away when exiting.

Objects' desirability

We asked participants how desirable the object was and their

general opinion of the object. In both cases, higher numbers indicated more positive ratings of the object. We averaged responses to these 2 questions to form an average measure of the object's desirability, $r(63) = .57$, $p < .001$. We wanted to investigate how the desirability of the object might predict distance estimates. To do this, we ran a regression predicting the rank order of the distance estimate from the 4 dummy coded conditions, the averaged desirability measure, and the interaction between these 2 predictors. Overall, this model was significant, $R^2 = .12$, $F(3, 59) = 2.73$, $p = .05$.

We made the specific prediction that the averaged measure of desirability should correlate negatively with distance estimates only for the target group, namely participants entering the dining hall and estimating the distance to pizza but not in any of the other 3 conditions. To test this specific prediction, we ran a linear contrast on the correlations between these two variables assigning weights of +3 to the correlation for our target group and -1 to the correlation between desirability and distance for each of the remaining 3 conditions. This contrast was confirmed, $Z = 3.49$, $p = .0002$. More specifically, desire correlated with distance within the target group, $r(14) = -.56$, $p = .04$. However, desire did not significantly predict distance estimates to cups when entering, $r(17) = -.17$, $p = .53$, when exiting, $r(14) = .32$, $p = .26$, or to pizza when exiting, $r(14) = .38$, $p = .12$.

Study 3: Manipulating Objects' Desirability

Study 2 demonstrated that outside of the lab, participants' natural variation in levels of visceral need bias distance perception. In study 3, we wanted to replicate this effect but with increased

experimental control and rigor. To do this, we manipulated the visceral state of the perceiver expecting that the desirability of an object should vary systematically as visceral states change. When thirsty, a bottle of water will be more desirable than when thirst is quenched. Study 3 held constant the object to which participants estimated distance and varied desire by manipulating the internal state of the perceiver. In this study, participants either consumed a large serving of dry, salty pretzels to make them thirsty or 4 8-ounce glasses of water to quench their thirst. These participants then estimated the distance to a bottle of water. We included a control condition where participants consumed no food or beverage and estimated the distance to a neutral object, namely a can opener. We predicted that thirsty participants would see the water bottle as more desirable and the distance to the water bottle as smaller than quenched or control participants.

Participants

130 Cornell undergraduates participated in exchange for extra credit in their psychology or human development class.

Procedure

Participants were randomly assigned to one of 3 possible conditions: thirsty, quenched, or control. To those assigned to the thirsty or quenched conditions, the experimenter explained that in this taste testing study actual taste experiences would be evaluated. For this reason, participants would be asked consume a food product and describe their reaction to it along a number of dimensions. Participants (n = 48) assigned to the thirsty condition were presented with a serving of dry, hard, Bavarian-style pretzel bits that constituted

over 30% of the suggested daily sodium limit and asked to consume the contents of the bowl. Participants (n = 44) randomly assigned to the quenched condition were presented with 4 glasses that each contained 8-ounces of water. Participants were asked to figure out which glass contained a different type of water than the other 3 glasses by drinking the contents of all glasses. In addition to their serving of the food product, on the table in front of participants sat an unopened bottle of water 28-in away from the edge of the table. Participants in the thirsty and quenched conditions were explicitly instructed by the experimenter to refrain from drinking the bottled water.

While consuming their food product, participants provided background information about themselves including the amount of time that since they last ate and drank any beverage. In addition, participants evaluated the product by indicating how much they enjoyed it and to what extent they preferred a different brand.

Participants completed a survey after having finished their food product or when they indicated that they could not consume any more. First, participants indicated how thirsty they felt on a 1-7 scale where higher numbers represented greater thirst. Secondly, a horizontal line on the page was labeled as 1-in in length to provide some frame of reference for a distance estimation task. After seeing this line, participants estimated the distance between themselves and the bottle of water on the table. Finally, participants indicated on a 1-7 scale how desirable the bottle of water was.

Participants (n = 38) randomly assigned to the control condition

did not consume any food product. Instead, they completed a survey ostensibly measuring their ability to make estimates. In particular, they estimated the amount of time that has passed since they last ate or drank among other time estimates to maintain the cover story. After these time estimates and other unrelated judgments, control participants estimated the distance between themselves and an object 28-in away from the edge of the table after being shown a 1-in line to establish a frame of reference. However, in this condition, participants estimated the distance to a can opener and not a bottle of water.

Results

One person in each of the thirsty and quenched conditions refused to participate after learning about the product they would have to consume leaving 47 participants in the thirsty condition and 43 in the quenched condition.

Manipulation checks

Participants in the thirsty and quenched conditions did not differ in how long before arriving at the lab it had been since they last ate, $t(88) = .12$, $p = .90$, or drank, $t(88) = -.21$, $p = .84$. Importantly, after consuming their product, participants in the thirsty condition indicated stronger feelings of thirst ($M = 6.1$) than participants in the quenched condition ($M = 1.4$), $t(88) = 21.99$, $p < .001$.

Distance estimates

We expected that thirsty participants would see the object on the table as closer than control participants while quenched participants would see the object as further away than control participants. To test this specific prediction, we conducted a linear contrast with a weight of

-1 to the rank order of the distance estimates from the thirsty group, 0 to estimates from the control participants, and +1 to estimates from the quenched group. This specific prediction was confirmed by a linear contrast, $t(125) = 2.06$, $p = .04$. In particular, participants estimated that the bottle of water was 24.5-in, while control participants estimated that the object was 26.3-in away. However, quenched participants saw the bottle as 27.7-in away.

Mediation by feelings of thirst

If it is the case that perceivers' motivational states influenced distance estimates, then we should find that reported feelings of thirst mediated the relationship between food product condition and distance estimates. To test this prediction, we conducted a mediational analysis using procedures outlined by Baron & Kenny (1986). First, we coded the thirsty condition as 1 and the quenched condition as 0. As stated above, the food product condition significantly predicted participants' feelings of thirst ($B = 4.67$, $SE = .21$, $p < .001$). In addition, participants' feelings of thirst significantly predicted distance estimates ($B = -.08$, $SE = .03$, $p = .01$). Finally, when both food product condition and feelings of thirst were included in the same equation predicting distance estimates, the former dropped to nonsignificance, and the latter remained marginally significant ($B = .28$, $SE = .38$, $p = .46$, and $B = -.13$, $SE = .07$, $p = .09$). Results of the Sobel (1982) test confirmed the significance of this mediated relation ($Z = -1.71$, $p = .045$, one-tailed).

Study 4: Measuring Actual Breadth of Attention

The previous studies demonstrated that desirable objects appear

closer than comparatively less desirable objects. We sought to replicate this finding but by using another means to measure distance estimates. In this study, participants pulled off a piece of string from a roll until the length of the string equaled the distance that separated themselves from the object.

In addition, Study 4 tested a possible mechanism implicated in this form of motivated perception. We investigated how a narrowed as opposed to expansive focus of attention leads to shorter or longer estimates of distance, respectively. In Study 4, we replicated the design of Study 2 and added measures that capture the breadth of perceivers' span of attention. In particular, we measured perceivers' ability to later recognize other objects that were located on the walls surrounding the target object. We predicted that desirable objects hold perceiver's attention and produce a narrowed focus of attention on the object as quantified by less accurate recognition of objects that surrounded the target object. A narrowed focus of attention on the object is predicted to produce shorter estimates of distance in comparison to instances where focus of attention is more expansive.

Participants

71 Cornell undergraduates participated in exchange for extra credit in their psychology or human development class.

Procedure

Participants were randomly assigned to one of 3 possible conditions: thirsty, quenched, or control. To those assigned to the thirsty or quenched conditions, the experimenter explained that in this taste testing study actual taste experiences would be evaluated. For

this reason, participants would be asked consume a food product and describe their reaction to it along a number of dimensions.

All participants were seated at one end of a cubicle across from a table. A number of objects were located on the wall opposite to where participants were seated including a far side poster, letters and numbers cut from construction paper, a foil doily, a bumper sticker, and other objects approximately 4-6-inches in height and width. All objects were clearly visible on the wall, although no explanation was given nor did any participants ask why they were secured to the wall.

Participants (n = 24) assigned to the thirsty condition were presented with the same serving size of Bavarian-style pretzel bits and same instructions as Study 3. Participants (n = 23) randomly assigned to the quenched condition were presented with 4 glasses of water and the same instructions as Study 3. On the table in front of participants sat an unopened bottle of water 53-in away from the edge of the table.

While consuming their food product, participants provided background information about themselves including the amount of time since they last ate and drank any beverage. In addition, participants evaluated the product by indicating how much they were enjoying it and to what extent would they prefer a different brand.

After finishing their food product or when they indicated that they could not consume any more, participants estimated the distance between themselves and an object on the table. In this study, we gave participants a ball of string and asked them to estimate the distance between themselves and the object by pulling off a piece of string until the length of the string equaled the distance that separated themselves

from the object. We also included the self-reported distance measurement used in the previous studies whereby participants write down the number of inches that separate themselves from the object.

After making this distance estimate, participants indicated how thirsty they felt on a 1-7 scale where higher numbers represented greater thirst. Secondly, participants indicated on a 1-7 scale how appealing the bottle of water was and their general opinion about the bottle where higher numbers indicated more positive impressions.

Participants (n = 23) randomly assigned to the control condition did not consume any food product. Instead, they completed the same survey as in Study 3. After these time estimates, control participants estimated the distance between themselves and an object by using the string method. However, in this condition, participants estimated the distance to a can opener and not a bottle of water.

After completing these measures, participants in all conditions were moved to a separate cubicle to complete a memory test. On a 15in iBook, participants were shown photographs of a number of objects, some of which were located in the cubicle they just occupied while others were foils. Participants indicated as quickly and as accurately as possible whether the exact object that appeared on the computer was located in the cubicle from which they were just moved. After indicating whether each object was or was not in the space, participants were debriefed and escorted from the lab.

Results

Manipulation checks

Participants in the thirsty, quenched, and control conditions

and did not differ in how long it has been since they drank any beverage, $F < 1$. Importantly, feelings of thirst depended upon condition, $F(2, 68) = 62.09$, $p < .001$. Participants in the thirsty condition indicated stronger feelings of thirst ($M = 5.9$) than participants in the control ($M = 4.3$) and quenched conditions ($M = 1.3$).

Distance estimates

First, the rank order of distance estimates using the string method depended upon condition, $\chi^2(2) = 5.91$, $p = .05$. We expected that thirsty participants would see the object on the table as closer than did control participants while quenched participants would see the object as further away than do control participants. To test this specific prediction, we conducted a linear contrast with a weight of -1 to the rank order of estimates from the thirsty group, 0 to estimates from the control participants, and +1 to estimates from the quenched group. Our specific prediction was confirmed by this linear contrast, $t(64) = 2.44$, $p = .02$. Using the string method, thirsty participants estimated that the bottle of water was 54.7-in away, while control participants estimated that the object was 64.2-in away. However, quenched participants saw the bottle as 63.7-in away.

We also tested distance estimates offered when participants reported the number of inches that separated themselves and the object. Although we expected the same pattern of results as when using the string method, we found that this was not the case, $\chi^2(2) = 4.41$, $p = .11$. The linear contrast described in the preceding paragraph was not, significant $t(68) = .72$, $p = .48$. Thirsty participants estimated

the distance was 45.8-in, control participants estimated it was 50.5-in, and quenched participants estimated it was 42.6-in. We suspect that the pattern of results using the string method and self-report method differ because of the number of inches away from the participant the object actually was. In this study compared to the previous ones, the object of interest was 1.9 times further away thus increasing the variance of reported responses.

Objects' desirability

As expected, ratings of desirability varied by condition, $F(1, 67) = 12.53$, $p < .001$. We expected that thirsty participants would see the object as more desirable than did control participants while quenched participants would rate the object as the least desirable. To test this specific prediction, we conducted a linear contrast with a weight of +1 to ratings from the thirsty group, 0 to ratings from the control participants, and -1 to ratings from the quenched group. This contrast confirmed our prediction, $t(67) = 4.72$, $p < .001$. Thirsty participants saw the bottle of water as more desirable ($M = 5.1$) than control participants rating the can opener ($M = 3.6$) and quenched participants rating the water bottle ($M = 3.2$).

Strength of attitude as a predictor of distance estimates

We offered additional evidence to refute the alternative that objects toward which individuals hold strong attitudes are more likely to attract attention (Roskos-Ewoldsen & Fazio, 1992). To do this, we computed a difference score that represented the strength of the attitude participants held about the object by taking the absolute value after subtracting the midpoint 4 labeled as "no opinion" from the

average desire scores. Strength of attitude depended upon thirst condition, $F(2, 67) = 11.57$, $p < .001$. Thirsty participants held a stronger attitude towards the object than did control participants, $t(45) = 4.65$, $p < .001$. However, quenched participants also held a stronger attitude than did control participants, $t(45) = 2.22$, $p = .03$. Counter to the alternative explanation, strength of attitude did not predict distance estimates using the string method, $r(66) = -.16$, $p = .20$. In addition, this relationship was not significant in any of the individual thirst conditions, p's > .20.

Focus of attention

After estimating distance and evaluating the object, participants were moved from the cubicle that contained the object. In a separate space, participants performed an object recognition task that assessed their memory for items on the wall beyond the object. First, accuracy in recognizing objects that were in fact on the wall behind the target object depended upon condition, $F(2, 68) = 2.45$, $p = .09$. Thirsty participants accurately recognized 19% of objects on the wall, control participants 14%, and quenched participants 12%.

However, we were more interested in the specific location of the objects that participants remembered. In particular, we expected that thirsty participants would focus their attention on the water bottle and as a result would be more likely to remember objects that were closer to the water bottle and less likely to remember objects that were further away from the water bottle. We expected that control and quenched participants would not have their attention as narrowly

focused on the target object, thus this pattern for location-based memory should not hold for these two groups.

We computed a memory score for each participant to compare location advantages. First, we divided the space around the target object into thirds. Objects located within a radius of 13-in from the target object were considered the close objects. Objects falling within a radius of 13 and 26 -in away from the target object were considered middle objects. Objects falling within a radius of 26 to 40-in away from the target object were considered far objects. Although ideally objects located in each of the 3 spaces would be equally attention-holding and equally memorable, that was not the case. Instead, regardless of thirst condition, objects on the wall were more memorable in certain locations over others, $F(2, 140) = 6.89$, $p = .02$. When collapsing across thirst conditions, accuracy was highest for mid objects ($M = 56\%$), lowest for far objects ($M = 43\%$), with accuracy for close objects falling between these two other locations ($M = 48\%$). This is most likely the result of object-specific advantages. A few objects in the mid radius were quite colorful and easy to label.

We created an index score to let us investigate the relative advantage of location within each thirst condition. The index score we computed controlled for an overall location advantage and our analysis controlled for thirsty participants' overall memory advantage. Specifically, to compute the memory index, we took the raw number of accurate object recognitions in each of 3 locations for each participant and subtracted from that the grand mean number of objects that were accurately recognized in each of these 3 locations collapsing across

thirst condition. This difference takes into account the confounding effect of ease of identification, labeling, and memory for objects in each of the 3 locations. Then, because the number of objects that fell into each location varied, we divided this difference score by the number of objects in each location. The resulting index score allows us to make meaningful comparisons among the 3 location areas. This index score represents the relative advantage of location that can be compared across locations and among conditions (see Table 4.1).

We made the specific prediction that the index score for thirsty participants should be highest for close objects followed by decreased memory for mid object and even greater decrease for far objects. However, this predicted contrast should not hold for either control or quenched participants. To test this specific prediction, we applied the following weights to individual participants' index scores to compute

Table 4.1
Participants' Memory Index Score in Each Location and Overall Weighted Index Score Representing Close Object Memory Advantage

Condition	Object Location			Overall Weighted
	Close	Mid	Far	
Thirsty	.16	.04	.06	.21
Control	-.08	-.07	-.07	-.02
Quenched	-.08	.02	.01	-.19

an overall index measure of the advantage in memory for close objects: +2 to the index score associated with close objects, -1 to the index for mid objects, and -1 to the index for far objects (see Table 4.1). Once we computed this single, overall weighted index of advantage for close objects for each participant, we performed a linear contrast predicting that this overall weighted index of close object advantage should be highest for thirsty participants, smaller for control participants, and smallest for quenched participants. Thus we assigned a weight of +1 to the overall weighted index of close object advantage for thirsty participants, 0 to the advantage index for control participants, and -1 to the advantage index for quenched participants. This linear contrast confirmed our prediction, $t(68) = 2.29$, $p = .03$.

As additional confirmation of thirsty participants' memory advantage for close as opposed to far objects in comparison to the advantage held by participants in either of the two other conditions, we ran 3 separate linear contrasts—one for each of the 3 conditions. We assigned weights of +2 to the index score for close objects and -1 for index scores for mid and far objects and applied these weights to the memory scores for each thirst condition. As expected, the linear contrast for thirsty participants was marginally significant, $t(69) = 1.90$, $p = .06$, and not significant for either the control condition, $t(69) = -.29$, $p = .77$, or quenched condition, $t(66) = -1.50$, $p = .14$. This pattern of index scores and the 3 contrasts together suggest that thirsty participants had a memory advantage for close objects relative

to both mid and far objects, but this same advantage was not present for control or quenched participants.

Study 5A: Asking If Desire Narrows Self-Reported Focus of Attention

We wanted to test for the mediating role of focus of attention in distance perception. Because our proposed mediator, the diameter of one's focus of attention, is difficult to measure but easy to manipulate, we decided to follow the advice of Spencer, Zanna, and Fong (2005) who recommended using an experimental chain design in just these circumstances. Chain designs utilize several studies to examine a psychological process by manipulating both the independent variable and the mediating variable. Step one is to show that the independent variable influences the mediator; step two is to show that when the mediator is experimentally manipulated, it will exert an influence on the dependent variable. Because it calls upon experiments to demonstrate causality, researchers can make stronger, more appropriate claims about the psychological process than with mediational analyses.

Studies 5A and 5B in combination tested this mechanistic chain. Study 5A demonstrated that perceivers reported a more narrowed focus of attention on objects that they found desirable, and objective measures of attention confirmed these self-reports. This first leg of the experimental chain established a relationship between our independent variable, amount of desire produced as a result of a need state, and our mediator, focus of attention. Study 5B, showed that when assigned to narrowly focus attention on an object rather than

adopting an expansive focus of attention, objects appear closer on objective measures of distance. This second leg of the chain established a relationship between our mediator and the dependent measure, objective perception of distance.

Participants

40 Cornell undergraduates participated in exchange for $3.

Procedure

Students participated in what was ostensibly a marketing survey asking for their opinions about various products. To those randomly assigned to the thirsty condition, the experimenter explained that in this taste testing study actual taste experiences would be evaluated. For this reason, participants would be asked consume a food product and describe their reaction to it along a number of dimensions. Participants (n = 20) assigned to the thirsty condition were presented with the same serving of Bavarian-style pretzel bits as in Study 3 and the same instructions. Participants (n = 20) randomly assigned to the control condition did not eat anything but instead completed a survey that asked for their opinions of various products that were not related to any particular food product. Within this marketing survey, participants provided background information about themselves including the amount of time that since they last drank any beverage. Near the end of all participants' survey but importantly after the thirsty group finished consuming the pretzels, participants indicated on a 1-7 Likert scale how thirsty they felt where higher numbers represented greater thirst.

After consuming the pretzels and completing the marketing

survey, participants were moved to cubicle. For all participants, a number of objects were located on the walls of the cubicle including a poster of the Cornell campus, a poster of a tropical island, far side cartoons, among others. Participants were seated at one end of the cubicle at the end of a long table. At the other end of the table, 65-in away from the participant, sat an object. For half of the participants, the object at the end of the table was an 8-ounce bottle of name brand spring water. The other half of participants saw a control object at the end of the table—namely, a can opener. Object type was crossed with the thirst manipulation resulting in a 2 (thirsty, control) X 2 (water bottle, can opener) factorial.

While seated across from the object, participants were asked a series of questions about this object that measured how desirable the object was and how focused participants' attention was on the object. To measure desire, participants indicated on a 1-7 Likert scale how positive, appealing, tempting, and attractive they felt the object was. These 4 ratings were averaged together to form a single measure of desirability (α = .88). To measure self-reported focus of attention, participants indicated on a 1-7 Likert scale how attention-capturing and eye-catching the object was in addition to how fixated and focused they were on the object. These 4 ratings were averaged to form a single measure of self-reported focus (α = .83).

After rating the object on theses dimensions, participants were moved to another cubicle where they completed an object recognition task. On a 15-inch iBook, participants were shown photographs of a number of objects, some of which were located in the cubicle they just

occupied while others were foils. Participants indicated as quickly and as accurately as possible whether the exact object that appeared on the computer was located in the cubicle from which they were just moved.

Results

Manipulation checks

After consuming their product, participants in the thirst condition indicated stronger feelings of thirst (M = 6.2) than participants in the control condition (M = 4.7), F(1, 35) = 16.65, p < .001.

Focus of attention

Again, we expected that participants would report having their attention focused the most on the object when that object was a water bottle rather than a can opener and when participants were thirsty rather than when in the control condition. To test the prediction that focus of attention would depend upon participants' thirst and the target object, we ran a 2 (condition: thirsty, control) X 2 (object: water bottle, can opener) factorial on the averaged measure of self-reported focus. As expected, the interaction between these 2 factors was significant, F(1, 36) = 6.96, p = .01. Thirsty participants reported focusing their attention more on the bottle of water (M = 4.5) than did control participants (M = 3.3), t (18) = 2.46, p = .03. Thirsty and control participants did not differ in how much they reported being focused on the can opener (M = 2.2, 2.8 respectively), t(18) = 1.33, p = .20.

Objects' desirability

We expected that while the water bottle might be rated as more

desirable than the can opener given the colorful label, etc., the visceral feeling of thirst would increase the desirability of the object when the object was a bottle of water rather than a can opener. To test the specific prediction that desirability of the object would be greatest when the object was a bottle of water and the participants most thirsty, we ran linear contrast assigning the weights of +3 to the desirability ratings of the thirsty group rating the water bottle, and -1 to the 3 remaining conditions of the factorial. As expected, the linear contrast predicting greatest reports of desirability by the thirsty group exposed to the water bottle was significant, $t(36) = 3.48$, $p < .001$. Thirsty participants saw the bottle of water as more desirable ($M = 5.6$) than the can opener ($M = 2.8$) and as more desirable than did control participants evaluating the water bottle ($M = 5.1$) or the can opener ($M = 3.5$).

Mediation by objects' desirability

If it is the case that perceivers' motivational states increases the desirability an object holds which leads to a narrowed focus of attention on that desirable object, then we should find that desire mediated the relationship between thirst condition and focus of attention. To test this prediction, we conducted a mediational analysis using procedures outlined by Baron & Kenny (1986). First, we coded the control participants exposed to the can opener as 1, thirsty participants exposed to the can opener as 2, control participants exposed to the water bottle as 3, and thirsty participants exposed to the water bottle as 4. Condition, as coded by the above method, significantly predicted participants' ratings of object desirability ($B =$

.85, *SE* = .19, $p < .001$). In addition, participants' ratings of desire significantly predicted focus of attention (*B* = .60, *SE* = .09, $p < .001$). Finally, when both condition and desirability were included in the same equation predicting focus of attention, the former dropped to nonsignificance, and the latter remained significant (*B* = .17, *SE* = .16, $p = .30$, and *B* = .53, *SE* = .11, $p < .001$). Results of the Sobel (1982) test confirmed the significance of this mediated relationship ($Z = 3.28$, $p = .001$).

Recognition of target object

As a second measure of focus of attention, we had participants perform an object recognition task on the computer where participants needed to indicate as quickly as possible whether the exact object that appeared on the screen was located in the cubicle from which they were just moved. Although the overall rate of accuracy rate for correctly responding *yes* to objects that were in the space and *no* to foils was 72%, there were no differences among conditions in accurately responding that the target object was in fact located in the space, $\chi^2(3) = 2.11$, $p = .55$. Of both thirsty participants identifying the water bottle and the control group identifying the can opener, 90% (*n* = 9 in each) accurately indicated that the object was located in the space while 100% of participants in the two remaining conditions (*n* = 10 in each) did so as well.

However, of greater interest in the speed with which participants are able to identify the object. Given the skewed nature of the reaction times, we ran our analyses on the natural log transformation. However we report the back-transformed means for ease of presentation. Faster

speeds at identifying the target object, we argue, is a proxy for a greater focus of attention on the object as faster response times indicates increased accessibility that is the product of the greater amount of attentional focus. In fact, the speed at which participants recognize the target object correlates negatively with self-reported focus of attention, $r(40) = -.31$, $p = .05$.

A priori, we made the prediction that thirsty participants who viewed the water bottle would be faster than any other group of participants when controlling for overall reaction times to other accurately identified objects. To test this specific prediction we ran a linear contrast assigning weights of -3 to reaction times from the thirsty group viewing the water bottle and +1 to all other groups and included the covariate described above. To control for reaction time differences among conditions that result from different states of arousal, we used as a covariate the time it took participants to accurately indicate that other objects were in fact in the room and that foils were not in the room. Our prediction was confirmed by this linear contrast, $t(35) = 2.21$, $p = .03$. In particular, thirsty participants indicated the water bottle was in the room in 1394 msec. Thirsty participants indicated the can opener was in the room in 2881 msec. Control participants indicated the water bottle was in the room in 2204 msec and the can opener in 2262 msec.

Study 5B: Manipulating Breadth of Attention

Study 5A suggested that desirability led to a narrowed reported and actual focus of attention on the object. Study 5B investigated the consequences of focus of attention on perception of distance. In this

study, we manipulated focus of attention by asking participants to adopt narrow or expansive spans of attention and investigated differences in perceptions of distance to a desirable object. We predicted that when adopting a narrowed focus of attention, distance to a desirable object would appear shorter than when adopting an expansive focus of attention.

Participants

Forty Cornell undergraduates participated in exchange for extra credit.

Procedure

Students participated in what was ostensibly a marketing survey asking for their opinions about various products. The experimenter explained that this was a study about first impressions of freshly baked cookies before they were consumed. On the far end of a long table 65-in from participants, a toaster oven was baking 2 chocolate chip cookies as participants heard this description. To those randomly assigned to the focused condition (n = 20), the experimenter explained that the participant should focus his or her attention on the cookies that were baking in the oven. They were reminded to look up as frequently as possible so as to remind themselves of the sights and smells of the cookies. Because this was a marketing study, the experimenter explained participants needed to be as familiar with the product as possible outside of having a tasting experience. At several points in the marketing survey, participants were instructed to look up and look directly at the cookies baking in the oven.

To those randomly assigned to the expanded attention condition

(n = 20), the experimenter explained that participants needed to make sure to take in their surroundings. In the real world, people would not form opinions about products in such a small office space. Instead, people would be in a large grocery store or a big kitchen with lots of merchandise surrounding them. Because of this, participants were asked to look up as frequently as possible to take in the information around them. Participants were directed to look at the walls to their left and right, straight ahead, and up and down. By looking around and taking in more information, the experimenter explained it is possible to mimic a real world experience. Again, at several points in the marketing survey, participants were instructed to glance up from their packet to look around them. For all participants, a number of objects were located on the walls of the cubicle including a poster of the Cornell campus, a poster of a tropical island, far side cartoons, etc.

All participants completed what was ostensibly a marketing survey. In this survey, participants provided background information about themselves including the amount of time since they last ate or drank anything. Participants answered a number of filler questions, embedded within which were 2 prompts to either look up at the cookies or to look around themselves at their surroundings. Immediately following the second of such prompts, participants were asked to estimate the distance between themselves and the oven baking cookies. Participants saw a horizontal line on the page that was labeled as 1-in in length meant as a frame of reference. Participants estimated the distance between themselves and the oven by writing down the number of inches that separated themselves from the oven.

As an additional measure of distance estimates, a subset of the total sample was asked to rate the subjective size of the oven. Closer objects that are closer appear larger while objects further away appear smaller. Thus, if the oven feels closer, it should also feel larger than when the object feels further away. To test this subjective size estimate as an additional measure of perceptions of the distance that separates oneself from the oven, 32 participants indicated on a 1-7 Likert scale how big the oven felt where higher numbers indicated larger subjective estimates of the oven's size.

After completing the marketing survey, participants were moved to another cubicle where they completed an object recall task. Participants were asked to write down all of the items that they remember seeing in the cubicle from which they were just moved. We used the object recall task as a manipulation check to ensure participants either focused their attention on the oven or looked around the space as instructed.

Results

Manipulation checks

As expected, participants in the focused condition remembered fewer items on the walls of the cubicle (M = 2.2) than did those in the expansive attention condition (M = 6.3), $t(38) = 4.88$, $p < .001$. Participants in the focused and expansive attention conditions did not differ in how long it has been since they last ate or drank or their subjective feelings of hunger or thirst, t's < 1, p's > .40.

Distance estimates

In this study, distance estimates were roughly normally

distributed. As a result, we conducted analyses on the non-transformed data[1]. We expected that participants who were focused on the oven with cookies would see the oven as closer than did participants in the expansive focus condition. As expected, participants estimated that the oven was closer in the focused condition (M = 36.7-in) than those in the expansive attention condition (M = 43.1-in), $t(38) = 2.30$, $p = .03$.

As an additional measure of distance estimates, we asked participants to report on a 1-7 scale how big the oven baking the cookies felt. The means suggest that participants who were focused on the oven tended to indicate that the oven felt larger (M = 5.5) than participants who looked around the room (M = 4.6), $t(30) = 1.88$, $p = .07$

General Discussion

Although Johnny Nash claims to "see clearly now," rarely are perceivers capable of seeing the world around them without bias. We asked if motivations might be one source of influence clouding perceptual experiences. We asked if motivations extend down to basic perceptual processes. Across these studies, we provided convergent evidence suggesting that desires lead perceivers to see what they want to see in their visual environment—to focus their attention on objects of their desire. We then went on to examine the downstream consequences of this narrowed focus of attention on perception of

[1] For the sake of consistency, we also conducted an analysis on the distance estimates using a Mann-Whitney test of the ranks. This analysis also supports our prediction, however marginally so, $U = 133.5$, $p = .068$.

distance, an element of nature with which perceptual systems should be well-acquainted.

Study 1A provided initial evidence that distances to desired objects such as chocolate are seen as shorter than distances to a neutral object. In study 1B, we argue that it is not the case that an object that commands a strong attitude, regardless of valence. Even though people held a marginally stronger attitude towards feces, chocolates were seen as seen as closer. In addition, we gathered distance estimates by relying on nonverbal, perceptual measurement techniques. In Study 1B, participants physically moved their body so that the distance between themselves and the object was equal to the set distance they were asked to estimate. In Study 4, we gathered distance estimates using another type of nonverbal, perceptual measurement technique where participants pulled off a piece of string from a roll until the length of the string equaled the distance that separated themselves from the object.

Study 2 replicated this basic pattern but captured people's naturally occurring state of hunger as they entered a dining hall. In this study, we accounted for an alternative explanation that any object regardless of its desirability will appear closer when a perceiver is in a state of arousal such as hunger. In studies 3 and 4, we manipulated participants' visceral need to satisfy thirst expecting that this state will influence the desirability of the same object. We found that visceral states lead to decreased estimates of distance only to objects that might satisfy that need. Across these studies, participants estimated that the objective distance separating themselves from the more

desired object was smaller than the distance to a less desired object.

In addition, we offered evidence that motivation influences perception through expansiveness of attention. Study 4 provided initial evidence that a narrowed focus of attention on the desired object was associated with reduced distance estimates. Studies 5A and 5B use an experimental chain methodology to further confirm that desire leads to decreased perceptions of distance. Study 5A demonstrated that visceral states lead to changes in the ratings of an object's desirability which narrows the focus of attention on that object. Study 5B continued by demonstrating that when attention is narrowed as opposed to expanded on a toaster oven baking fresh chocolate chip cookies, perceptions of distance decrease. In short, perceivers tended to focus their attention on desired objects resulting in decreased perceptions of distance.

Alternative Accounts

A critic might argue that the paradigms we used took advantage of psychological processes other than motivation that could influence participants' estimates of distance. First, one could argue that we selected objects that differed objectively in the strength that was associated with that object regardless of whether the attitude was positive or negative (Roskos-Ewoldsen & Fazio, 1992). We, however, controlled for this possibility. In Study 1B, participants estimated the distance to chocolates that were pretested to be objectively positive or to dog feces pretested to be objectively and not just relatively negative. That is, both objects held a strong affective charge and were equally attention-holding to pretest participants. In fact, perceivers held

marginally stronger attitudes towards feces in comparison to the chocolates, yet it was the chocolates that appeared closer.

Study 4 offered additional evidence that refutes this alternative. The strength of perceivers' attitude towards the target object did not predict distance estimates. That is, the correlation between strength of perceivers' attitudes did not significantly correlate with their distance estimates when collapsing across condition or when looking at the simple correlations within each of the visceral states conditions. Thus, attitude strength is not a viable alternative explanation for the biased distance estimates we observed.

Second, a critic may argue that inducing a state of arousal in perceivers by, for instance, making them exceptionally thirsty, would lead to shorter distance estimates not just to the object of their desire such as a water bottle, but to any object that was the focus of attention. If pushed for a rationale, this critic might offer the mildly supported proposition that the ability to describe peripheral features of a scene when engaged in a weapon focus scenario increases when in states of low versus high arousal (see metaanalysis by Steblay, 1992). That is, when in high-arousal, perceivers focus more on the central target item, a weapon in a crime scene, than when in states of low-arousal. Thus, inducing arousal might focus perceivers' attention on central rather than peripheral items. It may not be desire, per say, but arousal that biases distance perception.

Our data argue against this general arousal alternative. In Study 3, we employ a fully crossed design such that participants experiencing hunger as they enter a dining hall at dinner estimate the

distance to either 2 slices of pizza or a control object. The data indicates that distances appeared shorter to the hungry group only when they estimated the distance to pizza and not the control object. In addition, Study 5A employed a similar factorial design and showed that the visceral state of thirst focuses attention only on an object that could satisfy thirst and not a control object. These data argue against the alternative that arousal focuses attention on any object, which then decreases distance estimates.

A harsh critic, though, might argue that arousal is not just a product of the visceral state. Instead, this critic might argue that arousal is maximal when experiencing the visceral state while being exposed to the object of a perceiver's desire. That is, the most aroused participants in our studies are those that are thirsty and are estimating the distance to a bottle of water they have been told not to consume. Although our data cannot speak to these various levels of arousal a thirsty or hungry perceiver might experience, we contend that arousal is still not a viable alternative. Certainly, fear is a state in which physiological markers of arousal are heightened and will increase when exposed to the feared object. For instance, worrying about the possibility of seeing a alligator while canoeing 6-inches above water in murky Florida swamps certainly will make the heart beat faster and blood pressure rise, all while perspiration and respiration increase. Importantly, these signs of arousal will increase dramatically if a snout and 2 yellowy eyes rise above the water's surface.

However, unlike the state of fear with all its physiological

markers of arousal, thirst and hunger do not manifest themselves in the same manner. The state of thirst can increase without accompanying rises in these markers of arousal as they are controlled by different mechanisms (Messing & Campbell, 1971). When people have been deprived of hunger, systolic blood pressure, pulse, and respiration do not increase but instead decrease (Engel, 1959). In addition, physiological markers of anxiety have been well-documented using animal models. For instance, the heart rate and bar-pressing behaviors of thirsty rats suggested that thirsty rats will press a bar to receive water, but heart rate was uncorrelated with thirst (Hahn, Stern, & Fehr, 1964).

We cannot address whether a thirsty participant who sees a water bottle is more aroused than a thirsty participant with a can opener. However, this literature suggests that hunger and thirst are states that do not reliably manifest themselves by physiological markers of arousal that would lead to the perceptual biases we observed. Hunger and thirst do not produce states of physiological arousal such as anxiety, increased heart rate, increased pulse, etc. that would lead to a heightened focus on a target item. Therefore, we contend that our experimental designs and the state of the literature argue against arousal as an alternative explanation for biased perceptual experiences of distance.

Notes on the Mechanism Underlying Biased Perception

These studies left open one ambiguity about motivated distance perception that future work could profitably address. In Study 1B, we found that people tended to see the less desired object, the dog feces,

as further away than the pleasant object, the chocolates. We can ask if this bias arose because perceivers' motivational state was an "approach" one, facilitating processes associated with seeing a desired object as closer, or a "avoidance" one, facilitating processes that could lead perceivers to see the less desired object as further away. Although we did not explicitly test the role of avoidance motives, future work could potentially tease apart whether the phenomenon we uncovered is one in which people are biased toward seeing wanted stimuli or against seeing unwanted stimuli as closer.

In testing approach and avoidance motivations, future work might also provide empirical support for an adaptive motivational regulatory system we proposed early in this paper. Again, we suggested that motivations might restore or top off energy reserves to encourage action meant to approach and reach a desired goal. To accomplish this, motivations might also trick the perceptual system to convince it that a desired object is close enough to be considered reachable. By investigating the interaction between approach and avoidance motivations and the functional value of reaching a target object, future work might better understand how motivations regulate action via perception.

Where Does the Bias Reside in the Perceptual System?

We argue that desire led to a narrowed focus of attention on the object of desire even when information in the visual array was quite plentiful. Although we did point out the target object to participants, we do not think such a step is necessary when motivations, and in particular desires, are involved. Desires themselves, and not

necessarily the experimenters' statements that directed attention to the target object, might influence the expansiveness of perceivers' attentional spotlight. Upon entering into a state of desire such as thirst, perceivers may begin scanning the environment, consciously or nonconsciously, for objects that might satisfy their desire. When finding that such an object is present in the environment, desires might constrict the focus of attention to just that object. However, if a scan of the environment suggests that no such object exists, attention may remain expansive. Although we have demonstrated that desires influence the narrowness of perceivers focus, it may be the case that in fact motivations enter into the perceptual process at an earlier stage.

This question about the stage at which higher-order influences mold perceptual processes became a major theoretical battle in the New Look period of psychology in the 1940s. Critics of New Look research argue that higher-order constraints influence not basic perception but rather later stages of the perceptual processes that could be termed "post-perceptual" or "perceptual decision making" (Pylyshyn, 1999). However, asserting that part of the perceptual system is sealed off from higher-order influences is litigious (see the commentaries that accompany Pylyshyn, 1999). Recent evidence posits that higher-order processes penetrate very early stages of perception. For instance, Muller, Bartelt, Donner, Villringer, & Brandt (2003) observed with fMRI that the higher order constraint attention and not eye movements could modulate processing in V1, V2, primary visual cortex, and V4 (see also Meng & Tong, 2004).

Our work will not put this issue to rest, but it does suggest that the impact of motivation may not be limited only to later stages of perception but might instead extend to earlier and more primitive tasks the perceptual system utilizes such as the narrowness of attention's focus. Future work could examine when motivational influences, like other higher-order factors, have an impact on perception. Such a question would be relevant not only to work on motivation, but also to work on other higher-order constructs (e.g., stereotypes, expectations, frames) that have been at the focus of social cognitive work.

When does one wear black-tinted or rose-colored glasses?

We argued that attention is allocated preferentially to positive rather than to negative information. However, literature and theory suggests an alternative view that being prepared to ward off dangers is generally more important for the survival than making use of opportunities (see Rozin & Royzman, 2001). Thus, attention should be allocated to negative stimuli (see, e.g., Hansen & Hansen, 1988, 1994; Kahneman & Tversky, 1984; Peeters & Czapinski, 1990; Pratto & John, 1991). For instance, it would be imperative for a backpacker to take notice of the hungry grizzly bear unsuccessfully fishing for salmon just upriver from his camp. One might ask how we resolve this seeming discrepancy between our work demonstrating that people see what they want to see and a negativity bias in perceptual attention that pervades much of judgment and decision-making.

We suggest that perceptual systems are not simply computational machines that are insensitive to situational constraints,

differential consequences, or social influences. Instead, perceptual systems might be differentially sensitive to positive information for the following reasons. First, if the consequences of misperceiving an object, particularly a negative one, are low, then allocating resources to gain rewards might outweigh the costs of attending to a negative stimulus. For instance, failing to see a bag of trash may not be as egregious an oversight as failing to notice an edible sandwich when hungry. Second, the goals of the perceiver might dictate when positive information will be treated in a preferential manner to negative information. Consider a situation when one's acceptance in a social group has been threatened. Noticing the smiling face of a sympathetic other may be more important than noticing the neutral or frowning faces of the ostracizing group.

In addition to the cost benefit ratio and the goals of a perceiver, allocation of attention to positive or negative information can be predicted by personality traits. For instance, populations of people suffering from anxiety attend to personally threatening rather than neutral information (Pineles & Mineka, 2005). Optimists show attentional biases towards positive information (Segerstrom, 2001) as they are less likely to look first to and spend less time processing negative images (Isaacowitz, 2005). By examining the characteristics of the situation a perceiver experiences, their temporary goals, and chronic motivations, we might better predict when negative information will dominate perceptual processing and when people will see what they want to see.

In addition to their general disposition, people's reactions to

objects might predict when perceptual systems will be guided by wishful thinking rather than negativity dominance. A bowl of chocolate truffles provokes a different reaction than a freshly collected sample of dog feces, which will provoke a different reaction than a snake glistening in his warm, humid tank. Although the truffles will be seen as pleasant, desirable, or tempting, the feces will most likely be considered disgusting and the snake terrifying.

These object-specific reactions might be the predictive force that reconciles the positivity-negativity dominance debate within motivated perception. People may see what they wish to see unless the alternative is an object that requires immediate attention in order to successfully navigate one's world. If an alligator lays waiting in the marsh as a boater takes her canoe out for a morning paddle, that boater might be best served by noticing, attending to, and correctly identifying the reptile so that she might take the actions necessary to stay out of harms way. Alternatively, disgusting objects are less likely to require immediate action. To successfully navigate a refrigerator that contains leftover rigatoni a la vodka 3-weeks past its prime, the hungry graduate student does not need to have her attention fixated upon the foil-covered takeout box. In fact, her appetite and intestinal track might be better served by her failure to notice the takeout box at all. Thus, people may wear rose-colored glasses while surveying their surroundings unless its contents contain objects that must be attended to in order to ensure safety and well-being.

In fact, disgust-induced blindness and fear-induced vigilance are supported by physiological differences in the body's reactions to these

two emotions. As measured by neuroendocrine stress responses, disgust lowers blood pressure and cortisol levels while fear increases blood pressure and cortisol (Lerner, Gonzalez, Dahl, Hariri, & Taylor, 2005). Arguably, increased blood pressure and the hormonal marker of stress, cortisol, suggest the body and the perceptual system is prepared to take action. These biological markers suggest that although both disgust and fear are aversive states of arousal, fear is a motivating force that promotes action and, we argue, engages the perceptual system, demanding processing resources. Increased blood pressure and stress hormones may be the proximal mechanism by which perceptual systems attend to the fear-inducing object over a less aversive possibility.

Final note

If the world is really seen through the heart's eye, perhaps Christopher Ray was correct to remind us that "perception is merely reality filtered through the prism of your soul." The submission of this statement certainly begs one to ask how much of the real world does one really know, how much is one really aware of? If the answers to these questions suggest a less accurate representation, then one must ask, to what extent does one view the world through the eyes of accuracy as opposed to rose-colored glasses?

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CHAPTER FIVE

THE FETTERS OF ONE'S DESIRES: A SYNOPSIS OF MOTIVATED PERCEPTION

There are times when one's view of the world is indistinct. In October 1995, African American Johnny Gammage drove a Jaguar sedan through a nearly all-white Pittsburgh suburb of Brentwood in Allegheny County, Pennsylvania. He was pulled over by 3 Caucasian police officers for allegedly driving erratically. During what the police report was a scuffle, Gammage was suffocated on the pavement through excessive force on his back and neck. The officers testified that they saw Gammage emerge from his vehicle carrying a gun. This item was later confirmed to be a cellular phone. After 2 mistrials all officers were acquitted (Jenkins, 1995).

In 1972, Eastern Air Lines Flight 401 prepared to land in Miami, Florida when the pilot and crew became distracted by a non-functioning gear light flashing on the control panel. While pre-occupied with fixing the light, the autopilot was inadvertently disengaged. The pilot and his fellow officers never noticed the plane approaching the ground or heard the alarm indicating as much. The crash killed 101 people (Gilmore, 1996; Herald Wire Services, 1985; Twigg, Castaneda, & Sharp, 1996).

These tragedies are difficult to accept because, among other reasons, it hard to understand how the police officers or the pilots could have seen the world so differently than what it really was. Assuming they honestly saw it as such, how was it possible for the officers to have mistaken the phone for a dangerous weapon? How

could the pilot and crew of Flight 401 not have noticed the ground as it quickly approached? How could the officers and the pilot have failed to accurately see what lay right before their eyes?

Within these chapters, I asked how perceptual systems make sense of the mixed, multiple, and ambiguous information and what strategies are employed to handle the wealth of information the world offers. I suggested that motivations are an integral variable in the formula for perceptual processing. Motivations offer solutions to visual ambiguity, filter and sort the onslaught of information, and allocate processing resources where they are most needed or most desired. In addition, I examined the consequences of motivated perception on self-regulation and goal pursuit. Finally, I investigated the perceptual tasks that are shaped by motivational forces.

In the sections that follow, I will summarize the line of research described in the previous chapters. In the second section, I will use these data to expand upon my discussion of the ability of motivations to leave their mark on a variety of tasks perceptual systems face. Although Chapter 4 was specifically designed to test whether motivations bias the deployment of attention, other data contained within these chapters suggest that motivations are implicated in several other perceptual tasks. In the third section, I will discuss the consequences of motivated perception as they relate to self-deception and self-regulation of psychological states. In addition, I will suggest motivated perception can be considered an adaptive strategy. I will suggest ways in which a seeming discrepancy between my work and negativity dominance can be reconciled through the consideration of

individual differences and situational circumstances. Finally, I will end by suggesting applications of motivated perception.

I. Summary of Chapters

In the previous chapters, I explored one general psychological state shown to have a profound influence on the ways people come to judge themselves, evaluate others, and navigate their social world. That influence is perceivers' motivational drive to see the world as they want to see it rather than how it actually is. I examined the scope of motivated reasoning to investigate whether the motive to see the world through rose-colored glasses percolates down from conscious judgment and decision-making to preconscious perceptual processing. In doing so, I offered evidence of times in which people see the world not how it is but how they hope it would be, suggested the consequences of motivated perception for self-regulation and goal-pursuit and investigated one possible mechanism by which they might accomplish this.

A. CHAPTER 2: SEE WHAT YOU WANT TO SEE: MOTIVATIONAL INFLUENCES ON VISUAL PERCEPTION

In this paper, I asked if perceivers' perceptual experiences could be molded, in part, by such psychological states as personal wishes and preferences. I examined if perceivers, when presented with ambiguous visual information, would reach a perceptual conclusion that allows them to see what they want to see. Across the studies presented in Chapter 2, I provided converging evidence to suggest that participants' desires, hopes, or wishful thinking led them to see information they desired over what they did not.

1. Overview

In all studies, participants knew they would perform either a desirable task such as consuming orange juice or an undesirable task such as drinking a gelatinous green slime labeled "organic veggie smoothie." Participants learned that their assignment would be determined by the specific stimulus that appeared on their computer screen. For all participants, I manipulated what category of stimuli would bring about the desired and undesired outcomes. Then, participants saw an ambiguous figure that could be interpreted as a member of both categories. I predicted and found that desire led perceivers to see the stimulus in the desired way.

Studies 1 and 2 demonstrated that participants interpreted an ambiguous visual stimulus in a manner that fit with their wishes and preferences over one that did not. In addition, Chapter 2 provided the first account of motivated perception that is void of a viable response selection alternative explanation. Studies 3 and 4 added implicit measures to eliminate the possibility that the bias resided at the level of response selection by using a hidden video camera to track gross eye movements without participants' awareness. A majority of the time, participants' first saccades suggested they interpreted the ambiguous figure in the favored manner rather than the disfavored one. In Study 4, I added measures of concept accessibility. Perceptual bias produced by desire led to quicker reactions in a lexical decision task to words consistent with a preferred interpretation of the ambiguous stimulus than to words consistent with the less preferred interpretation. This pattern was exaggerated for those performing a

lexical decision task after viewing the ambiguous stimulus suggesting that both desire to see an animal and having seen that stimulus in the desired way facilitated response times to words consistent with that desire.

Study 5 added a procedural variation to affirm that participants had not seen *both* interpretations and chose to report the one that brought about the favored outcome. After establishing desire and motivation, participants viewed an ambiguous stimulus, but then the experimenter switched which interpretation was the favored one before participants reported what they saw. Participants tended to report seeing the interpretation they favored at the time they viewed the stimulus, even though that report, after the switch, assigned them to a less desired task. Wishful thinking constrained interpretations before perceptual judgments were made. If it was the case that wishful thinking was involved at a post perceptual stage—after reaching an interpretation—then participants would have offered a response that ultimately assigned them to the desired task. Whatever work the perceptual system had done to bias their interpretation involved processes taking place before participants became aware of their perceptual judgment.

2. Addressing Alternative Explanations

Data contained within this chapter also speak against a number of alternative explanations. First, in Studies 2, 3, and 4, I ruled out the possibility that perceivers fell prey to the gambler's fallacy; expectations that a favored outcome was bound to show up after a string of disfavored ones was not responsible for producing the

observed effect. Second, in all studies, I controlled for salience. In these experiments, I paired both the favored and less favored interpretations with equally salient events such as drinking delicious orange juice and drinking a foul smelling and looking concoction.

3. Motivated Perception as a Self-Regulatory Strategy

Finally, although not the primary goal, this chapter suggests one reason why perception may lack veridicality. Over the decades, social, personality, clinical, and cognitive psychologists have chronicled the paths by which people distort information so that they can believe that they are good people who live in a kind world (for reviews, see Baumeister & Newman, 1994; Dunning, 2001; Kunda, 1990; Mele, 1997; Pittman, 1998). To accomplish this feat, it is imperative that people remain unaware of the distortions they place on their thinking. If they knew that they construed themselves in an unjustly positive manner simply because they wanted to believe it was true, they might also begin to suspect, at least in part, how illegitimate that thought was. If those motivated cognitive and perceptual processes did not take place preconsciously, before any content of perception and cognition reached consciousness, people could not remain blind to the motives underlying their flattering self-construals.

This type of self-deception requires that such self-serving biases remain outside of conscious awareness, monitoring, and control. One way in which these efforts towards positive beliefs may remain covert is through motivated perception. That is, motivations can sort, filter, and monitor incoming information before the information even reaches judgment and decision making faculties.

To summarize, people see the world as they wish to rather than how it really is. Nonconscious mechanisms such as this stay behind the scenes, filtering the world before the information reaches conscious awareness so that people can see things as they wish to rather than how they really are. This self-regulatory strategy, whether occurring in cognition or perception, allows people to think of and see the world favorably.

B. CHAPTER 3: COGNITIVE DISSONANCE AND THE PERCEPTION OF NATURAL ENVIRONMENTS

In Chapter 3, I explored another type of motivation that serves the goal of allowing people to feel better about themselves—namely the desire to reduce cognitive dissonance. In particular, I investigated if the motivation to reduce this specific type of psychological and mental turmoil can lead people to see their world in a way that allows them to alleviate distress. Specifically, I investigated whether the drive toward dissonance reduction can bias the way people perceive an element of their environment that they are interacting with at the time of experiencing dissonance.

Cognitive dissonance theory assumes a drive-like motivation to maintain consistency among relevant thoughts and actions (Festinger, 1957). Although it is well documented that when attitudes and actions contradict one another, a drive-like motivation is produced that aims to restore harmony by shifting beliefs to realign them with behavior. Most documented is the restoration of harmony via a change in judgments, decisions, or attitudes (Festinger & Carlsmith, 1959; Knox & Inkster, 1968; Sherman & Gorkin, 1980). In this research, I asked if

restoration of harmony could prove successful through shifting perceptions. That is, I asked if motivated perception could assist the goal to produce consistency in thought and action.

In order to successfully pursue goals, people need to regulate their internal states, physical actions, and stores of energy. To act efficiently in the world, one must ensure that the energy stores are plentiful enough to meet the goal. Of course, there are downstream consequences of such effort regulation and in particular on perceptual processing. For instance, the amount of effort a person must expend to complete an action influences their perception of the relevant environment. For example, Proffitt and colleagues (e.g., Bhalla & Proffitt, 1999) argued that as the effort required to complete some physical action increases, the perceptual system responds by portraying the environment as more challenging, presumably to guide the individual toward what actions to take (or to avoid) as well as how to execute those actions successfully. The distance one expects to walk seems longer after strapping on a heavy backpack (Proffitt, Stefanucci, Banton, & Epstein, 2003). Hills appear steeper when perceivers wear a backpack, are fatigued after a long run, suffer from low physical fitness, or are in poor health (Bhalla & Proffitt, 1999).

Chapter 3 explored how the goal to alleviate cognitive dissonance might be accomplished through biased perception. I investigated how a psychological goal that arises when people experience cognitive dissonance biases perception of natural environments.

1. Overview

In both of the studies discussed in Chapter 3, participants performed an aversive task. In Study 1, participants walked across a campus quadrangle while wearing a costume inspired by Carmen Miranda, the Brazilian singer, dancer, and actress of the 1940's and 50's invariably clad in a large fruit-basket headdress. In Study 2, participants knelt on an all-terrain skateboard and pushed themselves up a grassy hill. In each study, I manipulated participants' subjective feelings of choice about completing the task to be either high or low. Under high choice, people needed to resolve the dissonance caused by their voluntary agreement to perform an aversive action. Under low choice, dissonance was easily resolved because participants attributed their agreement to lack of choice (Linder, Cooper, & Jones, 1967). Participants resolved their dissonance in high choice conditions by altering their perception of the environment to make the task less aversive, relative to perceptions reported by low choice and control condition participants. In Study 1, high choice participants saw the distance they had to walk as shorter. In Study 2, they saw the hill as less steep. Taken together, these studies demonstrated that psychological motivations like cognitive dissonance reduction influenced perceptual processes. The goal to resolve psychological tension systematically biased perception of natural environments.

C. CHAPTER 4: DISTANCE AND THE FOND HEART—AN EXAMINATION OF HOW DESIRES BIAS DISTANCE PERCEPTION

Although the Chapters 2 and 3 provide evidence that perceptual experiences do not accurately represent reality, the process by which

motivation infiltrates perception is as of yet ill-defined. In Chapter 4, I proposed that perceptual systems are tuned to positive information. Although this might be the result of attentional biases, changing thresholds for detection, biased constraints, etc., I investigated one mechanism among what might be many routes to motivated perception. I proposed that motivations lead perceivers to narrowly focus their attention on positive information at the expense of comparatively less desired information. In addition, I examined the downstream consequences of such focused attention on other perceptual tasks such as estimating distances. I suspect that narrowly focusing attention on a desired object will draw it in closer decreasing perceptions of the distance that separates oneself from the desired object.

1. Overview

In these studies, participants estimated distances between themselves and an appealing or less appealing object. In Study 1A, participants estimated the distance to a plate of chocolates or a neutral object, while in Study 1B they did the same to either chocolates or dog feces. In Studies 2 and 4, I manipulated participants' visceral thirst by asking them to consume a large portion of dry, salty pretzels or to drink 4 8-ounce glasses of water then estimate the distance to a bottle of water. In Study 3, I captured people's naturally occurring state of hunger as they enter a dining hall in contrast or their sated state as they exited the hall after dinner and asked them to estimate distances to 2-slices of fresh cheese pizza or a control object. Across these studies, participants estimated that the

objective distance separating themselves from the more desired object was smaller than the distance to a less desired object.

2. Mechanism

Motivation influenced perception through attention. Study 4 provided initial evidence that a narrowed focus of attention on the desired object decreased perceptions of distance. Studies 5A and 5B used an experimental chain methodology (Spencer, Zanna, & Cooper, 2005) to further confirm that appeal led to decreased perceptions of distance. Study 5A argued that visceral states changed an object's appeal which narrowed the focus of attention to that object. Study 5B argued that when attention was manipulated to be narrowly focused on a toaster oven baking chocolate chip cookies rather than broadly focused on all the objects in the room, perceptions of distance to the cookies decreased. In short, perceivers tended to focus their attention on desired objects resulting in decreased perceptions of distance.

3. Addressing Alternative Explanations

In addition to offering demonstrations and testing a mechanism by which perceptions are biased, I addressed two alternative explanations. First, I accounted for the possibility that distances seemed shorter not because the object was desired but because perceivers held a stronger attitude towards it than they did of the other objects. Secondly, I addressed the role of arousal. A critic may argue that inducing a state of arousal in perceivers by, for instance, making them exceptionally thirsty, should lead to shorter distance estimates not just to the object of their desire such as a water bottle,

but to any object that was the focus of attention. My data argue against these alternatives.

II. Where Do Motivations Hide? Where Does the Bias Reside?

Given the multifaceted and multi-component process that precedes conscious perceptual experience, one issue that these chapters begin to explore is the variety of perceptual tasks that are subject to influence by motivational factors. These chapters suggest the possibility that the reach of motivations extends to many of the tasks perceptual systems must undertake. In the sections that follow, I will suggest and use the preceding chapters as support for the position that motivations are implicated in 3 perceptual tasks. First, motivations bias perception even before the visual system is engaged. Motivations establish filters that allow some information to enter into visual processing and exclude other information. Second, motivations can bias where attention is deployed as information streams in. Third, motivations bias the way in which visual information is processed once it is received but before conscious judgment and decision making faculties are made aware of it.

A. PREPERCEPTUAL FILTRATION

Motivations begin to exert an influence on perception very early on, even before perceptual input is presented to visual faculties. Higher order constraints, including psychological states and motivations, prepare perceptual systems to receive, process, and interpret information. In preparation for the wealth of perceptual information to come, motivations, as one strategy, activate filters

through which perceptual information will be sifted. Importantly, motivations activate filters before receiving visual input, therefore beginning to bias perception even before perceptual processing has data to work with.

The filters that motivations activate are often called sets. Sets can be distinguished by the type of information contained within them (see Balcetis & Dale, 2006). One type of set, perceptual set (Bruner & Minturn, 1955), is a form of filter that prepares perception by activating specific, related, directly relevant perceptual information immediately descriptive of upcoming visual stimuli. Consider taking a visit to the Dali Museum outside Barcelona. You happen upon a rather eccentric room complete with a plush sofa shaped like a pair of lips nestled close to a nostril-shaped fireplace. Now, only if you had just caught a re-release of *Sextette* featuring Mae West in her final silver screen performance would you see the items in this installation come together as the face of this actress. Empirical work confirms that previous experience with visual information will assist in future object identification tasks. For example, Leeper (1935) activated perceptual sets by showing participants with drawings of a young or old woman. These images established a perceptual set that served as a filter when subsequently shown an ambiguous drawing that could be seen as an old or young woman. Participants reported an interpretation that was congruent with their prior visual experience (see also Fisher, 1967).

Another type of set known as conceptual set contains incidental, loosely related information that is not perceptual in nature but that subtly guides the perceptual system. For instance, sipping a mai tai

while walking on the beach with a new romantic partner at sunset might make it more likely that you notice the pooled water in the sand taking on the shape of a heart or the clouds in the sky as puckered lips. Outside of these anecdotes oddly reminiscent of daytime soap operas, Balcetis and Dale (2003, 2006) argue that conceptual sets bias object identification. Resolution of the Necker cube was biased when participants imagined looking up a tall building, down a deep canyon, or across the Great Plains. Perceivers who imagined looking up a skyscraper were more likely than perceivers in either of the other two conditions to resolve the Necker cube in a manner that suggested they saw the figure from below just as would be the case if looking up a tall building.

Just as sets filter perception, Chapter 2 offered evidence that psychological states such as preferences or desires privileged one type of filter over another. That is, perceptual information was filtered by wishful thinking as perceivers tended to interpret ambiguous visual information in a way that was consistent with the desired set. Specifically, reaction times during a lexical decision task just before participants viewed the ambiguous figure suggested that such desires activated a set of information related to a favored animal category. Participants provided quicker reaction times to words associated with the favored outcome than they did to words associated with the less favored one. This pattern suggests that a set was activated even before perceptual systems were exposed to the target object.

Although evidence that desires activated sets that filtered perception and biased resolution of ambiguity, it is not clear whether

desires activated a perceptual or conceptual set or both. That is, these data cannot attest to the level of specificity or content in the activated set. Anecdotal information supports the activation of perceptual set. In debriefing, one participant described her experience as follows: *"I kept getting +5 and –5 over and over, making me worry about eating the beans. At the last minute, I was sure I would have to eat the heinous beans and I prayed for the horse to give me a +5. I got it! Yes!"* Her statement suggests that perhaps participants in these studies activated perceptual sets. This participant may have been looking for the snout of a horse, the pointy ears, or the cute tail. The content of the activated set or filter was feature-based, specific, and directly related to the upcoming ambiguous figure.

However, in other studies within Chapter 2, I did not offer participants specific hints about what piece of visual information was indicative of a favorable outcome. Instead, participants knew only that farm animals foretold a pleasant future task. That is, I created situations in which perceivers could only activate broad categories (e.g., farm animal). Wishful thinking, in this case, activated sets that that were composed of many features. This broad and diffuse set of features would have been much too large to enact a specific and efficient feature search strategy to bias perception. Perceptual filters inspired by motivation can be quite diffuse and nonspecific. Whether divine intervention is required is still an empirical question.

In Chapter 2, I manipulated the breadth of the filter. Desires systematically biased ambiguity resolution through the activation of sets. Although this work did not address whether perceptual or

conceptual sets were activated, future work might explore through which type of set motivations resolve perceptual ambiguity.

B. ATTENTION

The second possible point in perceptual processing at which motivations filter information is after processing has begun. Motivations filter the stream of perceptual information as it trickles in. Specifically, motivations determine where attention will be deployed, what part of the perceptual stream the visual system will fixate on, and where it will fixate next. After an initial scan of the environment, motivations direct attention to certain elements of the environment at the expense of others, a process called selective attention (Posner & Petersen, 1990; Yantis, 1996).

One metaphor that has proved useful, although not comprehensive, in describing the role of attention suggests attention is a spotlight. Attention can act like a spotlight illuminating the visual field, casting light on items and events that happen to fall within its beam (Humphreys & Bruce, 1989). Perhaps, motivations direct the beam of the attentional spotlight to desired items or objects that might fulfill a need.

In contrast to the attentional spotlight with its "fixed aperture" (Humphreys & Bruce, 1989), an additional metaphor describes attention as the iris of a "zoom lens" that can be narrowly focused or quite expanded (Eriksen & St. James, 1986). A zoom lens on a camera can produce a richer image of a narrowly defined space as the photographer zooms in, but can include more square footage in the image as he zooms out. Therefore, there is a trade-off: attention can be

held with a wide angle but poor resolution of detail, or attention can be zoomed in on a part of the scene to improve the resolution. Just as is required of a photographer, attention must find an appropriate balance between richness of representation and expansiveness of coverage.

In support of the zoom lens model of attention, recent neurological evidence confirms the tradeoff between richness of representation and expansiveness of coverage. When perceivers narrow their attention to a smaller visual surface area, the cortical surface area responsible for processing this information decreases even in regions as primary as V1, but the proportional amount of activation in each of these early processing areas increases (Muller, Bartelt, Donner, Villringer, & Brandt, 2003). However, when attention is diffusely spread, the amount of surface area in early visual cortex used to process the scene increases, while the amount of activation in each area is proportionally less. Thus, there is a neurological tradeoff between richness of representation as measured by the strength of activation per unit of cortical area and the expansiveness of coverage as measured by the amount of cortical surface area activated.

Chapter 4 explored attention as a mechanism for motivated perception. I proposed that desires acted like the operator of the attentional spotlight directing attention to favorable, flattering, or positive elements of the environment. Then, like the zoom lens on a camera, desires narrowly focused attention on the object of desire at the expense of other objects in the environment. I explored the downstream consequences of this attentional focus on distance

perception. Specifically, I demonstrated that desires bias how much distance perceivers feel the world has placed between them and desired objects.

I tested attention as the mediating force between desires and distance perception. Desires focused attention on the object of desire and narrowed the scope of the attentional beam, at the expense of attention to peripheral objects. Desire narrowed attention, leading to a focus on fewer items and only the most important central, rather than peripheral, items in the environment. Narrowly focusing attention on a desired object made that object loom large which drew it in closer. Using an "experimental chain" methodology (Spencer, Zanna, & Fong, 2005), I first confirmed that desires led to changes in the ratings of an object's appeal which narrowed the focus of attention on that object. Secondly, a manipulation that narrowed the focus of attention decreased perceptions of distance.

Chapter 4 proposed attention as one among what might be many possible mechanisms behind motivated perception. In doing so, I argued that in the theater of perceptual processing, motivations act as a stagehand directing the attentional spotlight to desired objects then adjusting the beam onto just those objects.

C. MOTIVATED VISUAL INFORMATION PROCESSING

In this section I will discuss how psychological states and motivations infiltrate perception at later points of processing by biasing the manner in which perceptual information is processed after it is perceived. Indeed, even when all features of an object have fallen upon the retina and the visual system has taken in all a scene has to

offer, motivations still bias perception through the allocation of resources devoted to making sense of this input. This I call motivated visual information processing.

People are motivated to come to a desired conclusion (see Kunda, 1990 for review), and the ways in which they process information come to reflect this bias. This is no less true in perception. Kunda's (1990) theory of motivated reasoning posits that "people rely on cognitive processes and representations to arrive at their desired conclusions, but motivation plays a role in determining which of these will be used on a given occasion" (Kunda, 1990, p. 480). I suggest modifying this statement regarding social judgments to reflect a similar bias in perceptual judgments. Motivations may play a role in determining the type and amount of perceptual processing that will be allocated to perceptual information consistent or inconsistent with the motivation.

In order to arrive at the preferred perceptual outcome, perceivers might hold information to different levels of scrutiny. Other work in motivated reasoning has shown that information consistent with a favored conclusion is held to a lower standard of scrutiny than information consistent with an unwanted one (Dawson, Gilovich, & Regan, 2002; Ditto & Lopez, 1992; Trope & Ferguson, 2001). The standards applied when determining the validity of a piece of information vary depending on the type of information that is under consideration. For instance, motivation influences skepticism. People are less critical of information that supports a desired or existing belief (Ditto & Lopez, 1992). That is, they are more likely to accept positive

information without question, while they seek more evidence before accepting a conclusion that is inconsistent with prior beliefs (Ditto & Lopez, 1992).

In the same way that skepticism is dependent upon the motivation to accept a piece of information, motivated skepticism might influence the manner in which visual information is processed. Differential standards are applied to the amount or quality of information offered as evidence for a particular conclusion. Similarly, motivations might lower the threshold a feature must reach before the visual system allows it into consciousness. It could be then that desired components of the environment are recognized faster or more easily because the perceiver requires less of a match between what he or she hopes to see and what is offered by the environment.

It is plausible that wishful thinking contributed to visual ambiguity resolution (see Chapter 2) through differential standards and changing thresholds for detection. For instance, perceivers may have evaluated the ambiguous figure with a sufficiency mindset when attempting to identify the stimulus as a member of the desired class. Automatically and unconsciously, perceivers may have asked themselves if the features they saw were sufficient to warrant identification of the stimulus as the desired object. However, if having to entertain the possibility that the stimulus was a member of the less desired class, perceivers may have automatically and nonconsciously asked themselves if the information offered fully satisfies the components necessary to be identified as such. Thus, visual

information consistent with desired and less desired outcomes might be held to different standards of scrutiny.

Future work might examine the amount of tolerance a visual system withstands for blurred, vague, or imprecise objects or the clarity, precision, and accuracy the system requires to identify more and less desirable objects. I would predict that these standards for clarity would vary with desire and the ability of the object in question to satisfy the desire.

In addition, future work might examine the speed at which desired and less desired objects are identified. Of course, the original New Look researchers proposed this same investigation yet were unable to firmly conclude that thresholds for detection depended upon desirability of the target object (Erdelyi, 1974; Eriksen, 1963; Eriksen & Browne, 1956; Spence, 1967). Specifically, they could not disentangle changing perceptual thresholds from response biases. For instance, it is difficult to know whether taboo words took longer to recognize because of their negative nature (assuming researchers controlled for frequency) or because perceivers were reluctant to report that they had seen such a word (Chapman & Feather, 1972; Dulany, 1957; Howes & Solomon, 1950; Levy 1958).

To overcome this methodological issue, future research might employ nonconscious measures of perception or create situations where perceivers would not know that the dependent measure of interest actually reflected their perceptual experience. Inattentional blindness paradigms (Downing, Bray, Rogers, & Childs, 2003; Mack & Rock, 1998) allow researchers to test changing thresholds for detection

in a manner that eliminates issues of response bias and the possible contribution of attention. One could create a situation where participants will soon complete either a pleasant task or a less desirable task. In this paradigm, participants learn that if the computer displays one type of object, they will complete the pleasant task, but if it displays a different type of object, they will complete the less desirable one. Before completing the assignment process, participants complete what is ostensibly a visual acuity test. In this acuity test, participants fixate on a point before a cross appears on the screen for approximately 200 msec. Participants indicate whether the vertical or horizontal line of the cross was longer.

After several practice rounds of this task, the critical trial appears. During the critical trial, an item appears in one of the quadrants created by the cross and is immediately masked with an image suggesting the computer crashed. Following the crash, participants are asked if anything unusual appeared on the screen before the crash. If the object in a quadrant happened to be one previously established as the upcoming desired object, I would predict that participants would be more likely to have seen it and be able to report its presence. However, if the object was a less desired one, participants would be less likely to have seen it and less likely to be able to report it.

Because participants are attending to the arm length evaluation task and are not expecting either the desirable or less desirable object to appear during the critical trial, this paradigm, as argued by Mack and Rock (1998), eliminates the possible contribution of attention.

Participants are engaged in the secondary task, which focuses them on the center of the screen. The object, whether present or not and regardless of quadrant location should be equally salient to perceivers outside of this manipulation. In addition, because participants are not expecting the visual acuity task to be the circumstances by which they will be assigned to either task, they should be equally comfortable with offering a response that reflects either a desired or less desired outcome. This paradigm demonstrates preattentive perceptual filtration which is a measure of changing thresholds for detection. It measures differences in the sensitivity to detect positive and negative visual information that overcomes issues of response bias and attention.

D. SUMMARY

Motivations leave their mark on several perceptual tasks. First, motivations bias perception during pre-perception. Visual faculties may not even pick up information inconsistent with a hot motivational state. Secondly, motivations bias perception by changing where attention is deployed. In particular, motivations activate perceptual and conceptual sets that filter perceptual information before the visual system receives input. Once the visual system is exposed to an array of information, the attentional spotlight or zoom lens can differentially

focus processing resources on different elements. Finally, motivations are implicated in visual information processing.

In support of this 3-part proposition, Balcetis and Dale (2006) demonstrated that higher order constraints activate perceptual and conceptual sets that filter perceptual information. Chapter 2 takes the first step beyond this general claim to argue that motivations are one such higher order constraint. Chapter 4 provides extensive evidence arguing that motivations bias what information receives attentional resources; desired objects are attended to and narrowly focused on. Finally, motivations bias perceptual information processing. Preliminary evidence within Chapter 2 suggests that preferred visual stimuli are held to different levels of scrutiny than less preferred stimuli. Motivations are implicated continuously throughout many perceptual tasks that are required of the system.

E. ADDENDUM: PARRALLEL PROCESSING OF PERCEPTUAL TASKS AND IMPLICATIONS OF SUCH

I have proposed specific points in time and means by which motivations are tied to perception. I fear that, in doing so, I have inadvertently suggested that motivations call upon or are themselves bounded or static, symbolic entities. I suggested that wishful thinking activates perceptual sets with a highly specified membership. Certainly, it is common in addition to pragmatically useful to use discretely bounded, mental contents when describing the ways in which perception is biased. For instance, suggesting that features of a horse are activated and serve as a perceptual filter before the visual system is presented with an ambiguous image is easier (at least to me)

than discussing how normalized recurrence models might use a temporally synchronized overlapping, probabilistic, distributed representation or population code to explain perceptual bias. Unfortunately, the convenient description, and the one I chose to employ throughout these chapters, simplifies the process of reaching a perceptual conclusion.

Although I posited 3 perceptual processing tasks molded by motivations, this is not to say that I espouse the conception of perception as a factory line, assembly construction process where one function must be completed before the next can begin. Instead, it is important to acknowledge that these 3 tasks, among many other component parts to perception, are called upon simultaneously to assist in perceptual processing. There is no linear progression from one distinct stage to the next, no distinct and rigid temporal order of tasks. Filters are not engaged strictly only before input is received. Biased processing does not begin only after the environment finishes offering relevant input. Behavioral action plans are not engaged only after a perceptual conclusion has been reached. Instead, perceptual processing requires the concurrent interaction of several tasks. Motivations activate filters, sort the perceptual stream, direct attention, and construct perceptual thresholds continuously and simultaneously as time passes. Although the outcome of perceptual processes might be quite discrete (i.e. defining a visual stimulus as a horse), the patterns of perceptual organization that emerge over the course of processing and the mechanisms responsible for reaching a perceptual conclusion fluctuate and are rarely static.

There are, in fact, several analogs attesting to the dynamic and parallel nature of the component processes that comprise perception. For instance, in spoken word recognition, the individual parts of a word (the phonemes) are heard more or less one at a time. Therefore, even apparently unambiguous words, like *candle*, are temporarily ambiguous as they are spoken over the course of 500 msec (Marslen-Wilson, 1987; Marslen-Wilson & Welsh, 1978). Just as with completely ambiguous words, this temporary ambiguity leads to the concurrent activation of competing responses. That is, after a listener hears only the first phoneme, *can*, it is relatively a toss up when taken out of context whether the word will be *candle* or *candy*.

Consider a situation when a participant is instructed to click on the candle that appears within an array of objects on a computer screen that includes both a candle and a piece of candy. Spivey, Grosjean, and Knoblich (2005) recorded the x,y coordinates of the trajectories of participants' mouse movements when attempting this task. Interestingly, participants' movements often reflected the partial activation of the competitor object, candy. Participants' movements were directed slightly towards the competitor, candy, even as participants attempted to move directly to the candle. This evidence suggests that competing resolutions of the lexical ambiguity are simultaneously active as a spoken word is being heard. In addition, arm movements reflected the ambiguity and dynamic process of resolution.

As another point of clarification, the mechanisms by which perceptual input is organized are, in part, directed and orchestrated by

what information the environment offers to perceptual faculties. In other words, the relationship between higher-order influences and lower-level data is mutually constraining and interactive. Although most of my discussion implies a top-down filtration process where higher order constraints direct the processing of lower-order information, the system should generally be construed in a less hierarchical manner. Just as these tools of perceptual filtration influence the perceptual product, raw perceptual data will mutually constrain the types of tools perceptual systems can use. In the most extreme case, a perceiver can hope, wish, long for, and squint as much as he likes, but he has few tools available that will allow him to see a white square as, instead, a black circle. Just as filters bias processing of the input, the input will direct what filters can be called upon in processing.

In fact, the mutually constraining and parallel-processing interaction among perception, cognition, and behavior solves a problem that contributed to the defeat of the original New Look theorists. The traditional conception of perception as a linear series of stages posed a serious and ironic dilemma for New Look theorists—the mechanisms underlying perceptual defense required that an object first be perceived before motivational filters could defend against it. That is, by the time motivational forces knew that the object in question came with baggage or that it was consequential to the organism, the steps to achieve identification had already been taken. The object had already been perceived. Thus, perceptual defense must not have been perceptual at all. However, if motivational forces along

with many other higher and lower order constraints work in tandem, in parallel, to produce a perceptual conclusion, then perceptual defense mechanisms, as posited by the original New Look researchers, in addition to many other forms of motivated perception described in this work can indeed be perceptual biases.

So then, why might I have digested perception to focus on component processes if doing so creates the illusion that each component is an isolated stage? Well, I distinctly chose to break the big picture of perception into smaller, bite-sized chunks. I tested proximal, rather than distal or large scale, mechanisms that interface motivation and perception. However, this is far from the end of the line for motivated perception researchers. By establishing a clear and tight understanding of the proximal mechanisms underlying motivated perception, researchers will create a firm foundation for and have at their disposal solid materials to build a larger model of Perception—with a capital P. The goal, then, is to eventually offer a complete picture of the mutually constraining, dynamic process that includes filtration, motivated direction and expansiveness of attention, and information processing among many other component processes that work together to reach a perceptual conclusion and promote action.

III. Consequences of Motivated Perception

Throughout this work, I argue that people see the world as they wish to rather than how it really is. In this section, I explore the consequences of seeing the world in this way. Motivated perception allows people to self-regulate by first serving to alleviate psychological distress associated with cognitive dissonance. Second, motivated

perception serves an adaptive function assisting motor and perceptual systems in obtaining objects that can satisfy desires.

A. MOTIVATED PERCEPTION ALLEVIATES PSYCHOLOGICAL DISTRESS

A dieter standing outside a Parisian pastry shop eyes a fresh pain au chocolat begging to be removed from its delicate lace placemat. A financially strapped, infomercial addict sees the Sweep 'N Mop spokesman offering the limited time buy-one-get-one free offer if only she would call now. An old friend begs the graduate student trying to finish her dissertation to meet in a few weeks in Venice and go sailing in the Mediterranean. In each case, the circumstances these actors find themselves in pull him or her further away from achieving an important goal such as maintaining a healthy diet, a balanced budget, or a schedule for finishing up her degree.

People frequently encounter temptations that lead them away from achieving an important goal. Given that the experience of such deterrents is common, an enduring interest is understanding how people deal with conflicting goals and competing interests. One prevailing explanation suggests that a self-regulatory system assists in efficiently handling temptations, managing goals, and guiding behaviors toward desired means. This system regulates internal states, prioritizes goals, and directs behavior in order to achieve beneficial ends.

Chapter 3 explored a specific facet of the self-regulatory system. In particular, the self-regulatory system might assist in achieving a common goal to avoid psychological distress and mental turmoil. To

accomplish this, the self-regulatory system might use motivated perception as a means to arriving at a happy mental space. Just as people need to regulate their efforts towards maintaining a diet, spending habits to remain fiscally responsible, and daydreams about a vacation in order to remain focused on writing a dissertation, a similar regulation of action, intention, and thought is called upon when experiencing the aversive state of cognitive dissonance. Chapter 3 found that self-regulation extended down to visual perception, using motivated perception as a means to reducing dissonance. I argued that when perceivers found themselves in a distressing situation caused by dissonance, the regulatory system called upon motivations to bias perception in an effort to diminish the distress. In Study 1, participants experiencing dissonance saw the distance they had to walk as shorter than those not experiencing it. In Study 2, they saw the hill as less steep. Participants saw their environments in less extreme ways in order to cope with the distance they chose to walk in an embarrassing costume or the difficulty of ascending a hill in an embarrassing manner. That is, motivated perception is a means toward self-regulation and the eventual achievement of the goal to avoid psychological distress.

Taken together, these studies demonstrated that motivational pressures, including higher-order, intrapsychic motivations like cognitive dissonance reduction, influenced perceptual processes. When perceptual experiences of the world are malleable, when perceivers can push around the perceptual conclusion they reach, perceivers can take advantage of that fact to help them feel better,

reconcile unease, and settle mental unrest that might arise from a contradiction between action and belief. This paper argues that people see the world the way they want to see it in order to self-regulate, to feel good about themselves, their choices, and the world around them.

Motivated perception is a byproduct of a broad-reaching self-regulation mechanism. This self-regulatory strategy allows people to think of the world as benevolent, charitable, and one in which it is possible to accomplish psychological and physical goals and satisfy wants. Importantly motivated perceptions works within the preconscious so that this goal is not undermined by the realization that this benevolent world is a perceptual illusion. Motivated perception exists to hide the fact that people distort information with the goal to maintain rosy views of the self and of the world. In sum, this work offers that a motivated perception exists to assist in self-regulation of physiological and physical states.

B. MOTIVATED PERCEPTION ASSISTS IN GOAL PURSUIT

A second consequence of motivated perception is that it assists in goal pursuit. It tricks the perceptual system in order to facilitate actions meant to acquire a needed or desired object, and in doing so, motivated perceptual trickery serves an adaptive function. When motivated to satisfy a need, it would be wise for an organism to ensure that the resources required to satisfy that need are plentiful. Motivations might serve to regulate perceptions and behaviors to accomplish this adaptive goal. So that an organism feels that the resources available are sufficient to undertake the task of reaching the desired object (see Chapter 4), desires might refuel the system

providing energies to encourage action towards the favored object. If motivations energize the system or at minimum lead an object to appear closer than it otherwise would, motivations might encourage the system to take on the task of approaching the object. If the distance appears reachable, then the organism may be less reluctant to use its resources to take on the approach goal. If, however, the object seems too far away, the organism may be less likely to expend the resources in attempts to reach it. Thus, motivations might lead the perceptual system into seeing a desired object as closer than it really is, thus encouraging behaviors meant to acquire that object.

C. SUMMARY

One consequence of motivated perception is that the mind and body's ability to pursue goals effectively, be they psychological or physical, increases. These data argues that motivated perception assists in alleviating psychological distress and serves an adaptive function during goal pursuit. To accomplish these goals, people must be blind to the work that goes on behind the scenes and outside of awareness. Thus, motivated perception filters information outside of awareness. Motivated perception produces a distorted view of the world that results in improved psychological states and increases the effectiveness of goal pursuit.

IV. BLACK-TINTED AND ROSE-COLORED GLASSES: RECONCILING NEGATIVITY BIAS AND WISHFUL THINKING

Although the bulk of this work argues that people see the world as they want to see it, this certainly is not an accurate statement in all circumstances and across all populations. Rather, some people are

motivated to avoid harm, defend themselves against danger, and prepare for the worst-case scenario. To do so, these people are less interested in achieving or acquiring positive rewards and are more concerned with preventing the acquisition of negative outcomes. Although these people maintain a chronic orientation that precludes the dominating influence of wishful thinking, the perceptual bias they experience is still the result of motivational pressures. These individual differences in combination with situational pressures lead to the predominance of an alternative motivational goal.

This section will suggest a solution to the seeming discrepancy between positivity and negativity biases. I will discuss both chronic and temporary individual differences that predict negativity dominance in perceptual bias. Likewise, I will discuss situational circumstances that prescribe the content of the perceptual bias. For instance, I will suggest that the consequences of misperception will implicate either a positivity or negativity bias. The controllability of the outcome a perceiver experiences, the degree of ambiguity in the visual information, and the immediacy of required action also predict the color of the glasses perceivers wear.

A. DEFINING NEGATIVITY BIAS

Paul Rozin and Edward Royzman (2001) ask their readers to consider one of the most delicious meals ever presented before them. Then, imagine a cockroach sauntering across it. Much to the readers' chagrin, that delicious meal is now rendered completely inedible. However, the inverse phenomenon is completely implausible. A pile of cockroaches on a platter will never become edible regardless of the

amount of caviar, triple cream Brie, or dark chocolate placed on top. The asymmetrical dominance of this type of contamination offers a striking demonstration of a general principle called negativity bias. Negative events can be more salient and potent than positive events.

Threatening information commands more attention because of the asymmetry between the psychological impact of negative events and objectively equivalent positive events. For instance, when participants scan a collection of faces of the same person with the goal of identifying the one discrepant facial expression, participants do so the quickest when the target face is angry rather than happy (Hansen & Hansen, 1988). In addition, reaction times for naming the colors of words in a Stroop test are longer for undesirable than desirable trait words, suggesting an attention-grabbing power for negative social information (Pratto & John, 1991).

Negative events are more potent than positive ones, and this potency can manifest itself in several ways. First, even if experiencing events of equal objective magnitude, negative events are hedonically more potent than positive events. For instance, a seller might demand significantly more money for a ticket to one of basketball's March Madness Final Four games than a buyer is willing to pay. A seller who, in essence, loses that sporting experience feels more of a hedonic shift than a buyer who gains it. Secondly, the combination of events of equal but opposite subjective valence will not equal the same absolute value. For instance, the hedonic impact of losing $100 might be equal to winning no less than $150. Beyond self-reported emotional states, the asymmetrical impact of negativity is marked by greater

physiological arousal to negative events than positive events, and negative stressors impact health more than do equivalent positive experiences (Taylor, 1991).

B. INDIVIDUAL DIFFERENCES THAT PREDICT NEGATIVITY BIAS

Certainly, people do not always see the world how they wish to. Indeed, certain situations and certain psychological states lead a perceiver to see what is feared or dreaded. In the sections that follow, I will describe how chronic ruminations, personality characteristics, and temporary goals lead perceivers to the dark side of perceptual experience and attenuate the tendency to see the world favorably.

1. Chronic Traits

Personal dispositions reflect a chronic activation of a set of traits. A person who is dispositionally happy often entertains cheerful thoughts, acts in ways that promote his own happiness and usually the happiness of others, and generally goes about his day singing a jolly tune. However, a person experiencing paranoia often goes about her day with a sense of dread, a fear that the worst is just about to happen. Beyond thought and action, chronic traits can impinge upon the way people literally perceive the contents of their surroundings. In the sections that follow, I explore specific types of individuals who might more closely resemble the paranoid character. Although most people might consider themselves happy or at least aspire to that description, there are a great many who simply are not. I argue that the people who, for example, feel the world is out to get them might literally be more likely to see the bad in the world. In addition, people who maintain an excessive concern with their body image often hold

vastly exaggerated self-views that rarely reflect the actual shape and size of their body. I explore these types of chronic dispositions and their effect on perception. Additionally, I explore how these perceptual differences change over the course of the lifespan.

a. Anxiety and fear. People prone to anxiety often fear that the worst is about to happen. Anxious people think the cloud overhead will soon rupture when umbrella-less or the doctor is bound to say the spots are adult chicken pox rather than the remnants of a mosquito infested campout. In other words, anxiety leads people to think the worst. In addition, anxiety can similarly lead people to literally see the worst. Anxious populations pay particular attention to negative or threatening visual information (Mogg, Millar, & Bradley, 2000; Williams, Watts, MacLeod, & Mathews, 1997; Yovel & Mineka, 2005). Social phobics' attention is capture by information signaling social threats. Social phobics show an attentional bias toward heart-rate information, an internal cue for feelings of threat (Pineles & Mineka, 2005). Patients coping with psoriasis demonstrated an attentional-bias in a modified Stroop task for disease-specific words (Fortune, Richards, Corrin, Taylor, Griffiths, & Main, 2003).

To be sure, chronic positive personality traits bias perceptual processes. Optimists, for example, maintain an attentional preference for positive information in an emotional Stroop task (Segerstrom, 2001). Optimists maintain an avoidance orientation towards negative information as they look less frequently from the very first trial at cancer images, even when the information could be self-relevant

(Isaacowitz, 2005). Personality traits and general orientation perceivers chronically hold from one day to the next guide perceptual processing.

b. Body image. When people look at their reflection in the mirror, perceptual experiences are rarely veridical, and in fact are more negative than reality warrants. Individuals who are preoccupied with body size and shape generally see themselves as larger than they really are and do so automatically and without awareness (Williamson, 1996). The picture in our mind of how our body appears is formed and more importantly disturbed, by perceptual, attitudinal, and behavioral input (Williamson, 1990). In fact, emotion and stress exacerbate discrepancies between perceived and actual body size (Baker, Williamson, & Sylve, 1995; Kulbartz, Florin, & Pook, 1999; McKenzie, Williamson, & Cubic, 1993; Slade, 1985). Negative mood leads to even greater overestimations of current body size by women with bulimia nervosa (Kulbartz, et al., 1999). People who ruminate over body image differentially attend to and remember body-related stimuli, thus perpetuating dissatisfaction with their body size (Baker, et al., 1995; Sebastian, Williamson, & Blouin, 1996; Watkins, Martin, Muller, & Day, 1995). Further, individuals judge ambiguous situations or stimuli in a manner congruent with their negative self-perceptions of body image (Jackman, Williamson, Netemeyer, & Anderson, 1996).

An additional danger of such erroneous self-perception is the consequences for self-representation and body satisfaction. Consistently looking in the mirror and distorting self-perceptions might lead to the formation of chronic representations of oneself that are harsher than is actually the case. In addition to forming inaccurate

representations of the self, people generally hold representations of the general public that are extreme caricatures of reality (Johnson & Tassinary, 2006). When examining a line up of figures whose waist to hip ratio is systematically varied along a continuum, what participants considered prototypical of male and female bodies were physically implausible shapes even nature cannot create.

Unfortunately, these extreme external standards are used as a point against which (inaccurate) representations of oneself are evaluated. In fact, basic perception of personal body size correlates with the extremity of the representation one holds for female bodies. Women who hold an extreme caricature of the prototypical woman perceive their bodies to be bigger than women who hold more moderate and accurate representations. However, after exposing women to pictures of the actual prototype of the average woman, basic perceptions of their bodies became more accurate in comparison to women exposed to the extreme prototype. This suggests that exposure to caricatured sex prototypes misleads basic self-perception, quite literally making self-perceptions of personal body size appear larger than is objectively warranted. Perhaps fearing that one's body does not conform to the norm, however misinformed one is about that norm, actually leads a person to literally see his or her body as a different size than it actually is which increases dissatisfaction with one's body.

c. Age and time perspective. Individuals maintain an intricate set of goals that are chronically pursued, guide action, and suggest approaches to life. The set of goals an individual pursues throughout the course of his or her life biases the way in which people take in

information about their world and influences the way in which perceivers process the information once they receive it. Although chronically activated, goals can evolve as situational pressures grow or as time passes.

One constraint known to have a profound impact on the evolution of goals is age, or more specifically one's stage in life otherwise called time perspective. In particular, socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999) posits that with increasing age, goal hierarchies are reorganized such that goals toward emotional satisfaction are prioritized over goals that maximize long-term payoffs. When time is perceived as open-ended as is often the case for younger, healthy adults, goals of gathering and expanding one's knowledge base and experiencing novelty weigh heavily.

However, as people approach the end of life because of age or terminal illness (Carstensen & Fredrickson, 1998), goals associated with emotional meaning and well-being increase in salience whereas goals associated with acquiring knowledge for future use decrease. It is less pivotal for aging adults to accumulate stores of information as the goals emphasizing feeling states and goals to maintain satisfying relationships meant to optimize well being becomes increasingly important. To illustrate, younger adults are more likely to chose to interact with social partners offer new information, such as a book author, whereas older adults are more likely to chose social partners likely to satisfy emotional goals, such as close friends or family members (Fredrickson & Carstensen, 1990).

People can self-regulate and prioritize these emotional and

informational goals at a very preliminary point in processing. In particular, regulation can occur at the very point at which people are exposed to information that might assist or derail the pursuit of these informational or emotional goals. Older adults were slower to react to negative faces than neutral faces, and faster to respond to positive faces rather than neutral ones. By contrast, younger adults did not show any biases for the faces. Eye-tracking measures argue that both younger and older adults glance initially at the negative picture. However, younger adults in comparison to older adults looked longer at the negative pictures. According to the theory, the biased manner in which adults at various stages in life process perceptual information is a result of the motivation to pursue two very different types of goals. The focus on emotional goals among older adults leads them to favor positive and avoid attending to and processing negative information. Thus, the goal to pursue fulfilling, meaningful social and emotional relationships leads to biased processing of the surrounding environment.

As time perspective decreases, people spend less time attending to negative information. That is, older adults seem to have their attention initially captured by negative information just as do younger adults, but they quickly look away and are less likely to look back to that negative information. Given this propensity, it is plausible that older adults may interpret ambiguous information in a favorable light, seeing information with more than one interpretation as offering a favorable perceptual solution. This may be particularly true when one possible construal is emotionally consequential. An older adult may

resolve ambiguity positively if that positive result is suggestive of emotional bonds.

Alternatively, given the complexity of the surrounding world, it is quite possible that in some situations information highly relevant to a focal goal such as emotional fulfillment is present in close proximity to negative information. Time perspective might predict the strength of the attentional bias towards that goal relevant information. For example, the speed with which a perceiver's gaze comes to land on the goal-relevant information may correlate negatively with age. First saccades may be less likely to fall upon negative information. In addition, time perspective might predict the amount of temptation the visual system experiences. That is, as age increases, the number of switches from positive, goal-relevant information to negative information may decrease.

The existing literature argues that time perspective interacts with goals leading to attentional biases in visual processing. However, the boundary conditions that establish the limitations of goal-directed perceptual biases are as of yet unknown. Establishing these conditions will offer insight into the malleability of perception more generally. For instance, examining the types of information that emotional or information goals activate can suggest the influence of set on pre-perceptual processes. In addition, adding to the existing literature on goal-based attentional biases such as those offered by socioemotional selectivity theory can suggest how goals serve to filter perception and amend perceptual judgments that occur at later levels of processing. Thus, using time perspective as a context in which to examine

perceptual biases can add to the general understanding of the penetrability of perception.

2. Temporary Goals

Perception assumes a powerful position in the self-regulation of goals. In order to accomplish goals, one must efficiently detect elements of environments that are goal-relevant and can assist in satisfying the need. Just as important, though, is the ability to detect pitfalls, temptations, or features of the environment that are detrimental to a particular goal. Thus, because successful regulation of one's personal goals relies in part upon the way in which the environment is scanned and the elements of the environment that are attended to, perception is often biased by the goals a perceiver holds. Successful goal pursuit depends on how good a perceiver is at finding elements of the environment that assist in goal pursuit and avoiding elements that hinder goal pursuit. That is to say, effectively managing and attaining goals requires more than just ambition but a set of cognitive and motivational tools that serve as filters to the visual world. However, goals do not always lead perceivers to see what they desire but lead perceivers to see information congruent with their negative aversive need state they seek to alleviate. Perceivers see not only what can pull them closer to a goal, but also those less helpful elements that push them further away.

a. Self-regulation to fulfill needs. Motivations, objectives, and goals direct attention, ultimately serving a functional role in the accomplishment and regulation of goals. However, working in concert with goal pursuit, are influences on perception that may not assist in

the satisfaction of goals. For instance, the goal to satisfy one's thirst arises because one is thirsty. Thus, the deprived state of thirst is also accessible and exerts an influence on perception. At the same time that a thirsty perceiver scours the environment with the hopes of finding a bottle of water, the deprivation state pushes the perceptual system to find objects descriptive of that need state such as a cactus.

In fact, Balcetis and Ferguson (in prep) demonstrated that both the goal to satisfy thirst and the actual need state direct visual attention to different objects in the environment. After eating a serving of dry, salty pretzels constituting over 30% of their daily serving of sodium, thirsty participants were more likely to notice, remember, and freely recall objects that would satisfy their thirst, like a water bottle, in comparison to a control condition. However, these same thirsty participants were also more likely to notice, remember, and freely recall objects that were descriptive of their state of thirst, such as a cactus, even after controlling for total number of objects remembered. Goals bias perception towards items in the environment that will satisfy the goal but also to items descriptive of the deficit state but that will not assist in goal-pursuit.

Given these opposing influences on perception that differentially affect the success of goal pursuit and self-regulation, future work can examine the consequences of such biased perceptual processes on behavior. This particular interest may, in fact, be informed by including individual differences in a model of motivated perception. Leave aside the example of thirst, and instead consider a social interaction where the individual difference of need to affiliate is

measured. Future work might use a social exclusion manipulation on participants high or low in a need to affiliate. Using a lexical decision task, the accessibility of concepts representing the deficit state (i.e. alone), and the actual goal to affiliate (i.e. together) could be measured. Then, participants could be invited to join a partner in a separate room. Upon entering, it would be clear that the partner has stepped out, but the partner has left a book bag next to the only chair clearly indicating the seat he or she will be sitting in. The experimenter could direct participants to take a chair into the room, have a seat, and wait for the partner's return.

Of particular interest is how the relative accessibility of goal and deficit-relevant information will interact to predict goal-relevant behavior. This paradigm would allow for the development of a model that includes the relative accessibility of information descriptive of the state of exclusion, the accessibility of goal-relevant information related to inclusion, and the individual difference of need to affiliate to predict the actual distance participants place their chair from their partner.

Additionally, perceptions of physical and subjective distance might depend on the accessibility of both types of information. Participants' estimates of the physical distance separating themselves from their partner and their subjective feelings of closeness to their partner might depend on the accessibility of goal-relevant information and information descriptive of the state of exclusion. In particular, as the goal increases in accessibility, distances might be increasingly underestimated as participants might be motivated to restore closeness with others. Similarly, participants should feel closer to their

partner as goal accessibility increases. This pattern might be stronger for those high in a need to affiliate than for those low in a need to affiliate. This could produce a striking disconnect between actual physical distances that separate a person from their partner and their subjective feelings of closeness. The goal to affiliate may lead people to actually sit further away as they see the distance that separates the two of them as smaller than it really is all the while feeling quite close.

b. Approach and avoidance motivations. Some items are desired more than others (consider a delicious slice of dark chocolate New York style cheesecake versus a Hostess Twinkie past its expiration date) and some times the same object is desired more than at other times (a down parka during the dead of winter versus the sweltering heat of summer). Generally speaking, people wish to acquire positive objects and experiences while distancing themselves from bad ones. Typically, when people encounter a desirable object, they use their arms to pull it in towards themselves. People try to *approach* situations or facilitate an object's approach to the self that provide the promise of positive, or at minimum a lack of negative, outcomes. Conversely, situations and items are *avoided* or pushed away that suggest a threat of negative outcomes or a lack of positive ones. Motor movements, then, can be a signal to safety suggesting benign or problematic objects and situations as pushing and pulling with the hands and arms signal approach and avoidance motivations (Cacioppo, Priester, & Berntson 1993; see also Friedman & Forster, 2000).

If approach and avoidance motivations are associated with these

behavioral contingencies, then one might predict they would also maintain a relationship with specific perceptual distortions. For instance, flexing the arm activates approach goals and acquiring a desired object. Because of this, I predict that distances to a desired object should appear closer when flexing rather than when extending the arm. A goal to move an item closer might lead a perceiver to see that object as closer to encourage action towards acquiring the object. In addition, flexing the arm might represent an embodied signal of safety further encouraging perception and action meant to acquire the object.

Motor movements also influence information processing styles through the activation of approach and avoidance motivations. Movements that engage an avoidance motivation foster the spontaneous adoption of a detail-oriented, bottom-up processing style. However, bodily actions associated with approach motivations encourage heuristic, top-down processing resulting in greater creativity. When flexing and enacting an approach behavior, Friedman and Forster (2000) found that participants generate more creative solutions to a categorization task (see also Ekstrom, French, Harman, & Dermen, 1976; Witkin, Oltman, Raskin, & Karp, 1971). However, extending the arm engaged a more fine-grained, detail-oriented processing strategy. Fewer items were considered representative members of each category. A situation is scrutinized and processing becomes more detail-oriented when arm movements signal a problematic situation. However, global processing strategies are

implemented when movements hint to the safety of the situation (Riis & Schwarz, 2003).

Just as approach and avoidance motivations bias the ways people parse the contents of their judgments, motivations bias the ways in which people parse their visual environments. As approach motivations engage global information processing styles, I predict that approach motivations also engage global visual processing strategies, while avoidance motivations should engage local visual processing strategies. Certainly this hypothesis could be tested using the Navon task where perceivers are asked to identify an image. The image might take the form of a capital letter T made up of smaller objects like lower case h's. When using a global strategy, people quickly identify the T, while local strategies lead to faster identification of the component parts such as the h's. In addition, field dependence should be greater when in an approach motivational state rather than an avoidance one. Approach motivations that engage global processing strategies, such as those enacted when pulling up on a table, should increase perceivers' reliance upon contextual elements and backgrounds to parse a scene.

In addition to processing style, approach and avoidance motivations result in differential allocation of attentional resources to positive and negative information in the environment. In particular, Neumann and Strack (2000) asked participants to hold their arms with a 90-degree bend at the elbow while seated at a table. Some participants turned their palms up and pushed upwards on the table while others turned their palms down and applied slight downward

pressure to the top of the table. While applying pressure, participants responded to words that appeared on the computer screen in front of them, specifically by categorizing them according to their affective connotation. The identification of positive adjectives was facilitated when participants were flexing their arm as opposed to extending it. That is, when the body assumed an approach posture, attention was captured and held by positive information in the environment as measured by faster response times to positive words. However, when the body assumed an avoidance posture, attention was captured by negative information. Future work might investigate the boundary conditions of such approach and avoidance motivations induced by motor movements. Is it possible for such motivations to influence the resolution ambiguous visual information? Can approach and avoidance motivations not only facilitate the identification of information congruent with the motivation but filter out incongruent information such that perceivers are literally blind to it? Just as wishful thinking assists in the disambiguation of visual information, would engaging an approach rather than avoidance motivation result in a positivity bias in visual ambiguity resolution?

The consequences of such biased information processing and allocation of attentional resources are most extreme when considering situations that require assessments of risk. In order to make good judgments, one must weigh the pros and cons of various facts, opinions, evidence, and details. If approach motivations lead to heuristic processing in comparison to avoidance motivations, then the ways in which such information is filtered and how attention is

allocated during information processing might be proportional to its affective value. Approach motivations may lead people to avoid attending to and thus seeing information suggesting the harm in an option being considered. In addition, positive affect, often implicated in approach motivations, increases risky-behavior in low-risk situations (Nygren, 1998). Because this motivation produces positive affect and heuristic processing, approach motivations and positive affect may lead to an underestimation of risk and ultimately suboptimal decisions.

These suggested studies and predicted results contribute to a larger theoretical debate within cognitive science. It is difficult to imagine the evolutionary constraints on an organism that would lead it to be satisfied by perfecting an ability to represent the external world with complete authenticity. Representations are not the goal, purpose, or ideal end state of vision. Evolutionary pressures care not about the veridicality of internal representations but the ability to map representations onto behavior. Consider the thought experiment posed by Spivey (in press). When our caveman ancestor, oft called upon to illustrate an important evolutionary perspective, went out for a stroll, what allowed him to make it home to enjoy a romantic evening with his cave wife was not his ability to detect an alligator in the swamps that bordered the path or even recognize the beast as the one that found the next door neighbors as a tasty treat. Forming an internal representation of the visual scene did little to protect the caveman from the approaching alligator. Instead, what mattered was the

caveman's ability to map or pair that visual information onto action; that caveman needed to run away.

Action-based approaches to vision (e.g., Allport, 1989; Gibson, 1979; Spivey, in press; Tucker & Ellis, 1998) contend that object recognition is tied to the activation of motor patterns an organism might use when interacting with that object. For instance, recognizing a mug as such simultaneously activates the action one associated with the mug such as grasping it with the hand closest to the handle (Ellis & Tucker, 2000). The concurrent activation of intended grasping prepares the motor system for action, which slightly facilitates response times to a decision making task that requires the same hand to respond with a press of a button. This series of experiments, and many others like them, argue for a trifecta: perception, cognition, and importantly action are mutually interactive.

C. SITUATIONAL DETERMINANTS OF THE DOMINANCE OF THE NEGATIVITY BIAS

1. Consequences of Misperception

Positivity biases are partially a result of the natural distribution of perceived objects and events in the surrounding world. Because negative events are rarer than positive events, it is adaptive to assume the world is benevolent while continuing to be on guard for the occasional sign of danger (e.g., Lewick et al., 1992; Peeters, 1971, 1989; Peeters & Czapinski, 1990). However adaptive positivity biases might be, there are certain situations where the consequences of such misperception are too great (see Rozin & Royzman, 2001 for a discussion). In some situations, negative events are more threatening

than positive events are beneficial. At the extreme end of the spectrum, avoiding death is, arguably, of the highest priority. To avoid death, one must be vigilant for experiences that tempt this irreversible end state. Negative events require rapid responses whereas positive ones usually do not. In addition, negative events are more contagious than positive ones. Again, one cockroach can ruin a good meal, but no amount of yummy treats can make more appetizing a plate of mealworms (Rozin, Haidt, McCauley, & Imada, 1997).

Although attempting reproduction is another important task, there are usually multiple opportunities to do so, but a blundered attempt to avoid death blows out the candle illuminating these options. Thus, from an evolutionary perspective, it is advantageous to be on guard for danger rather than seeking gains when in a situation where one faces the possibility of harm. However, when in situations where such grave threats do not loom large, as is the case most often, then seeking advancement or looking for affordances to further goal pursuit may be quite productive.

2. *Controllability*

Another situational dynamic predicting the prevalence of positivity or negativity dominance is the controllability of the perceptual experience. If the situation is construed as one where fate, or more likely the experimenter, has already determined the outcome of the perceptual task, then a person may be less likely to feel that any particular hope can change the outcome of the event. For example, an intern at a magazine publishing company learns he will either be assigned to assist the beer critic for the food and beverage section or

index the muscle-toning, body-sculpting,
vitamin/nutrient/supplement ads for the back pages. If the intern is told that his assignment was decided yesterday, he might feel less control over his assignment than if he is told he will be assigned tomorrow regardless of whether he gets to offer his preference to the supervisor. If the assignment is already decided, there is little that can be done to change the outcome. Hoping can do nothing but produce disappointment. However, if the assignment will be decided tomorrow, the intern might feel more control over the outcome as there is still time and room for hoping, praying, or wishing on the first star of the night to perhaps direct the winds of good fortune in his direction. In other words, the act of hoping may only be engaged if one feels that hope can be effective.

Certainly, situations vary in the amount of control they allow a person to experience. Additionally, perceivers themselves vary in the amount of control they feel that they have over an outcome. Locus of Control (Rotter, 1966) is an individual difference that captures generalized expectancies for internal versus external control over events. People with an internal locus of control feel their own actions determine outcomes they experience, while those with an external locus of control believe that their own behavior is irrelevant to their outcomes. Given that they expect they are responsible for their outcomes, those with an internal locus of control may be prone to motivated perception. However, those with an external locus of control might be prone to relatively more accurate perceptual experiences as

they are less likely to engage in wishful thinking or defensive pessimism to prepare for an upcoming perceptual experience.

3. *Degree of Ambiguity*

Consider an ideal perceptual experience, where the perceiver has sufficient time to take in all visual information, where the lighting conditions are perfect, the physical and cognitive context not misleading, and the stimulus clear. In this situation, perception should be as accurate as is possible. Rarely do perceivers experience these ideal circumstances. Instead, most perceptual circumstances more closely resemble those created in the experiments previously described. Most commonly, the stimulus in question lacks clarity and is to some degree and by some manner ambiguous. It might be in just these circumstances that there is room for motivational forces to infiltrate perception. That is to say, motivated perception may occur only when more than one construal is easy to settle on. In analog, when personality traits are ambiguous (i.e. intelligent), people will define them in idiosyncratic ways to ensure that these traits will be descriptive of them (Dunning, Meyerowitz, & Holzberg, 1989; Suls, Lemos, & Stewart, 2002). Thus, when possible to construe self-relevant information in a positive light, people will do so. It is not too much of a stretch to argue that the perceptual system functions in a similar manner; when there is room to construe visual information in a way that will reflect positively on the self or one's situation, the visual system will do so.

4. *Emotion and Immediacy of Required Action*

To better predict when perceptual systems will be guided by

wishful thinking rather than negativity dominance, it might be necessary to examine the emotion that is evoked within the situation. Being in the presence of a freshly collected sample of dog feces will rarely evoke the same emotional response as being in the presence of a tarantula that recently found the escape hatch from her tank and is freely roaming the tabletop. It is quite likely that the first object will be met with disgust reactions while the latter with fear. Although both fear and disgust are negative emotions and ones that produce arousal, fear differs from disgust physiologically as measured by neuroendocrine stress responses. In response to stressful circumstances, disgust decreases blood pressure and cortisol, the hormonal marker of stress, while fear increases blood pressure and cortisol (Lerner, Gonzalez, Dahl, Hariri, & Taylor, 2005). Arguably, increased blood pressure and cortisol suggest the body is prepared to take action. These biological markers suggest that although both disgust and fear are aversive states of arousal, fear is a motivating force that promotes action while disgust leads to withdrawal and inaction.

Given the physiological differences produced by fear and disgust, one might argue that these emotions should systematically bias action and perception systems. The presence of a feared object might activate a defense system that promotes action. If a cougar lay waiting in the shrubs as a hiker takes a morning stroll, that hiker might be best served by noticing, attending to, and correctly identifying the animal so that he might take the actions necessary to remain out of harms way. Alternatively, disgusting objects are less

likely to require immediate action. To successfully navigate an environment that contains the rotting carcass of a squirrel, the student walking to school does not need to have her attention captured by or fixate upon the item (provided the poor thing is not lying in one's path). In fact, misinterpreting the remains as a pile of leaves or not seeing them at all might better serve her.

In other words, emotions vary in terms of the immediacy of reaction that they require. Some emotions, such as fear, require a person to engage in action quickly to prevent a dangerous outcome. Other emotions, such as disgust, may not require immediate action to avoid harm. A feared object that requires immediate action might be noticed and accurately perceived, while disgusting objects that do not require immediate action can be distorted or left unattended at the will of the motivated perceptual system. In fact, a person might benefit by allowing the motivational system to activate coping strategies to deal with the disgusting although not immediately threatening situation. Thus, objects that evoke different emotions and behavioral reactions at various degrees of immediacy predict when wishful thinking rather than negativity dominance will lead to perceptual bias.

D. WHY POSITIVITY BIASES IN MOTIVATED PERCEPTION EXIST IF BAD IS STRONGER THAN GOOD

Baumeister and colleagues (Baumeister, Bratslavsky, Finkenhauer, & Vohs, 2001) put forth a treatise emphatically stating that bad is stronger than good. They flood their readers with countless examples, discuss generations of research, offer theoretical rationales, and search for evidence to argue for the contrary yet find only a few

exceptions to the fact that negative information and events command a larger presence than do positive. Bad parents, bad emotions, bad life experiences, bad relationships, and bad feedback, among many other examples of negativity all impact life in more extreme ways than their positive counterpart. It might seem that Baumeister's well-supported assertion undermines the conclusions warranted by my work. On the contrary, I see this as an opportunity for additional insight into the motivation for the existence of motivated perception but, more specifically, for the specific variety of motivated perception I investigated: positive motivated perception.

People need a system, a strategy, a defense system, or a bastion against the power of bad to cope with its prevalence in so many facets of daily life, its power, and its asymmetric relationship with good. Students experiencing bad social support systems had weaker immune systems (Kiecolt-Glaser, Garner, Speicher, Penn, Holliday, & Glaser, 1984). Students' self-views took a bigger blow after receiving negative feedback (Coleman, Jussim, & Abraham, 1987). Of course, these are only a few of the many examples of the discrepancy between positive and negative outcomes for the self, one's health, and one's prospects. Positive motivated perception may be a member of the garrison defending the mind and body from the detrimental effects of negative information. Seeing the world favorably may deter from the otherwise oppressive presence of and consequential reaction to the great quantity and powerful punch of negative information. Positive motivated perception allows people to achieve their goals of feeling like a good person, in a benevolent world, with favorable prospects for the

future. If no such defense system were in place, then it is quite possible that we might fall under the force of the slings and arrows that are tossed in our direction by negative information.

E. SUMMARY

The glasses through which people view the world are not always rosy. Instead, there are certain individuals who seem inclined to interpret ambiguity in the harshest light, to see the bad at the expense of the good. But, of course, there are times when this is the safer strategy. In some circumstances, it might be best to be on guard for the bad that lurks in the dark. At times, the consequences of missing a hazard far outweigh the benefits of seeing something beneficial. For instance, when immediate action would be required to prevent harm, one might be best served by identifying the threat so that behavioral action systems can be launched. Other times, it is just not possible to see the world in any way other than what it is. The ability to manipulate incoming information is out of one's control either because the information is so clear or the outcome has already been decided and room for hope closed. Although this project is devoted to explicating the role of desires in motivated perception, I acknowledge the boundaries and conditions of this bias.

V. Applied Value of Motivated Perception Research

Motivated perception is a process that invites itself into many important facets of daily life. In the sections that follow, I will describe how motivations influence the effectiveness of self-performed screening exams for cancer and the evaluation of information that might assist in early detection. In addition, I will speculate about how motivated

perception may lead couples to literally see their partners in substantively different ways, which affects well being and satisfaction. Finally, I will discuss how promotion and prevention goals might differentially influence what information is attended to when evaluating products in a marketing context.

A. PREVENTATIVE ACTIONS TO DETECT CANCER

Early detection of cancer is a critical component of effective treatment. Yet early detection often requires that an individual combat many emotional, motivational, and perceptual urges that might undermine attempts at early detection. In this section, I will discuss motivational biases in cognitive and perceptual processing of cancer-related information.

One of the most controversial options for decreasing the risk of breast cancer in women not yet diagnosed with the disease is bilateral prophylactic mastectomy (Snyderman, 1988). With this preventative procedure, both breasts are surgically removed in order to reduce the risk of developing breast cancer. Although some studies suggest a reduction in risk (Hartmann, Schaid, Woods, Crotty, Myers, Arnold, et al., 1999), the preventive value of prophylactic mastectomy in high risk, unaffected women is yet to be determined (see Stefanek, Enger, Benkendorf, Honig, & Lerman, 1999). What is agreed on though is that mastectomy is effective only before cancer develops, and treatment options narrow if detection occurs too late. One way in which to assess the likelihood of developing breast cancer before it exists is through genetic screening for mutation. Of women who have the specific genetic mutation, 50–85% to develop the disease. Given the mixed

nature of the effectiveness of and extensive, dramatic nature of bilateral prophylactic mastectomy, it is important to get a sense of public opinion about the procedure. Will women entertain this as an option, or, providing the research concludes the procedure is effective, will it be necessary for health-care providers to campaign to convince the public of its value?

In a vignette study, Stefanek and colleagues (1999) asked women whether they would opt for prophylactic mastectomy. Women reported levels of worry about personal risk of breast cancer and estimated the 10-year risk for the woman in the vignette. High personal worry and greater risk estimates increased the likelihood of the selection of surgery, regardless of whether the participant had a first-degree relative with breast cancer. Although this hypothetical scenario study suggests women worried about cancer were no more likely to opt for the treatment, there is reason to suspect that if instead faced with the gravity of a real diagnosis themselves, women at risk may act quite differently than their predictions suggest. That is, predictions and actual behavior may be discordant.

It is important to understand what underlying factors predict what type of women will entertain the notion of surgery. More generally, it is important to capture what factors underlie women's decision to pursue preventative and treatment options to the full extent of availability. This is of most concern when considering that selective genetic testing in addition to self-performed breast exams are often the first means by which women are made aware of a possible problem. One particular factor that might predict different approaches

to selecting genetic testing or performing the self-exam is the motivational state of the woman in question. That is, predictive genetic testing can bring reassurance to many, but can also cause considerable distress to others (Salkovskis & Rimes, 1997; Shaw, Abrams, & Marteau, 1999). In addition, the quality of self-screening may depend upon the motivations and psychological states of the women performing the self-exam.

When investigating interest in undergoing genetic testing, Shiloh and Ilan (2005) found that when women's dominant motivation was to prevent disease, higher perceived risk led to more interest in testing. By contrast, if the dominant motivation for testing was emotional reassurance, then high-risk perceptions predicted opposite tendencies. In fact, the integration of affect and cognitive factors in predicting behavioral intentions accounted for 15% of the explained variance.

The prevention of breast cancer is dependent upon women engaging in detection and preventative behaviors. The effective performance of monthly self-breast exams increases the likelihood that breast cancer can be detected early on. To perform a monthly self-breast exam effectively and combat breast cancer most aggressively, one must be sensitive to lumps while documenting any changes in breast tissue. Although some evidence, however mixed, suggests a positive correlation between self-reported worry about cancer and performance of self-exams (Lerman, Kash, & Stefanek, 1994; McCall, Schroeder, & Reid, 1996), there is little evidence that speaks to the quality of the self-exam that at risk populations perform. Women with high and low risk for cancer may differ dramatically in the quality of

the self-breast exam. For instance, women at high risk may perceive their breast tissue and process the tactile information they receive in a very different manner than women at low risk.

Women at risk, perhaps because of family history, are well aware of the difficult road ahead for a cancer patient. Because of emotional involvement and fear, women at risk maintain a desire to avoid receiving threatening information, thus they do not take all steps possible to detect cancer at early stages (Welkenhuysen, Evers, & d'Ydewalle, 2001). That is to say, this knowledge could produce greater motivation to avoid detecting cancer. One might predict that if at risk women do engage in self-exams, the ways in which they process the tactile information they obtain during the exam might be undermined by the motivation to avoid detection. The consequences of this error, obviously, have grave potential.

Alternatively, women with a family history of cancer might realize the benefits of early detection. Because they might be better informed or more familiar with detection strategies and action plans for combating the disease, women at risk may perform self-breast exams more effectively. That is, they might be more attuned or sensitive to changes in their breast tissue because they are motivated to detect it in its early stages.

A motivation for knowledge about one's health may produce different types of preventative action taken by women at risk or alter the quality of the action taken. At odds with this is that a motivation towards emotional regulation may undermine these actions. These results suggest that the quality of self-screening may in fact be biased

by the underlying motivations of the screener. Given the consequences of not detecting a lump as it begins to form, the implications for biased detection and perception are severe.

B. RELATIONSHIPS

Visual perception plays a pivotal role in relationship satisfaction and well being. The ways in which couples perceive themselves, their partners, and others in their world are related to their happiness within their relationship. In investigating signals of successful, lasting relationships, Miller (1997) found that satisfied relationship partners are unlikely to think about or even look at attractive alternative partners (Miller, 1997). In addition, they derogate available others in efforts to support optimistic and positive views of their own partners (VanYperen & Buunk, 1991; Johnson & Rusbult, 1989; Simpson, 1987). One might ask if happy couples see attractive others in ways that differ from partners in unhappy relationships, single others, or otherwise unavailable others. Perhaps happy partners are happy because they are more likely to literally see the imperfections of alternative mates.

The ways in which couples see one another predicts relationship satisfaction. Seeing one's partner in the most positive light possible leads satisfied individuals to feel more committed within their relationships (Murray, Holmes, Griffin, 1996a, 1996b; Van Lange & Rusbult, 1995). In fact, such overly favorable views and optimistic perceptions are critical for healthy well being (Murray & Holmes, 1997). Indeed, there is not much comfort to be gained by exaggerating a partner's weaknesses or vices. Instead, commitment, security, and

satisfaction are the by-product of seeing one's partner charitably and favorably (Murray, 1999). Given the benefits of literally seeing the best in one's partner, other perceptual experiences might also reflect this motivated bias. Might a satisfied relationship partner perceive time differently? Would they see stubborn behaviors as lasting less long as there is little to be gained by feeling committed to a stubborn partner? Will satisfied partners be motivated to see their partner as smiling rather than smirking even after controlling for experience with both expressions?

In an effort to improve the quality of long-term relationships, much research documents emotional distress in marital arguments. Wives are significantly more upset by marital arguments than are husbands (Almeida & Kessler, 1998; Almeida, McGonagle, Cate, Kessler, & Wethington, 2003; Bolger, DeLongis, Kessler, & Schilling, 1989). Further, emotional reactivity on the part of wives increased as self-esteem decreased and dependency increased (Almeida et al., 2003). Tentative evidence suggests that husbands' reactivity was positively correlated with self-esteem and negatively with dependency. Almeida and colleagues suggest that these gender differences may be due to wives perceiving marital arguments as more threatening and uncontrollable than did husbands.

Gender biases construal of the relationship but may also lead to differences in physical perception of the interaction partner, as well. It might be the case that wives are more emotionally reactive because they view their husbands differently than husbands see their wives. Wives may see a more hostile or non-cooperative interaction partner.

That is, wives might be more sensitive to small facial twitches, smirks, condescending looks, or other fleeting behavioral responses that suggest their interaction partner is hostile. Wives, then, might be reacting to what they literally see as a more negative interaction partner. This tendency may be exaggerated as wives grow increasingly less assured, but increasingly dependent upon the companionship of their husband.

Psychological states, such as low self-esteem, dependency, and anxieties of various forms can cloud even the best intentions to achieve satisfaction. Certainly, dating individuals' high anxiety lead them to interpret their partners' imagined and actual transgressions in suspicious ways leading to feelings of distrust and decreased conviction (e.g. Collins, 1996; Collins & Allard, 2004; Simpson, Rholes, & Phillips, 1996). Outside of anxious partners' construal of information of which they are consciously aware, anxiety might lead relationship partners to filter their sights, sounds, and memories. When interacting with their partner, anxious individuals might level and sharpen their perceptual experiences such that they only see and remember the slights or interpret the ambiguous actions of their partner negatively. Through the commotion and constant banter by the other guests at a party, the anxious partner might hear their mate say "break up" and fear the worst when in actuality the conversation was about the new line of Sephia *make-up* products.

A specific form of anxiety that taints attempts at relationship satisfaction and undermines well-being is an excessive concern about being rejected (Ayduk, May, Downey, & Higgins, 2001; Downey,

Freitas, Michaelis, & Khouri, 1998). Rejection sensitivity is the disposition to anxiously expect, readily perceive, and intensely react to social rejection (Downey & Feldman, 1996). Individuals high in rejection sensitivity are both concerned about the possibility of rejection and expect that others will indeed reject them (Feldman & Downey, 1994). Such sensitivity is the by-product of previous rejection experiences (Feldman & Downey, 1994). In rejection-relevant situations, these expectations are automatically activated, preparing those high in rejection sensitivity to detect the occurrence of rejection in the negative or ambiguous behaviors of others (Ayduk, Downey, Testa, Yen, & Shoda,1999; Ayduk, Downey, & Kim, 2001; Downey & Feldman, 1996, Study 2). Just as other forms of anxiety bias the intake and processing of information, fear of rejection might also filter and bias perceptual experiences. For instance, individuals fearing rejection or those high in a similar individual difference, need to belong (Baumeister & Leary, 1995), might see the distance that physically separates themselves from their partner at a party, for example, as greater than it actually is. These same individuals might see expressions on interaction partners' faces differently. Fearing isolation, rejection sensitive individuals might interpret an ambiguous facial twitch as a smirk or signal of contempt when the intent behind it was hardly negative.

C. REGULATORY FOCUS IN A MARKETING CONTEXT

The ways in which people pursue goals and the actions they take to work towards a desired end influence the way they think about and see the world around them. According to regulatory focus theory,

there are two pathways by which people regulate their actions in an effort to achieve their goals (see Higgins, 1997, 1998). One might employ a promotion focus that is concerned with hopes, aspirations, and desired end-states. This focus is sensitive to the presence and absence of positive outcomes and focuses regulatory efforts on using strategies to maximize gains and minimize nongains. Regulation can also occur with a prevention focus that is concerned with responsibilities and security and is sensitive to the presence and absence of negative outcomes. This system focuses individuals' efforts on strategies to avoid losses and attain non-losses.

Regulatory focus and situational constraints lead to systematic biases in judgment and decision-making. Wang and Lee (2006) asked participants to compare 2 different brands of toothpaste along a number of dimensions. Evaluators who were promotion-focused and less involved in the decision opted to evaluate the brands along more promotion (i.e. whitens teeth) than prevention features (i.e. prevents gingivitis), whereas prevention-focused participants selected more prevention than promotion features.

In extension, the ways in which information is extracted from the environment might coincide with chronic or temporary focus states. Although the contrived setting of the previously described marketing study offered participants easy glances at all the dimensions by which they might evaluate the toothpaste, in a drug store, grocery store, or market the dimensions may not be so obviously displayed. Dimensions that are promotion or prevention oriented may be a bit less salient or easily distinguishable. Regulatory focus might

predict the type of information that is attended to. That is, perceivers might have their attention drawn to information consistent with their focus state. However, it might also be the case that equally important information although dissimilar in purpose might be overlooked. A chronic promotion focus may bias a shopper to notice the phrase "freshens breath" on a tube of toothpaste, but overlook another brand that not only freshens breath but prevents gingivitis, plaque, and tooth decay. Whether these are predictions testing motivated attention rather than motivated perception is a question for the empirical research to address. Although, obviously, both weigh heavily in the ultimate perceptual representation that the perceiver forms about his or her surroundings.

D. SUMMARY

This work informs not only the theoretical understanding of perception, but this work also maintains an important relationship with applied dimensions outside of the laboratory. This work suggests additional dimensions that warrant attention within such domains as early detection of cancer. Motivated perception research may address reasons for emotional reactivity as well as satisfaction and well-being in relationships. Suggesting an implication for marketing, the goals perceivers assume may direct attention and processing within product evaluations. These are a few among many applications for the role of motivations in perception.

VI. Conclusion

In February 2006, Vice President Dick Cheney went hunting at the Armstrong Ranch outside of Corpus Christi, Texas. Unfortunately, Cheney failed to notice his friend and financial supporter, 78-year old fellow hunter Harry Whittington, about 30-yds away before peppering him with a round from his 28-gauge shotgun (VandeHei & Moreno, 2006). It is difficult to imagine how Cheney missed his friend's obvious presence. How could Cheney have been blind to, mistaken, or interpreted the outline of a fellow hunter for the birds that were his target? Although the White House was not forthcoming with an explanation, it is possible that the complexity of the landscape, Whittington's unexpected presence, and Cheney's quick reaction contributed to this unfortunate occurrence. Or perhaps Cheney quite literally saw Whittington as the quail (Quayle?) he was hunting.

Motivations do impact perception. The world people know, the one they act in and upon which their actions are based, is the one they take in through their senses. However, perceptions of the world are subject to influence from a host of characters much greater and much more broad-reaching than pure bottom-up, details the retina is responsible for funneling. A plethora of preconscious processes including motivational urges mold, shape, twist, filter, and bias this information continuously throughout the many tasks perceptual systems undertake before people realize they have had a perceptual experience. Wishful thoughts, intrapsychic goals, and visceral desires, all of which are activated long before conscious awareness, are only a few among many of the forms that motivations can assume. The

message is clear. Perceptual systems are penetrable. The world as we know it is not the world as it really is for people come to know perceptual reality only as it appears through “the fetters of one's own ever-shifting desires” (Einstein, 1918).

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