EXPLORING THE MODERATING ROLES OF EXPECTATION-BIAS BELIEF AND THE AMBIGUITY OF STIMULUS EFFECTS ON EXPECTATION EFFECTS

by

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ABSTRACT

Expectations about an upcoming experience often bias the actual or perceived experience later, a phenomenon known as the expectation effect (or bias). However, this phenomenon does not happen all of the time. Previous research shows that the level of belief one has that their expectations bias their experience moderates the influence of expectation effects on experience. However, research findings supporting this moderation conflict. Early research found that people higher in the belief that expectations bias their experience tend to correct against expectations and experience less expectation effects than people who are lower in such beliefs. Newer research found the complete opposite; people higher in belief that their expectations bias them experienced more expectation effects than people lower in expectation-bias belief. To explain these opposing patterns of results, the current thesis explored the possibility that the ambiguity of stimulus effects moderates the effect of expectation and expectation-bias belief on experience evaluations. Thus, the present thesis tested the hypothesis that people higher in expectation-bias belief would experience less expectation effects when encountering an ambiguous stimuli and more expectation effects when encountering a less ambiguous (concrete) stimuli, relative to people lower in this belief. In a reported experiment, participants were randomly assigned to either a control condition that received no expectation about the affective influence of an upcoming picture set, or a negative-expectation condition that received an expectation of negative affect regarding an upcoming picture set. Next, participants viewed the pictures and then completed measures of affect and expectation-bias belief. Statistical analyses revealed a significant interaction between expectations and expectation-bias belief in a pattern that replicated previous research by Carstens Namie and Handley (2005). However, the results did not support the overall hypothesis that stimulus ambiguity would moderate the interaction between expectations and expectation-bias belief. Explanations of the results, alternative explanations of the previous research, and possibilities for future research are discussed.

INTRODUCTION

In any book store, in any city in the United States, there is inevitably a self-improvement section filled with books on how to harness the power of expectations and belief to create the life one desires. The perspectives of such books range from the metaphysical/New Age arena like "The Law of Attraction" by Esther and Jerry Hicks—which promotes the idea that people experience (or attract to them) what they expect to experience—to the more mainstream business arena like the classic "Think and Grow Rich" by Napoleon Hill—which promotes the power of positive thoughts (expectations) to create success. Despite these diverse perspectives, such popular books converge on a phenomenon well accepted in the scientific world: individuals' expectations for upcoming experiences congruently influence those experiences when they occur. Such phenomena are known generally as expectation effects, or more popularly as placebo (or nocebo) effects (e.g., Atlas &Wager, 2014; Geers, Helfer, Kosbab, Weiland, & Landry, 2005a; Kirsch, 1985; Kirsch, Moore, Scoboria, & Nicholls, 2002; Wager et al., 2004; Wilson, Lisle, Kraft, & Wetzel, 1989).

Interestingly, the mere fact that such simplistic self-help books are out there seemingly reveal that some individuals realize and believe that expectations shape experiences, whereas others either do not realize this, or do not believe their expectations shape experiences. Perhaps people who perceive that their experiences generally match (are congruent with) what they expected develop beliefs that their expectations influence their experience to a greater extent than people who perceive that their experiences generally differ from (are incongruent with) what they expected. Or, maybe some people

have simply given more thought to the issue of expectation effects than others. In either case, research conducted by Handley and colleagues (2009, 2013) furthermore supports the idea that individuals differ in the extent to which they believe expectations congruently influence, or bias, their later experiences.

Central to the current thesis, research indicates that individuals' belief that they are influenced/biased by their expectations, or *expectation-bias belief* (EBB; Carstens Namie & Handley, 2015), is not merely an interesting side note, but significantly impacts the manifestation of expectation effects (Handley, Albarracin, Brown, Li, Kumkale, & Kumkale, 2009; Handley, Fowler, Rasinski, Helfer, & Geers, 2013). According to Handley and colleagues' reasoning, individuals who correctly believe that expectations bias their experiences should correct against that bias, reducing, eliminating, or even reversing expectation effects. This idea is consistent with a large literature on bias correction (e.g., Isbell & Wyer, 1999; Ottati & Isbell, 1996; Wegener & Petty, 1995, 1997). Alternatively, individuals who incorrectly believe that expectations do not bias their experiences should not correct against that bias, allowing the expectation effect to manifest. Indeed, Handley et al. (2009, 2013) found that participants lower in EBB reported expectation effects, but that these effects significantly diminished (ultimately vanishing) at higher levels of EBB.

Despite these findings, more recent experimental results (Carstens Namie & Handley, 2015) found that individuals higher in EBB actually reported *greater* expectation effects than individuals lower in EBB. That is, this newer research revealed a pattern precisely opposite to that reported by Handley et al. (2009, 2013). Thus, this

newer research presents a quandary; given the same individual difference (EBB) apparently results in vastly different results when it comes to the manifestation of expectation effects. To address this quandary, it is useful to note that individual and situational factors can influence the expectation effect. Therefore, it is possible that contextual or situational differences between the experiments reported initially by Handley et al. (2009, 2013) and that conducted by Carstens Namie and Handley (2015) could reveal an important moderator to the influence of EBB and expectations on expectation effects.

In particular, Handley et al.'s research provided expectations about stimuli with ambiguous qualities or effectiveness, such as a simulated alcohol beverage that purportedly altered affect (2009) or a cream which purportedly reduced pain experiences (2013). Alternatively, Carstens Namie and Handley's (2015) research provided expectations about stimuli with more concrete qualities or effectiveness, such as art images with notable qualities that may influence affect. Further, there is theoretical reason to suspect that this contextual difference could explain the difference between these sets of findings. The current thesis will test this possibility, after laying forth a pertinent review of the literature on expectations effects, EBB, and importantly the theoretically justified predictions that the concreteness or ambiguity of stimulus effects can moderate the effect of EBB and expectations on expectation effects.

Expectations & Expectation Effects

Expectations are beliefs that something will or is likely to happen (Kirsch, 1985, 1999; Price, Finniss, & Benedetti, 2008), such as the belief that ingesting a particular medication will likely reduce pain. Importantly, expectations can greatly impact peoples' lives, influencing behavior, affect, experience, and perception (e.g., Kirsch, 1985; Price et al., 2008; Wilson et al., 1989). In particular, people often experience a stimulus or event in the way they initially expected to experience it (i.e., congruently), a phenomena known as expectation effects or expectation-bias. For instance, when someone thinks he/she will have a bad day, that person tends to have a bad day. Though there are many different types of expectation effects, the placebo effect is perhaps the best known type. Placebo effects are actual experiences or responses to an inert substance or treatment that are in line with a prior expectation about the effects of that substance or treatment (Kirsch, 1999). For example, people commonly experience less pain after taking a pill (which was actually inert) if they were led to expect the pill would relieve their pain.

Historically, many researchers construed the placebo effect as an imagined improvement; but it is a very real phenomenon with neurological underpinnings (Atlas & Wager, 2014; Price et al., 2008). Atlas and Wager (2014) conducted a meta-analysis of 25 functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) studies. They found consistent evidence of specific patterns of activation in specific areas the brain in response to placebo analgesia and pain responding, such as the prefrontal cortex (PFC), anterior cingulate cortex (ACC), and the amygdala. The meta-analysis also revealed that expectancy of placebo analgesia decreased activity in pain

processing areas of the brain as well as increased activity in areas of the brain associated with endogenous opioid release, or the production and release of "feel good" hormones that reduce pain. Thus, the placebo effect (and expectation effects generally), do not appear to be mere imagined influences on perception; research suggests that expectations truly alter perceptions.

Further, the placebo effect is very robust. In a review of the placebo effect, Price et al. (2008) reported on the results of several placebo analgesia studies and clinical trials which found that compared to no treatment control conditions, 26% to 56% of people in the placebo control conditions responded to the placebo treatment as if they received the real treatment (placebo effects); specifically 26.9% in Bendetti (1996), 30% in Beecher (1955), 39% in Levine, Gordon, Bornstein and Fields (1979), and 56% in Petrovic et al. (2002). Additionally, Kirsch, Moore, Scoboria, and Nicholls, (2002) conducted a meta-analysis of 47 randomized placebo controlled trials of depression medication and concluded that approximately 80% of these drugs' effectiveness were due to placebo effects. Nonetheless, placebo effects do not always occur, and research investigating psychological moderators to the effect is fairly new; these complex effects are only somewhat understood.

Situational Factors

Research has found that situational and contextual factors such as the conditions and means by which treatment is administered, supporting cues, and goals influence expectation responding and can moderate the manifestation of expectation/placebo effects. Such factors can include the ambiguity of situation in which the treatment is

administered, specifically whether it is clear (highly salient) that an individual received a treatment or not very clear (ambiguous). A clear, high salient treatment condition is one in which an individual is told and clearly sees that he or she is receiving a treatment that will help them (from a person). An ambiguous, less salient, treatment condition is one in which an individual is hooked to a machine he or she assumes (but is not certain) administers a treatment Placebo research often utilizes this "open-hidden" paradigm in which a clinician (open - in full view of the participant, with a verbal instruction of pain relief) or a mechanical pump (hidden - without the participants' knowledge) administers a drug (placebo), then participants record/measure their level of pain. The typical finding is that people in the open (clear/salient) condition report more pain relief than those in the hidden (unclear/ambiguous) condition (Price et al., 2008). Conceptually, this could indicate that increasing the clarity of the situational context results in more placebo effects and more ambiguity of the context results in less placebo effects.

In addition, Craggs, Price, & Robinson (2014) found that adding a verbal suggestion of pain relief in addition to an existing expectation for pain relief increased placebo analgesic responding. More precisely, when people were given a verbal suggestion of pain relief at the same time they are given a placebo analgesic, they reported less pain (placebo effect) than people only given the placebo and no verbal suggestion. They also found that the reports of reduced pain correlated with fMRI brain imaging that showed decreased activation of pain processing areas of the brain (Craggs et al., 2014). This suggests that receiving additional confirmatory cues, in this case the verbal suggestion, in addition to the already received expectation of an effective

treatment, strengthened the expectation and increased the effectiveness of the treatment, even though it is a placebo.

Externally primed goals can also determine whether and to what degree placebo effects manifest (Geers, Weiland, Kosbab, Landry, & Helfer, 2005b). Geers et al. (2005b) contend that placebo effects are most likely to occur when currently activated goals align with expectations. Goals are motivational and self-regulatory in that people try to guide their responses in order to achieve their goals. Further, situational or contextual cues can activate goals automatically, outside of conscious awareness. For instance being in a medical office, seeing a medical professional, seeing medical equipment or even a lab coat could activate (unconsciously) personal goals of wellness or healing. Subsequently, activated goals influence attention, thoughts, and behavior in order to try to fulfil the goal. Activated goals also provide motivation to experience desired expectation effects. Therefore, Geers and colleagues (2005b) reasoned that activated goals serve as motivators in expectation responding, increasing or decreasing the amount of expectation effects a person experiences depending upon the goal activated and whether it was in alignment (congruent) with the expectation.

In Experiment 1 of Geers et al. (2005b), participants were randomly assigned to one of four conditions: no expectation/no prime, placebo expectation/no prime, placebo expectation/cooperation prime, and placebo expectation/independent prime. More specifically, participants first recorded their current affect, and then completed a task that primed them with one of three nonconscious goals: cooperation, neutral, or independence. Next, the participants listened to a piece of music and were either given

the expectation that it would improve their mood (placebo condition) or were instructed to simply evaluate the music and were given no expectation (no expectation condition). Last, the participants recorded their current affect (a second time). Participants' affect was determined by comparing their pre-music affect to their post-music affect. Geers and colleagues (2005b) found that people primed with the cooperation goal reported more positive affect (relative to those given a neutral or independence prime) but only when they were also given the expectation that the music would improve their mood. So, placebo effects manifested when participants had an expectation and a cooperation goal (but not independence or neutral goals). These results show that subtle cues in the situation can prime goals outside of one's awareness, and that those goals can influence one's motivation and the degree to which a person is influenced by expectation effects.

Individual Factors

Various individual factors such as personality traits can also impact whether or not expectations influence individuals' experiences. For example, individuals' level of depositional optimism and pessimism (Geers et al., 2005a), and extroversion (Kelly et al., 2009), can moderate placebo effects. For instance, Geers et al. (2005a) found that, among participants high in *optimism*, those who were told a drug would produce unpleasant feelings reported less negative feelings (i.e., less expectation effect) than participants in the control (no-expectation) condition. Conversely, when participants high in *pessimism* received clearly deceptive information (the drug would make them feel bad) they reported more negative affect than those in the control (no-expectation) condition. Thus, optimism-pessimism moderated the extent to which expectations biased experiences.

Further, Kelly et al. (2009) investigated the influence of extraversion on expectation responding to placebo acupuncture treatment for irritable bowel syndrome (IBS). All of the participants received an expectation that the acupuncture treatment (a placebo sham treatment) would reduce symptoms of IBS. Then participants were randomly assigned to one of three groups: a no treatment waitlist group, a limited group that received treatment from a neutral practitioner, and an augmented that received treatment from a warm and caring practitioner. They found that participants in the augmented group that were also high in extroversion (as assessed with the Five-Factor Personality trait assessment) reported more relief of IBS symptoms as a result of the placebo acupuncture than people low in extroversion or in the control or limited groups. Thus, individual-difference variables seem to influence the expectation effect. Of interest to the current thesis, individual differences in peoples' belief that expectations bias their experiences can also influence expectation effects (Handley et al., 2009; Handley et al., 2013), although the quality of this influence is an area ripe for inquiry.

Expectation-Bias Belief & Correction

Individuals vary in the extent to which they hold expectation-bias belief (EBB), or the belief that expectations congruently bias peoples' perception/experience (Handley et al., 2009, 2013). According to Handley and colleagues, individuals who correctly believe that expectations bias their experiences (higher EBB) may correct against that bias, reducing, eliminating, or even reversing expectation effects. A large body of literature on bias correction supports the supposition that these individuals should correct against the bias so long as they are motivated and able to do so (e.g., Isbell & Wyer, 1999; Ottati &

Isbell, 1996; Wegener & Petty, 1995, 1997). According to the Flexible Correction Model (Wegener & Petty, 1995), for example, people typically correct against biases when they 1) believe there is a biasing influence (real or imagined) on their judgments (such as the EBB), and 2) are motivated and able to correct against that influence. Following these ideas, individuals higher in EBB should correct against expectation effects so long as they are motivated and able. Of course, if individuals do not believe there is a biasing influence of their judgements, even if there really is one, they should not correct against the influence, thus allowing the expectation effect to manifest. As a result, Handley et al. (2009, 2013) predicted that individuals lower in EBB should experience expectation effects, but these effects should diminish and eventually vanish (and perhaps eventually reverse) among individuals with higher and higher EBB.

More precisely, Handley et al. (2009) reasoned that people who were higher in EBB would likely consider the influence of the expectation when making judgments about their affect (attributions). Specifically, in appraising their affect, participants would infer that their feelings resulted to some extent from the stimulus and to some extent from the expectation. But, given the expectation influence represents a bias, individuals higher in EBB should correct against this influence and appraise their affect as less positive (or more negative) if they received a positive expectation for the stimulus (a beverage), for instance. In contrast, people who were lower in EBB would likely not consider the influence of the expectation when making judgments about their affect. Thus, given they (incorrectly) do not believe expectations bias experiences; they would not correct against this actual bias, and report expectation-congruent affect (expectation bias).

To initially investigate these ideas, Handley et al. (2009) conducted two very similar experiments in which they told participants that they were researching a herb-derived simulated-alcohol drink (actually an inert placebo). The participants then received a packet of information about the drink indicating that the drink elicits a either a positive affective state (e.g., happiness, optimism, joy) or an unpleasant affective state (e.g., sadness, negativity, anger). Then, participants viewed a table reporting the percentage of individuals who experienced various emotions (positive and negative) after drinking the beverage. This table reported high percentages for the positive emotions and low percentages for the negative emotions for participants in the positive-expectation conditions, and opposite for participants in the negative expectation conditions. Next, participants completed a questionnaire measuring their affective expectations (ensuring the expectation manipulation worked), then sampled the simulated alcohol beverage. After consuming the beverage, participants engaged the mundane task of writing a letter to a friend with noises of a coffee shop in the background. This provided time for the beverage to supposedly take effect, and a similar context in which people would likely consume the beverage once it (supposedly) hit the market place. Finally, participants completed a questionnaire measuring judgments of affect and intentions to consume the beverage later, as well as their expectation-bias belief. The researchers measured expectation-bias belief with participants' agreement to 3 items, 1) *People are likely to experience the mood they expect to experience*, 2) *If one is favorably predisposed to experience a positive mood, one will probably experience a positive mood*, and 3) *if one is favorably predisposed to experience a negative mood, one will probably experience a*

negative mood (Handley et al., 2009). Although both experiments were essentially the same, the researchers manipulated the distraction participants experienced (low vs. high) while reporting their affect in the second experiment.

Handley and colleagues (2009) found that people who were lower in EBB reported more expectation-congruent affect (expectation effect) relative to people higher in EBB. In other words, participants that were lower in EBB who received an affective expectation that the simulated alcohol would make them feel negative (positive) feelings subsequently reported congruent affect, more negative (positive) feelings (expectation effect). In contrast, at higher levels of EBB, people reported affect that was not significantly influenced by expectations.

In subsequent research, Handley et al. (2013) found evidence that EBB also altered pain reports. Before the experiment, the participants completed a pre-screening questionnaire that contained the three questions measuring EBB from Handley et al. (2009) as well as two additional questions that asked about medically related expectations. Later, during the actual experiment, participants learned that they were going to participate in a painful cold-pressor task for which they would submerge their hand in ice water for 2 min. Participants were then randomly assigned to one of two expectation conditions, a pain-expectation condition and an analgesic (less pain) expectation condition. In the pain-expectation condition, a research assistant applied an inert cream to participants' hand and told them the cream was a hand sanitizer. These individuals earlier learned that the upcoming task was painful, and received no suggestion that the cream would relieve that pain. In the analgesic-expectation condition,

a research assistant applied the same inert cream to participants' hand but told them the cream was a topical analgesic that would reduce the amount of pain the participants would experience in the cold-pressor task. Next, participants completed the cold-pressor task, placing their hand in 4°C ice water for 2 min. Participants then completed a questionnaire measuring pain intensity, pain severity, and amount of pain.

As in the Handley et al. (2009) research, Handley and colleagues (2013) found that people who were lower in EBB reported more expectation-congruent affect (expectation effect) relative to people higher in EBB. In other words, when individuals who were lower in EBB received an expectation that the cream would make them feel less pain (analgesic), they subsequently reported less pain (expectation bias) relative to the control condition. In contrast, at higher levels of EBB, people reported levels of pain that were not significantly influenced by expectations. The results of Handley et al. (2009, 2013) provide evidence that people higher in EBB correct against expectations to a greater extent.

Expectation-Bias Belief: Mixed Results

The published research by Handley and colleagues supports the idea that individuals higher in EBB correct against expectations and thus are less influenced by them. Yet, very recent research by Carstens Namie and Handley (2015) actually found support for the opposite. The original goal of this newer research was to *conceptually* replicate and build upon Handley and colleagues' findings by creating an expanded scale measuring EBB that might better predict expectation effects. The methodology used in

this experiment was modeled after the previous research conducted by Handley and colleagues in 2009 and 2013. Unlike the previous research, however, this experiment was conducted online using workers sampled from Amazon's Mechanical Turk (M-Turk) instead of in a laboratory relying upon a student sample. Another primary difference from Handley and colleagues research was that this experiment had a true control condition in which participants received no expectation about the effects of the stimuli. Additionally, the stimuli were changed such that participants received expectations for an upcoming set of *paintings* instead of a simulated alcohol drink or cream.

In Carstens Namie and Handley's (2015) experiment, instructions conveyed to participants that they were going to evaluate paintings for an art book, about which the researchers were conducting marketing research. Via random assignment, participants either received no expectations about the way the paintings make people feel (no-expectation condition) or received an expectation that the paintings make people experience negative/sad feelings (negative-expectation condition). The participants then viewed a (fictitious) table listing the percentage of various positive and negative emotions previous raters supposedly experienced after viewing the pictures (e.g., "*sad 87%*", "*happy 12%*") in order to reinforce a negative expectation. Next, participants responded to four expectation-check questions (α = .96) on 9-point scales (1 = *Strongly Disagree* to 9 = *Strongly Agree*), such as, "*I expect that viewing the pictures from this book will make me experience a negative mood.*" Participants then viewed a series of 18 (affectively neutral) paintings presented for 5 s each. After viewing the paintings, participants' reported their affect by indicating their agreement with 10 statements (α = .94) on 9-point

scales (1 = *Strongly Disagree* to 9 = *Strongly Agree*), such as, "*Viewing this set of paintings made me experience a negative mood.*" Finally, the participants completed the measure of EBB (α = .87) used to measure participants' belief in the expectation-bias, responding to items such as "*If I am predisposed to being in a negative mood, I will probably be in a negative mood*" on 9-point scales (1 = *Strongly Disagree* to 9 = *Strongly Agree*).

Regression analyses revealed a significant interaction between EBB and expectation condition on reported affect. However, unlike Handley et al.'s (2009, 2013) findings, participants who were lower in EBB reported less expectation-congruent affect (less expectation-bias) relative to people higher in EBB. In other words, individuals lower in EBB reported comparable affect when they received a negative or no expectation. Conversely, individuals higher in EBB reported more negative affect if they received a negative versus no expectation, and thus experienced the expectation-bias to a greater extent than individuals low in EBB. This pattern of results is in direct opposition to the Handley et al. (2009) and (2013) research which found that people who have higher in EBB correct against expectations to a greater extent.

In contrast to Handley et al.'s 2009 & 2013 research, the more belief participants had in the expectation-bias, the more expectation effects they experienced. There are many possible reasons why this result differed so drastically from Handley and colleagues' previous results. First, perhaps the Handley and colleagues' findings were a fluke. This seems unlikely because the expectation correction effect was found in repeated experiments, two in the 2009 research and one in the 2013. Second, perhaps the

Carstens Namie and Handley (2015) findings were a fluke. This also seems unlikely because this experiment was well powered with 210 participants equating to over 90 people for each of the two conditions.

Third, perhaps the differences between M-Turk workers and college psychology students resulted in different responding. More specifically, the M-Turk participants were a much more demographically diverse group with participants from multiple ethnicities, income levels, and education levels represented whose ages ranged from 18 – 55+ years. In contrast, the college psychology participants were likely less diverse, at least in age and certainly in education level than the M-Turk participants. More importantly, perhaps there were differences in levels of motivation and seriousness in that M-Turk workers were paid to money to complete the survey and are paid to perform other work on Amazon's Mechanical Turk. In other words, because the M-Turk workers received money maybe they were more motivated or serious about the study than college students who received class credit.

Fourth, and more interestingly, perhaps there is something theoretically interesting about this experiment that differed enough from Handley et al.'s initial research to drive different responding to expectations based on EBB. That is, something in the difference between these experiments might illuminate a variable that adds to our theoretical understanding of how EBB and expectations interact to influence perception. This thesis addresses precisely this possibility. Below, I further discuss the process by which individuals presumably come to perceptions of their experiences following expectations, and explain how that process might unfold differently depending on

whether individuals encounter stimuli with arguably ambiguous or clearer influences on affect.

Ambiguity, Attribution, & EBB

In examining the Handley and colleagues' (2009, 2013) experiments and Carstens Namie and Handley's (2015) experiment for differences, the "effects" of the stimuli may have been more ambiguous in the former than in the latter. More specifically, it was likely very ambiguous to participants how much the simulated alcohol or cream influenced affect and pain in Handley and colleagues' (2009, 2013) research largely because, in reality, these stimuli did not directly influence affect or pain. In addition, there were no clear, noticeable or salient qualities of the stimuli that would help individuals determine the extent to which these stimuli, relative to the expectations, influenced their internal states. That is, the potential influence of these stimuli was ambiguous, uncertain, unclear and not very salient or noticeable. In contrast, in Carstens Namie and Handley's (2015) research it was possibly clearer to participants how much the pictures influenced their affect. Though the paintings were affectively neutral, they had visible, noticeable and salient qualities and features that participants could reasonably infer influenced their affect. That is, the presumed influence of these stimuli was likely less ambiguous, more certain, more concrete, and more salient. Overall, it is possible that it was easier for participants to identify and interpret features or qualities within the paintings such as an object, image, person or expression that could plausibly influence their affective state, especially relative to the placebo simulated alcohol drink (Handley,

et al., 2009) or the placebo analgesic cream (Handley, et al., 2013) used in earlier investigations of EBB.

It is useful to note that the magnitude of internal states such as affect and pain are subjective, and determining their source(s) or cause(s) can be highly ambiguous (Geers et al., 2005b; Kirsch, 1999). For example, if an individual feels happy, it is not obvious how much that affect was caused by recent good news, the weather, the time of day, and a multitude of other factors. And, people might perceive some of these influences as more valid and adjust their perceptions of "genuine" affect based on what they feel are appropriate or inappropriate influences. For example, a person might slightly adjust her or his perceptions of affect to account for invalid influences like time of day, and attempt to report a more genuine level of affect based on sources such as good news or beautiful weather. And, as Handley et al.'s (2009, 2013) research suggests, individuals can adjust against inappropriate influences of expectations to arrive at seemingly more genuine perceptions of affect or pain. The global point is that individuals likely do not know exactly how they are feeling (or why), but to some degree infer their feelings or interpret their feelings in context and according to their beliefs. Thus, differences in how the attribution process unfolded for participants in Handley et al.'s research and Carstens Namie and Handley's research, particularly as the result of the different stimuli effects, might explain the different results in that research. Therefore, I discuss the attribution process in more detail in the following sections, addressing how ambiguity and salience influence causal attribution and expectation responding.

Attribution

The above highlights that individuals' affect can result, in part, from causal-attribution processes. Attributions, or causal explanations for events, experiences, and behavior, are related to expectations. Whereas expectations are predictions of what might occur, attributions are explanations for what has already occurred (Maddux, 1999). When people report their responses after exposure to stimuli or events, they often engage in causal attribution (Kelly, 1973; Storms & Nisbett, 1970) to determine not only the sources of their experience, but more "accurately" perceive the quality of that experience. Individuals can compare their current experience with expectations/predictions and the stimuli in order to attribute a likely cause for that experience: the expectation or the stimuli (Kelly, 1973; Maddux, 1999; Storms & Nisbett, 1970). That is, in trying to determine how individuals feel, they can try to figure out how much of their feelings result from their genuine reaction to the stimulus versus the influence of a prior expectation (and potentially other factors).

In fact, past research on expectation effects demonstrates that attributional processes influence experiences that result from expectations. For example, Storms and Nisbett (1970) conducted research on insomniacs, giving participants either an inert pill that supposedly increased feelings of anxiety, or created feelings of calm, or no pill. Importantly, these insomniacs commonly experienced anxiety as they attempted to fall to sleep (hence their difficulty falling to sleep). Somewhat counterintuitively, participants who expected the pill to produce anxious feelings actually fell to sleep more quickly than normal and participants who thought the pill would make them feel calm took longer to

fall asleep than normal. That is, the researchers observed the opposite of an expectation effect. They explain these results from an attribution perspective; participants who took the "anxiety pill" attributed their anxiety to the pill and not as a genuine reflection of their internal state, so they fell to sleep more quickly than usual. Alternatively, participants who took the "calm pill" could not attribute their anxiety to the pill, and interpreted their anxious feelings as a genuine reflection of their internal state, so it took them longer than usual to fall to sleep. The participants in the control condition had no significant change in the amount of time it took them to fall asleep. Although this research is different in many regards to the current research, it illustrates that attributional processes likely influence perceptions following expectations. Further, it demonstrates the relationship between causal attribution of affect and expectation responding. Specifically, participants consult their expectations about the effects of the stimuli during the attribution process when they determine and report how they feel. And, differences in expectations resulted in vastly difference experiences (getting to sleep faster or slower).

More relevant to the current thesis, this research supports the likelihood that participants in Handley et al. (2009, 2013) and Carstens Namie and Handley (2015) engaged in causal attribution when determining their affect in response to the stimuli. Participants likely compared their perception of their current experience (affect or pain) with the expectations and the stimuli effects in order to attribute a likely cause for that experience resulting in the manifestation (or not) of expectation effects. It is possible that attributional processes unfolded differently for participants in Handley et al. (2009, 2013) and Carstens Namie and Handley (2015) due to differences in levels of ambiguity of the

stimuli effects. Perhaps the more ambiguous effects of the stimuli in Handley et al. (2009, 2013) were less noticeable or less salient and therefore deemed as less causal when making attributions of affect. Conversely, perhaps the less ambiguous, more concrete, more easily confirmable effects of the stimuli in Carstens Namie and Handley (2015) were more noticeable, salient and seemingly more causal to participants when making causal attributions of affect. The influence of salience on attribution is a reasonable line of thought, which is further supported and discussed in greater detail in the next section.

Salience, Ambiguity and Attribution

Importantly, individuals are particularly likely to attribute causality in a situation to more perceptually salient, or more noticeable, information. For instance, in Experiment 1 reported by Fiske and Taylor (1975), participants viewed 2 people having a basic "get to know you" conversation with the instructions to simply witness the conversation. All participants witnessed the same conversation and people, but from different perspectives. Participants were seated around the conversationalists (who were facing each other) in a circle such that they viewed the interaction from different vantage points. Participants in the control condition had a full view of both conversationalists, whereas participants in the experimental conditions had a modified view in which one group saw the face of one conversationalist and the other group saw the face of the other conversationalist. After viewing the conversation, participants answered questions aimed at determining which person in the conversation seemed most casual in the interaction. Fiske and Taylor (1975) found that the participants who could see both people in the conversation attributed

causation equally between the two conversationalists. However, participants who viewed the face of only one of the conversationalists deemed the person they viewed as more causal in the conversation (i.e., they perceived the more salient person as setting the tone for the conversation, determining the content of the conversation, and influencing the behavior of the other participant to a greater extent). Salience determined the attribution of causation.

Furthermore, in other studies on salience and attribution, Lassiter and various colleagues (e.g. Lassiter & Irvine, 1986; Lassiter, Geers, Munhall, Handley, & Beers, 2001; Lassiter, Beers, Geers, Handley, Munhall, & Weiland, 2002; Lassiter, Munhall, Berger, Weiland, Handley, & Geers, 2005) looked at whether the salience of a crime suspect during an interrogation influenced how voluntary a videotaped crime-confession appeared. Specifically, they had participants view videotaped interrogations and confessions that differed in the vantage point of the camera such that some participants saw the interviewer and the suspect equally, mostly the interviewer, or mostly the suspect. Lassiter and colleagues consistently found that participants ascribed greater causality in the interrogation/confessions to the individual who was perceptually most salient to them. Specifically, participants perceived the confession as most voluntarily given when they viewed the suspect-focused version (i.e., more causality to the suspect), as least voluntarily given when they viewed the interviewer-focused version (i.e., more causality to the interviewer), and middling levels of voluntariness when they viewed the confession in which the suspect and interviewer were equally salient. The findings of

Lassiter and colleagues (1986, 2001, 2002, 2005) provide additional evidence that individuals ascribe greater causality to perceptually salient information (people).

Although the research reported by Fiske and Taylor (1975) and Lassiter and colleagues (1986, 2001, 2002, 2005) is quite different from the current experiment, it demonstrates that salience influences causal attribution. Similarly, evidence in placebo literature supports that expectation-effects are attributional in nature, and that more salient information influences judgement and placebo responding. Specifically, people are more likely to experience placebo effects when stimuli and their effects are more salient.

For example, in a within-subjects placebo study looking at brain activation patterns, Wager et al. (2004) informed participants that they were participating in a clinical trial of a topical analgesic cream which they were testing against a control cream that had no active ingredients. Participants were told they were going to receive painful thermal heat to test the analgesic cream. The cream was applied to different patches of skin on the forearm, one of the creams was the "control" cream and the other was an analgesic (really a placebo) that would supposedly reduce the amount of pain experienced from the thermal stimuli. However, in reality, both creams were the same. After the application of the cream, the participants completed three phases of trials. In the first phase participants received 3 different levels of painful heat. In the second phase, the manipulation phase, the painful heat alternated from the control-treated patch in one block to the placebo-treated patch in the next. Experimenters told the participants that the noxious heat was administered at a pain level of 8 (on the 10-point scale) on both the

control-treated patch and the placebo-patch. However, the heat that was administered to the placebo-treated patch was only at a level 2 (making the seeming pain reduction noticeable or salient). In the third phase, the test phase, the participants received the expectation that the heat was administered at a pain level of 8 but it was actually administered at pain level 5 for both the placebo- and control-treated patches. Although the pain levels were actually reduced in both of the conditions during the test phase, Wager and colleagues (2004) found that people reported less pain when the heat was administered to the placebo-treated patch (placebo-effect) than when the heat was administered to the control-treated patch. Arguably, it seemed that the "analgesic" effects of the cream were more noticeable or salient, in that it was easier for the participant to notice the "analgesic effects" when the heat was actually less painful in the placebo condition. The more noticeable/salient pain reduction then lead participants to attribute the pain reduction to the "analgesic" cream relative to the expectation for pain relief.

Consistent with the above ideas, individuals are likely to make greater causal attributions of their affect to either the expectation or the stimulus, depending on which is most salient. The effects and qualities of the stimuli used by Handley et al., (2019, 2013) were likely more ambiguous and thus of *low salience*. In this case, other information like expectations and personal beliefs in expectation bias (if present and strong) could heavily influence attribution relative to the low-salience effects of the stimuli. However, effects and qualities of the stimuli used by Carstens Namie and Handley (2015) were likely fairly noticeable, less ambiguous, more *salient*, and seemingly influenced affect. In this case,

other information like expectations and personal beliefs in expectation-bias (even if present and strong) may influence attribution less than the (seeming) highly salient effects of the stimuli. As elaborated below, the different levels of salience or ambiguity in the effects of the stimuli used in previous research on EBB could produce very different effects on affect.

Considerations of Attribution, Ambiguity, & EBB on Past and Present Research

Important to the current thesis, there may be differences in the levels of ambiguity of the stimuli effects between Handley et al.'s (2009, 2013) experiments and Carstens Namie and Handley's (2015) experiment. Perhaps such differences influenced participants' attributions regarding their internal states differently, producing the very different effects of EBB and expectation on experience. In more ambiguous situations like that found in Handley et al., (2009, 2013), the attribution process in which participants' likely engage unfolded as Handley et al. suggested. Specifically, when the stimuli effects are not salient, or are ambiguous, participants are left with little to no information to understand the cause of their feelings. In this case, individuals higher in EBB are likely to note that their expectations likely biased their feelings. That is, their expectations and beliefs are relatively salient, and seem to cause their feeling states. Thus, participants higher in EBB should correct more against the inappropriate influence of the biasing expectation to arrive at a presumably more genuine perception of their internal state, reducing or eliminating expectation effects. Alternatively, participants lower in EBB (inaccurately) believe that expectations do not bias their experience (or at

least, this influence is lesser). For them, neither the effects of the stimuli nor the expectation is salient (given they do not think there is an effect). Thus, they likely report their affect assuming it is a genuine perception of their internal state, do not adjust against the real biasing influence of their expectations, and experience expectation effects.

However, the current thesis proposes that the attribution process may unfold differently when individuals encounter stimuli with *less* ambiguous, or *more* salient, noticeable, plausible effects. In Carstens Namie and Handley's (2015) research, the stimuli likely seemed to produce less ambiguous or more salient effects, meaning participants might have attributed more causal influence to the stimuli (relative to the expectation) in determining affect. Although Carstens Namie and Handley showed participants an affectively neutral set of pictures, these pictures had noticeable features and characteristics (e.g., objects, people, faces, expressions, animals, landscapes, etc.), and the possible effects of such stimuli on affect were probably *more* salient relative to the stimuli used in Handley et al.'s research (2009, 2013). If true, individuals could more easily attribute influence of their affective state to the set of stimuli. For example, if participants felt sad, they could attribute that affect (logically, even if inaccurately) to noticeable, salient information such as specific images, expressions, triggered memories, etc. Thus, the seeming influence of the expectation on affect might seem negligible (less salient) relative to the very plausible (and noticeable) influence of the salient stimuli. It is possible, therefore, that although participants higher in EBB (accurately) believe that expectations bias their experience to some degree, their affect is plausibly explained by the stimuli in this situation. That is, in this context at least, the stimuli are perceived as

highly causal relative to expectations in determining affect. Thus, even individuals higher in EBB will conclude that their affect plausibly and genuinely reflects their reaction to the stimuli, and will not correct against the expectation (which does actually bias perceptions). Given this, participants will generally experience expectation effects when the effects of the stimuli are more salient (less ambiguous), as was found in Wager et al. (2004) where participants reported less pain when they expected pain reduction and the reduction was made salient. If true, this could explain the results of Carstens Namie and Handley, in which expectations effect were observed at higher levels of EBB.

This explanation has one shortcoming; it is not readily obvious why Carstens Namie and Handley (2015) observed no expectation effect among individuals lower in EBB. In fact, any attribution process for these individuals should be the same as described above for individuals higher in EBB; they can reasonably attribute affect to the stimuli, should not correct against an expectation (because they do not believe expectations are biasing), and thus should also demonstrate an expectation effect. Perhaps people higher in EBB are more sensitive to expectations and expectation effects in general. It is possible that increased sensitivity could be due to many factors such as instances in the past in which their expectations seemed to match or coincide with their perceived experiences so they are more aware of and reactive to expectations. More precisely, although they think they are not being biased and do not correct, perhaps in reality people higher in EBB are actually *more* sensitive to the expectation and as a result experience *more* expectation effects than people lower in EBB (unless they correct).

So according to this line of reasoning, ambiguous stimuli may seeming produce *less* salient effects, which seem *less* causal in attributional processes. Additionally, ambiguous stimuli activate internal cues such as schemas and beliefs making internal cues more salient (Gilovich, 1991). For people high in EBB, this should activate their beliefs about expectation-bias, which should exert more influence than the stimuli when making causal attributions about their affect. And, given individuals typically do not want to be biased, people higher in EBB will correct against biasing expectations. In contrast, people lower in EBB do not have beliefs that expectations bias them, although expectations are biasing. Further, because the ambiguous stimuli have low-salience effects and should seem less causal, expectations are likely to drive attributions about affect. This results in people lower in EBB experiencing more expectation effects than people higher in EBB.

Continuing along this line of reasoning, less ambiguous, more concrete stimuli have features that are clear, noticeable, and easier to interpret and identify, thus making the effects of concrete stimuli more salient and more seemingly causal in attributional processes. Additionally, peoples' internal cues such as schemas and beliefs are not activated due to the ease of interpretation of the stimuli effects (Gilovich, 1991). Therefore it is easier for people (both high and low EBB) to attribute current states of being to the highly salient effects of stimulus because they can validate their experience with evidence from the stimuli making it seem more causal than the expectation or low salient internal cues. However, when people high in EBB encounter a less ambiguous, concrete stimulus with seemingly salient effects, they may incorrectly think that the

expectation is not influencing them so like those low in EBB, they do not correct against the bias and ironically end up experiencing expectation effects. Salience influences causal attribution, and as introduced above it is possible that the ambiguity of the stimuli or their effects influences what information is salient by prompting effortful processing and causal attribution. This possibility is explored in more detail in the next section.

Ambiguity, Cognitive Effort, & Attribution

Related to the above, a different line of research also suggests that ambiguous stimulus effects may work with EBB to moderate expectation effects. More precisely, ambiguous stimuli effects are difficult to interpret, requiring thought and additional cognitive effort, influencing causal attribution. Ambiguity increases cognitive effort such that people think more, activating their beliefs, schemas, and expectations when making causal attributions. As a result, ambiguous stimuli and their effects are less salient (i.e., less causal) and more difficult to interpret and reconcile with expectations when making causal attributions about ones' experience (Boring, 1930; Gilovich, 1991; McManus et al., 2010; Moskowitz, 2005). For example, neurological research conducted by Mason, Just, Keller, and Carpenter, (2003) found that it took longer for participants to interpret and read ambiguous sentences than clear sentences. Additionally, fMRI brain imaging showed that brain signals were more intense and numerous when participants were processing ambiguous sentences than unambiguous sentences, indicating that more cognitive processing occurred when interpreting ambiguous information (Mason et al., 2003). Overall, it seems that ambiguous stimuli instigate more effortful processing than

do more concrete stimuli. Importantly, the different levels of processing have implications for attributions and interpretations of internal states following expectations.

Specific to the current thesis, the idea that ambiguous stimuli effects trigger greater cognitive effort than concrete (less ambiguous) stimuli effects has implications for how people will understand and experience their internal states depending on EBB and expectations. Specifically, when individuals encounter ambiguous stimuli following an expectation, they should think carefully about how they are feeling, and why, when making causal attributions. This thought activates and makes salient (noticeable) internal cues and schemas which are then used in interpreting the stimuli effects and making causal attributions. If individuals are low in EBB, they will likely consult their activated internal cues, schemas, and beliefs. However, they do not have beliefs about expectations and should not consider the biasing influence of expectations. Therefore, these individuals will determine that their feelings are genuine, thus manifesting expectation effects. Alternatively, if individuals are high in EBB, they too will consult their activated internal cues, schemas, and beliefs. However, people high in EBB have the belief that their expectations bias their experience and will likely question whether their feelings are genuine or a result of expectation-bias when making causal attributions. As a result, they assume the expectation biases them, correct against that bias, and therefore manifest decreased (or no) expectation effects (as seen by Handley et al, 2009, 2013).

However, when individuals encounter less ambiguous stimuli following an expectation, they should not think particularly carefully about how they are feeling, or

why, because less cognitive effort is needed to interpret the effects of the stimuli. Because less cognitive effort is required, internal cues, schemas, and beliefs are not activated. Therefore, regardless of whether individuals are high or low in EBB, they will likely passively assume their feelings are genuine, not consider the biasing influence of expectations, and thus manifest expectation effects. That is, because people invest less effort in thinking about less ambiguous (concrete) stimuli, even individuals high in EBB might not evoke their personal beliefs about expectation biases in this situation; putting the effort in activating such beliefs might seem unnecessary in response to less ambiguous (concrete) stimuli. Thus, these ideas suggest different patterns of results from EBB and expectations depending on whether people experience highly ambiguous or less ambiguous (concrete) stimuli. Focusing primarily on individuals high in EBB, it is likely that highly ambiguous stimuli will prompt cognitive effort and the use of beliefs about the expectation-bias in order to determine internal states (reducing expectation-effects), whereas less ambiguous (concrete) stimuli will not (allowing for expectation-effects).

Summary

In summary, both lines of thought regarding salience and ambiguity converge on the same general idea, *more* ambiguous information is *less* salient and appears *less* causal when making causal attributions. More ambiguous information also requires *more* cognitive effort to interpret, activating internal cues such as schemas and beliefs. In turn the increased cognitive effort makes activated internal cues *more* salient and *more* causal (than the stimuli) when making causal attributions. In contrast, *less* ambiguous (or more concrete) information is *more* salient and appears *more* causal when making causal

attributions. Less ambiguous information also requires *less* cognitive effort to interpret so internal cues such as schemas and beliefs are not activated. Because internal cues are not activated they appear *less* salient and *less* causal than the stimuli when making causal attributions.

Furthermore, such causal attributions are likely to influence expectation responding differently depending on the expectation and the individuals' level of EBB. Therefore it is likely that the ambiguity of stimuli effects interacts with expectations and EBB to result in differing expectation-effects. More precisely, researchers initially found that people high in EBB corrected against expectation-bias (Handley et al., 2009; Handley et al., 2013), whereas subsequent research found opposing results, specifically that people high in EBB instead experienced expectation-bias to a greater extent than people low in EBB (Carstens Namie and Handley, 2015). As discussed above, individuals' experiences can result, in part, from attributional processes that take into account expectations, EBB, and the ambiguity of stimulus effects. The current research tests the possibility outlined in this section, that the ambiguity of stimulus effects moderates the influence of EBB and expectations on experience. Specifically, the above lines of reasoning leads to the hypothesis that higher (vs. lower) EBB will result in reduced expectation effects for stimuli with highly ambiguous effects (as in Handley et al., 2009; 2013), whereas higher (vs. lower) EBB will result in greater expectation effects for stimuli with less ambiguous (concrete) effects (as in Carstens Namie & Handley, 2015).

Overview and Hypotheses

The reported experiment essentially replicated the Carstens Namie and Handley (2015) experiment, but furthermore randomly assigned participants to experience stimuli with "concrete" or "ambiguous" effects. More specifically, participants were given a cover story and, via random assignment, either no expectation or an expectation of negative affect for a set of upcoming paintings. Then, depending on random assignment, participants viewed a set of concrete or ambiguous paintings. Last, the participants answered questions about their mood/affective state and completed the Expectation-Bias Belief (EBB) measure. Overall then, participants were randomly assigned to the conditions of a 2 (expectation) by 2 (picture set) between-groups design in which EBB served as an additional predictor variable of participants' affective state.

Hypothesis 1: Among participants who receive a set of ambiguous stimuli, EBB and expectations will interact such that participants will experience greater expectation effects at lower levels of EBB than higher levels of EBB. In other words, participants will report more negative affect if they received a negative expectation relative to no expectation, and this difference will be most evident at lower levels of EBB. This hypothesis follows directly from the research findings and logic of Handley et al. (2009; 2013).

Hypothesis 2: Among participants who receive a set of concrete stimuli, EBB and expectations will interact such that participants will experience greater expectation effects at higher levels of EBB than lower levels of EBB. In other words, participants will report more negative affect if they received a negative expectation relative to no expectation, and this difference will be most evident at higher levels of EBB. This hypothesis follows

logic laid forth in this proposal, and this predicted pattern of results would replicate Carstens Namie and Handley (2015).

Overall Ambiguity Hypothesis: The combination of Hypotheses 1 and 2 overall predict a 3-way interaction between expectation, picture type, and EBB. Thus, I predict a 3-way interaction in the pattern described by a combination of these two hypotheses.

METHODS

Participants and Design

Overall, 403 Montana State University Psychology 100 undergraduate students participated for partial class credit. These participants were randomly assigned to the conditions of a 2 (expectation: none vs. negative) x 2 (picture type: ambiguous vs. concrete) between-groups design, which, in addition to a continuous measure of their expectation-bias beliefs, were used to predict affective reactions to a set of pictures. As detailed more fully below, the data from forty-five participants' was removed for potential demand characteristics as assessed by two independent coders. The final analysis was conducted with the remaining 358 participants.

Procedure

The experiment was conducted on Dell computers with 17 inch monitors using Media Lab software. Upon entering the lab, participants were seated at a computer station where they read and signed an informed consent form. Then, all participants received a cover story to disguise the true purpose of the study and thus reduce the influence by demand characteristics on participants' responses. Specifically, participants were told that the psychology department was collaborating with another university to test and evaluate the impact of a set of paintings that was intended for use in psychological assessment. After reading the cover story, participants were randomly assigned to either control (no-expectation) or negative-expectation conditions. Participants assigned to the control

condition were told that the upcoming paintings were created by artists known for "creating interesting and unique paintings," and the paintings were chosen based on results of previous research. Participants randomly assigned to the negative-expectation condition were additionally told that previous participants who viewed the upcoming paintings reported negative affect in response to viewing the paintings and were shown a (fictitious) table of experienced affect as reported by previous viewers. Next, the participants indicated their expectations regarding the upcoming paintings, serving as a manipulation check. Following this, the participants viewed either a set of ambiguous or concrete paintings (the stimuli), as determined by random assignment. Immediately after viewing the paintings, participants completed a measure affect (the primary dependent measure), followed by a measure of Expectation-Bias Belief. Finally, participants completed four questions to probe for suspicion and demand characteristics or problems experienced during the experiment, such as computer glitches. The experiment concluded by fully debriefing and thanking participants.

Independent and Predictor Variables

Expectations

The expectation manipulation used by Carstens Namie and Handley (2015) (and modeled after Handley et al., 2009) was highly effective in setting a negative versus neutral expectation, and so was adapted for use in the current experiment. Participants randomly assigned to the negative-expectation conditions were told that the artists of the upcoming picture set were known for producing "emotionally charged paintings that tend

to evoke negative feelings." They were further informed that previous raters reported negative affect after viewing the paintings, and then viewed a table with various positive and negative emotions (e.g., happy, sad, positive, negative, etc.) and the percentage of previous viewers who reported each emotion. The table was constructed such that the negative emotions purportedly had much higher percentages than the positive emotions, bolstering the expectation of negative affect.

Participants randomly assigned to the control conditions were simply told that the artists of the upcoming picture set were known for producing "interesting and unique paintings" and the current set of paintings were chosen based on ratings made by previous raters. They received no other information, nor a table indicating the percentage of previous viewers who reported each of several emotions. Thus, these participants had no (or, at least, were not provided a) particular expectation for how the upcoming set of pictures would make them feel.

Picture Type Manipulation

Independent from the expectation conditions, participants were randomly assigned to view either a set of ambiguous or concrete pictures. Participants in the ambiguous conditions viewed a series of 18 ambiguous paintings. Each picture appeared on the computer individually for 5 seconds, after which the computer automatically advanced to the next painting. For the current research, I defined ambiguous paintings as those whose effects are more difficult to interpret, unclear, contain no distinct or easily identifiable themes or images. Likewise, the participants in the concrete conditions viewed a series of 18 concrete paintings, each of which appeared on the computer

individually for 5 seconds, after which the computer automatically advanced to the next painting. For the current research, I defined concrete paintings as those whose effects are less ambiguous, easy to interpret, clear, and contain distinct or easily identifiable themes or images.

The paintings used as stimuli were pre-tested using 121 Amazon Mechanical Turk workers who rated the paintings on two dimensions: affect (positive/negative) and on level of ambiguity using 9-point scales (1 = *Very Positive / Not at All Ambiguous* to 9 = *Very Negative / Very Ambiguous*, respectively). The M-Turk workers rated a total of 60 paintings that were experimenters identified as potentially affectively neutral stimuli, 30 of which were identified as potentially concrete and 30 identified as potentially ambiguous. Eighteen of the paintings rated were the same paintings used in the Carstens Namie and Handley (2015) experiment. It was important for the paintings to be rated as affectively neutral so that a true expectation-bias (placebo effect) could be created such that the any negative affect experienced by participants in the current experiment could be attributed to the negative expectation, not the paintings. A paired samples t-test was used to ensure the final 36 paintings were rated as affectively neutral such that the concrete paintings (n = 18, M = 4.66, SD = 1.0) and the ambiguous paintings (n = 18, M = 4.79, SD = 1.13), did not differ in the affect they produced, $t(120) = 1.29$, $p = .20$, and that the paintings did differ to the extent to which they were perceived as concrete (M = 4.86, SD = .91), or ambiguous (M = 7.42, SD = 1.36), $t(120) = 17.01$, $p < .001$.

Expectation-Bias Belief

After recording their affect participants completed a measure of Expectation-Bias Belief (EBB). The EBB measure is a scale in development by Carstens Namie and Handley intended to measure the level of belief in expectation-bias. The EBB measure includes the original 3 and 5 questions used in Handley et al., (2009) and (2013), respectively. It consists of 12 items that measured using 9-point scales (1 = *Strongly Disagree* to 9 = *Strongly Agree*), e.g., "*If one is predisposed to being in a positive/negative mood, one will probably be in a positive/negative mood.*"; "*People are/I am likely to experience the mood they expect to experience.*"; "*If I expect that a medication will reduce my pain, I will probably experience less pain when I take that medication.*"; "*My expectations for an experience influence the way I perceive that experience.*" Negative items were reverse coded then all the items were averaged for each participant. Reliability analysis indicated that these 12 items are interrelated (Cronbach's $\alpha = .81$). The original items correlate with the other items of the scale indicting that the EBBS is measuring the same construct as the original items, $r = .639$, $p < .001$.

Dependent Variables

Expectation-Manipulation Check

To ensure that the expectation manipulation influenced affective expectations about the paintings, participants were asked to respond to 4 items regarding their expectations just prior to viewing the pictures. Specifically, participants responded the statement "*I expect that viewing the paintings will make me feel _____*" "*pleasant*,"

"*unpleasant*," *negative*," "*positive.*"; Participants responded to the four expectation check items using 9-point scales (1 = *Strongly Disagree* to 9 = *Strongly Agree*). Negative items were reverse coded then all the items were averaged. Reliability analysis indicated that these items were highly interrelated (Cronbach's α = .84).

Affect Measure

After viewing the picture set, participants responded to 9 statements intended to measure the same emotions that were mentioned in the expectation manipulation. The items were measured using 9-point scales (1 = *Strongly Disagree* to 9 = *Strongly Agree*), e.g., "*I feel _____ now*," "*sad*," "*happy*,", "*pessimistic*", "*optimistic*"; "*Viewing those paintings made me feel _____*.", "*pleasant*", "*unpleasant*"; "*Viewing this set of paintings made me experience a positive mood.*"; "*Viewing those paintings made me feel discouraged.*"; "*Viewing those paintings made me feel hopeful.*" Negative items were reverse coded then all the items were averaged. Reliability analysis indicated that these items were highly interrelated (Cronbach's α = .85).

Demand Characteristics

In order to identify possible demand characteristics, the experiment concluded with four questions about whether participants experienced any issues or oddities with the experiment and whether or not they knew the purpose of the research; that the experimenters were researching expectation-correction and expectation-bias/placebo effect. Two independent coders, blind to the condition of the participants, read and coded the participants' answers to the questions. The coders independently reviewed the

answers to the questions and indicated whether participants 1) knew the purpose of the study; 2) Did not know the purpose of the study; or 3) Maybe knew the purpose of the study. After individually coding the data, the coders then consulted each other to verify and clarify ratings. Any remaining conflict in coding was resolved by the author (also blind to the participants' conditions) and all 1's were removed from the data set. Interrater reliability analysis using the Kappa statistic indicates substantial consistency among raters, Kappa = 0.613, p <.0.001. The data from forty-five participants was removed because they indicated that they knew the experiment was investigating placebo (expectation) effect, beliefs about expectation effect, or both.

RESULTS

Final Sample Determination & Demographics

As noted earlier, 45 of the 403 participants who completed the experiment were removed from the below analyses because they were likely aware of the main hypotheses and true purpose of the experiment. The final analysis consisted of data from 358 participants, 205 females (57%) and 153 males (43%). No other demographic information was collected.

Expectation Check

Participants' responses to the expectation check were analyzed using hierarchical regression analysis in which expectation (dummy coded), picture type (dummy coded), and EBB (centered), then all 2-way interactions, and finally the 3-way interaction were entered as predictors of affective expectation. Importantly, this analysis revealed a significant main effect of expectation, $b = -1.556$, CI [-1.841, -1.271], $t(354) = -10.729$, $p < .001$, such that the negative expectation group ($n = 171$, $M = 4.55$, $SD = 1.55$) reported expecting to experience significantly more negative affect than the control group ($n = 187$, $M = 6.14$, $SD = 1.14$). Thus, the manipulation was effective in producing two groups with different expectations. There were no significant interactions, supporting successful random assignment to conditions (see Table 1).

Table 1. Hierarchical Regression Analysis of Expectation Check Items

	b	*SE B*	*β*	*t*	*p*	R^2	ΔR^2
Step 1						.270	.270***
Expectation	-1.556	.145	-.496	-10.729	.000		
Picture Type	-.270	.142	-.086	-1.896	.059		
EBB	.135	.103	.060	1.304	.193		
Step 2						.280	.010
Expectation x Picture Type	-.227	.290	-.062	-.783	.434		
Expectation x EBB	-.319	.209	-.103	-1.523	.129		
Picture Type x EBB	.290	.210	.095	1.380	.169		
Step 3						.280	.000
Expectation x Picture Type x EBB	.193	.421	.049	.459	.646		

Note: Asterisk (*) indicates ΔR^2 value is significant, $p < .05$. Asterisk (**) indicates ΔR^2 value is significant, $p < .01$. Asterisk (***) indicates ΔR^2 value is significant, $p < .001$

However, it is worth noting that the mean for the negative-expectation group was very near the midpoint of the scale, pointing to the possibility that the negative-expectation manipulation was not highly influential. Still, a single sample t-test demonstrated that the mean in the negative condition ($M = 4.55$, $SD = 1.55$) was significantly below the midpoint of the scale (5), $t(170) = -3.83$, $p < .001$, indicating that the participants in the negative-expectation condition did expect to experience negative affect in response to the paintings. However, the Cohen's effect size, $d = -0.29$, suggests a small to moderate expectation of negative affect.

EBB and Random Assignment

To investigate the possible relationship between EBB and the independent variables, expectation and picture type, a 2 (expectation) x 2 (picture type) ANOVA was

conducted with EBB as the outcome variable. This analysis revealed a significant main effect of expectation, $F(1, 354) = 13.075$, $p < .001$, such that the control group ($n = 187$, $M = 5.363$, $SD = .654$) was significantly higher in EBB than the negative-expectation group ($n = 171$, $M = 5.098$, $SD = .726$). This could indicate that receiving a negative expectation negatively influenced self-reported EBB. More precisely, there was a possible quirk in the randomization such that people low in EBB ended up in the negative condition and people high in EBB ended up in the control condition, though the lack of a significant interaction between expectation and picture type in the regression and ANOVA would indicate that this is unlikely. It is plausible, and highly likely, that this finding indicates carry over effects given the EBB measure was completed immediately after the affect measure with no task or time for negative affect to subside which may have influenced responding on the EBB measure.

Main Analyses

The same hierarchical regression analyses used to analyze the expectation check measure were also used to analyze reported affect. These analyses revealed no main effect of expectation, $b = -.075$, CI [-.341, .190], $t(354) = -.558$, $p = .58$, meaning that participants who received a negative expectation reported comparable affect to those who received no expectation. However, a significant main effect of picture type emerged, $b = -.379$, CI [-.640, -.118], $t(354) = -2.856$, $p = .005$, indicating that participants experienced more positive affect if they viewed the ambiguous relative to concrete paintings. This result was not predicted, and is actually inconsistent with the pre-testing data which

indicated that individuals viewed the pictures used in these ambiguous and concrete sets as affectively comparable (and neutral). Interestingly, there was a marginally significant main effect of EBB, b = .187, CI [-.002, .377], $t(354) = 1.942$, p = .053, indicating that higher EBB was perhaps associated with more positive affect.

Beyond this, the analysis only revealed a significant interaction between expectation and EBB, b = -.471, CI [-.852, -.089], $t(351) = -2.427$, p = .016, indicating that EBB moderated the difference in affect between participants in the negative- and no-expectation conditions. The predicted 3-way interaction between expectation, picture type, and EBB was not significant, b = .226, CI [-.541, .992], $t(350) = .579$, p = .563, nor was the two-way interactions between picture type and EBB, , b = .007, CI [-.376, .390], $t(351) = .036$, p = .971, or expectation and picture type, b = .483, CI [-.045, 1.012], $t(351) = 1.799$, p = .073. Further, an outlier analysis identified two extreme outliers in the EBB measure that were over 3 standard deviations from the mean. Removal of these outliers from the analysis did not notably change the results, as the Expectation x EBB interaction remained significant, b = -.457, CI [-.850, -.064], $t(349) = -2.288$, p = .023 (see Table 2).

Table 2. Hierarchical Regression Analysis of Affect DV

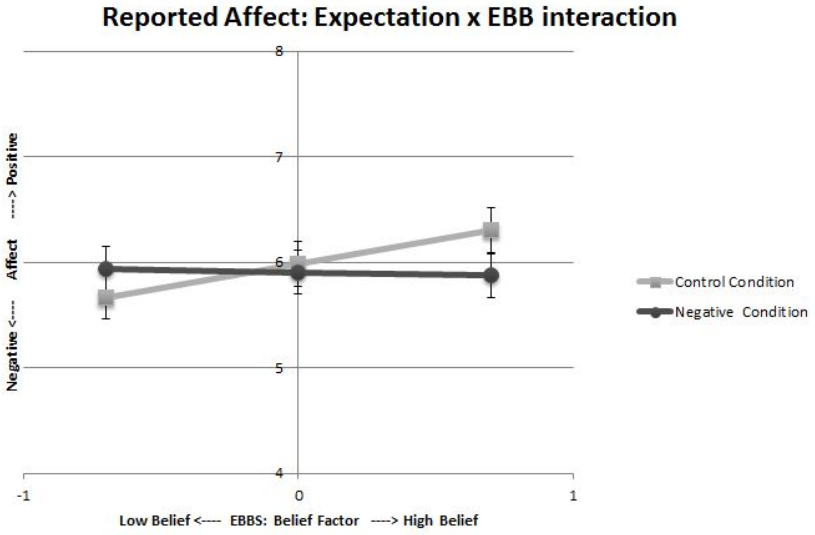
	b	*SE B*	*β*	*t*	*p*	R^2	ΔR^2
Step 1						.035	.035**
Expectation	-.075	.135	-.030	-.558	.577		
Picture Type	-.379	.133	-.149	-2.856	.005		
EBB	.187	.096	.103	1.942	.053		
Step 2						.060	.025*
Expectation x Picture Type	.483	.269	.163	1.799	.073		
Expectation x EBB	-.471	.194	-.187	-2.427	.016		
Picture Type x EBB	.007	.195	.003	.036	.971		
Step 3						.061	.001
Expectation x Picture Type x EBB	.226	.390	.071	.579	.563		

Note: Asterisk (*) indicates ΔR^2 value is significant, $p < .05$. Asterisk (**) indicates ΔR^2 value is significant, $p < .01$. Asterisk (***) indicates ΔR^2 value is significant, $p < .001$.

This thesis predicted that that when viewing ambiguous paintings, individuals high in EBB would correct against the expectation and would experience less expectation effects relative to those low in EBB. This thesis further predicted that when viewing concrete paintings, individuals high in expectation-bias belief would be more influenced by the expectation and would experience more expectation effects, reporting more expectation congruent affect than individuals low in expectation-bias belief. However, the analysis did not demonstrate a significant interaction between expectation, picture type, and EBB, and therefore these data do not support this prediction. That is, the interaction between expectation and EBB was unaffected by picture type (concrete vs. ambiguous), and failed to support the line of logic laid forth in the introduction. Rather, the interaction revealed by Carstens Namie and Handley (2015) again manifested unmoderated by picture type.

Importantly, however, the significant Expectation x EBB interaction is theoretically relevant, as Handley et al. (2009, 2013) and Carstens Namie and Handley (2015) have reported an interaction between these variables, although with opposing patterns. Therefore, this interaction was investigated in two ways. First, simple effects tests following the procedures outlined by Aiken and West (1991), demonstrate that participants in the negative- versus no-expectation conditions reported more negative affect at 1 SD above the mean for EBB, b = -.428, CI [-.855, .001], $t(351) = -2.0$, $p < .05$, but no such difference emerged at 1SD below the mean for EBB, b = .267, CI [-.108, .6430], $t(351) = 1.40$, $p = .162$. That is, this interaction pattern replicates the findings of Carstens Namie and Handley (2015) in that an expectation effect occurred for individuals high, not low, in EBB; this pattern is also perfectly opposite to that reported by Handley et al. (2009, 2013). Second, analysis of the slope of EBB in predicting affect indicated a slope significantly different from 0 in the control condition, b = .452, CI [.175, .729], $t(185) = 3.22$, $p < .01$, $R^2 = .053$., but not in the negative-expectation condition, b = -.044, CI [-.308, .219], $t(169) = -.332$, $p = .741$, $R^2 = .001$ (see Figure 3).

Figure 1. Expectation x EBB Interaction Graph - Regression Lines of Predicted Affect by Expectation Condition, anchored at 1SD Above and Below the mean for EBB. Interaction significant, $p < .02$.



Additional Analyses

A correlation analysis of the continuous measures indicates that a significant weak positive relationship exists among EBB, expectation check, and affect (see Table 3).

Table 3. Correlation Matrix - Pearson Correlation Coefficients of Continuous Variables

	1	***2***	***3***
1. EBB	1		
2. Expectation Check	.155**	1	
3. Affect	.110*	.231***	1

Note: Asterisk (*) indicates correlation is significant, $p < .05$. Asterisk (**) indicates correlation is significant, $p < .01$. Asterisk (***) indicates correlation is significant, $p < .001$

Further, in the control condition, there was a significant weak positive relationship between EBB and expectations of affect ($r = .167$, $p = .023$) and perceived

affect ($r = .23$, $p = .002$), indicating that the higher a person was in EBB the more positive they expected to feel in response to the paintings and the more positive they did feel after viewing the paintings. A significant strong positive correlation was also found between expectations of affect and resulting affect ($r = .416$, $p < .001$). It appears that in the control conditions, expecting more positive affect resulted in experiencing more positive affect. There were no significant correlations in the negative expectation condition.

DISCUSSION

Expectations about an upcoming experience often bias the actual or perceived experience later, a phenomenon known as the expectation effect (or bias). However, this phenomenon does not happen all of the time, and various factors moderate the effect. Of focus for the current thesis, previous research shows that the level of belief individuals' have that their expectations bias their experience moderates the influence of expectation on experience (Carstens Namie & Handley, 2015; Handley et al., 2009, 2013). However, research findings supporting this moderation conflict. Specifically, early investigation by Handley and colleagues (2009, 2013) found that people higher in EBB tend to correct against a given expectation and experience less expectation-bias than people who are lower in EBB, whereas Carstens Namie & Handley (2015) found the complete opposite; people higher in EBB experienced more expectation-bias than people lower in EBB. This thesis took the prior research findings as valid, and thus sought to isolate methodological differences in the research that might reveal a theoretically plausible moderator to the effect of expectation and EBB on experience evaluations. Of note, there is theoretical support for the possibility that the ambiguity of stimulus effects could influence attributional processes such that people high in EBB attributed the cause their affect to different sources depending on the encountered stimulus effects in addition to expectations. Thus, the primary goal of the current thesis was to investigate the opposing findings of Handley et al. (2009, 2013) and Carstens Namie and Handley (2015) by exploring the ambiguity of the effects of stimuli as a moderator of expectation effects in addition to EBB.

More specifically, research on salience and attribution (as well as ambiguity and attribution) suggests that individuals higher in EBB are more likely to focus on their expectations and beliefs when the stimuli they encounter have ambiguous effects on affect. And, given they believe expectations bias experiences, they will correct against the expectation-bias, reducing expectation effects (relative to those lower in EBB). Alternatively, individuals higher in EBB are less likely to focus on their expectations and beliefs when the stimuli they encounter have less ambiguous (more plausible and identifiable) effects on affect. In this case, participants are likely to view their affect as genuine, and thus not correct against the expectation-bias even if they are high in EBB. Thus, individuals will experience expectations effects when it is easier for them to identify plausible affect from the stimulus. To test these ideas, participants either received a negative or no expectation about a set of paintings, then viewed either ambiguous or less ambiguous (concrete) paintings, and then completed measures of affect and EBB. The current experiment used ambiguous paintings as a means to *conceptually* simulate the more ambiguous stimuli effects participants experienced in Handley and colleagues' (2009, 2013) experiments, placebo simulated alcohol and placebo analgesic cream respectively. Based on the above ideas, I predicted a three-way interaction between expectations (negative/no), picture type (ambiguous /concrete) and EBB. More precisely, Hypothesis 1 predicted more negative affect among participants who viewed ambiguous paintings and received a negative expectation (vs. did not), particularly at lower levels of EBB, whereas Hypothesis 2 predicted more negative affect among participants who viewed concrete paintings and received a negative expectation (vs. did not), particularly

at higher levels of EBB. Yet the predicted 3-way interaction between expectation, picture type and EBB was not significant and therefore does not support these hypotheses.

However, the primary analysis did reveal a significant interaction between EBB and expectation condition in a pattern that replicates Carstens Namie and Handley (2015), regardless of the types of pictures participants received. That is, the results did demonstrate the pattern predicted by Hypothesis 2, but regardless of whether participants viewed the ambiguous or concrete paintings. Thus, the current research does not confirm the idea that the ambiguity of stimulus effects can help explain the different EBB x Expectation interactions observed by Handley et al. (2009, 2013) versus Carstens Namie and Handley (2015). Assuming that the effects of the stimuli were sufficiently ambiguous in the current experiment, perhaps the ambiguity of stimulus effects is not a moderator of expectation-effects.

Further Exploration & Alternative Explanations

Salience

The findings of the current experiment did not rectify the conflicting findings of Handley et al. (2009, 2013) and Carstens Namie and Handley (2015), and did not support the hypothesis that the ambiguity of stimulus effects moderates the interaction between EBB and expectation on affective responding. It is possible that the current experiment did not sufficiently manipulate the ambiguity of the stimuli effects. This possibility is discussed in more detail in the limitations section. However it is also possible that ambiguity is not a moderator, and there are other methodological differences between the

Handley et al. (2009, 2013) and Carstens Namie and Handley's (2015) experiments that influence expectation responding. Considering stimulus salience greatly influences causal attributional, perhaps the salience of the stimulus influences expectation responding instead of (or more so than) ambiguity. Given this, perhaps the plausible effects of the ambiguous paintings were considerably more salient when making causal attributions than a drink or a cream. Phrased differently, perhaps the possible effects of the paintings used in the current research (concrete or ambiguous) were still sufficiently salient to elicit the pattern of responding seen in Carstens Namie and Handley (2015).

Future research could manipulate the salience of the stimulus effects to investigate the possibility that the salience of the stimuli effects moderates of the interaction between EBB and expectation on affective responding. This possibility could be explored by modifying the methodology used in the Wager et al. (2004) experiment by adding a low salience analgesic condition and adding the EBB measure from the current experiment. Recall from the introduction that in the Wager et al. (2004) experiment participants received painful heat applied to areas on their arm after the application of two creams. Participants received two expectations about the creams: that one cream would do nothing because it was a "control" cream with no inert properties and the other cream was an experimental analgesic cream and would reduce the pain. In reality the analgesic cream was really a placebo with no inert properties. Participants then received painful heat on each patch in alternating blocks during 3 phases: calibration, manipulation, and test phases. In the test phase, participants received painful heat at 3 different pain levels on each patch. In the manipulation phase, the participant was told the

pain was applied at a level 8 (of 10) on both patches but was at 8 on the control patch and only on 2 on the "analgesic" patch, thus making the pain reducing effects of the "analgesic" cream noticeable or salient especially in comparison with the control patch. In the test phase, participants were again told the pain was applied at level 8 but was really applied at level 5 on both patches. Participants reported less pain on the "analgesic" patch than on the control patch even though pain was reduced on both patches. However, the effects of the "analgesic" cream were noticeable or made salient in the manipulation phase in that the cream appeared to really reduce the pain (though it was because the pain was really reduced) so "analgesic" cream seemed more effective in the test phase. Adding a third condition would better manipulate the salience of the effects of placebo cream. The participants would receive expectations about two different "analgesic" creams tested against the control and three heat patches applied. The third condition could serve as a low salience condition in which the pain is applied the same as on the control patch but the participant has an expectation of pain relief. This would allow another comparison condition that has the same expectation with only the salience of the effects differing. Ideally EBB measure could be given before the application of the cream and painful heat tasks. Manipulating the salience of the stimulus in this way could potentially help identify specific mechanisms that are involved in expectation responding and determine whether EBB interacts with salience to moderate placebo effects. Such knowledge could possibly help medical professionals increase the effectiveness of prescribed medications and decrease side-effects.

The Expectation x EBB Interaction: An Issue of Internal & External Expectations?

The primary analysis did not support Hypotheses 1 or 2, and the only theoretically interesting and relevant finding was a significant two-way interaction between expectation and EBB which replicated the findings of Carstens Namie and Handley (2015). Specifically, when collapsing across picture type, there was no significant difference of reported affect between expectation conditions when participants were lower in EBB (1 SD below the mean for EBB), but was a significant difference of affect between expectation conditions (expectation effects) when participants were higher in EBB (1 SD above the mean). Looking at this interaction another way, an analysis of the slopes of EBB predicting affect revealed that the slopes significantly differed from 0 in the no-expectation condition, but not in the negative-expectation condition (the slope was nearly flat). In Carstens Namie and Handley (2015), the slope of EBB in the negative- and no-expectation conditions significantly differed from each other, but did not significantly differ from 0. This indicates that both conditions likely contributed to the interaction equally. The slope of EBB in the control condition was positive in both the current experiment and the Carstens Namie and Handley (2015) experiment and steeper in the current experiment. This might reveal something interesting about the influence of EBB on people when they have no external expectation. Perhaps when there are no external expectations, EBB interacts with personal or internal expectations, magnifying personal expectation effects at higher levels of EBB.

As hinted above, another possible reason that expectation responding differed in Handley et al. (2009, 2013) and Carstens Namie and Handley (2015) is that *internally*

generated and *externally* provided expectations may influence causal attribution of affect and expectation responding differently. More precisely, of the previous research into the influence of EBB on expectation responding, the Carstens Namie and Handley (2015) research was the only one to have a true control condition in which expectations about the upcoming stimuli were not manipulated. In Handley et al.'s research (2009), participants received either a positive or a negative expectation (an external expectation). In Handley et al. (2013), all participants received and expectation of pain from the experimenter (an external expectation), and some received an additional (external) expectation that a cream could reduce that pain, followed by a cold pressor task. Thus, all participants in the research of Handley and colleagues (2009, 2013) received external expectations of some sort from the experimenter; there were no true control conditions without a provided expectation. Therefore, perhaps when no external expectation exists, people are left with the influence of their internal cues and personal expectations to make causal attributions of affect. Further, the influence of expectations may differ depending on their source, externally provided or internally generated.

This reasoning is in line with research indicating that internal expectations can influence perceptions more heavily than external expectations, especially when the expectations conflict (Geers & Lassiter, 2005). Prior experience with a stimulus informs and influences internal expectations. And, when these internal expectations conflict with externally provided expectations for affect, people typically base their perception of their affective state on their internal expectations instead of externally provided expectations (Geers & Lassiter, 2005). For example, Geers & Lassiter (2005) investigated the

influence of internal and external expectations on expectation responding by manipulating participants pre-exposure to the stimulus. Specifically, about half of the participants were exposed to the main stimulus before the external expectation manipulation and main exposure to the stimuli, whereas about half of the participants were not. They found that when participants received an external expectation for their affective state that conflicted with the internal expectation that was formed by pre-exposure to the stimuli (previous experience), participants affect was less in line with the external versus internal expectations. As a result, participants did not experience expectation effects (from the externally provided expectation). So, perhaps when participants made causal attributions of their affect, the lack of an externally provided expectation in the control conditions of the present research and that of Carstens Namie and Handley's (2015) allowed participants' internal expectations to seem more causal than the effects of the stimuli. In this case, individuals in the control condition who are high in EBB might view their personal expectations as less biasing and not correct against them in determining their affective reactions to the paintings.

Furthermore, there was a positive correlation between EBB and expectations in the control conditions. Although this relation was not expected, it might help explain the positive relationship between EBB and affect. Participants higher in EBB also held more positive personal expectations regarding the pictures, and given they had no further external cues to help them interpret their affect, they relied on these expectations. Again, it is not clear why there was a relation between EBB and personal expectation in the first place, and this current line of thought serves as a potential post hoc explanation. As part

of this explanation, it is also necessary to understand why individuals high in EBB did not correct against the biasing influence of their personal expectations. One possibility that is certainly worth exploring is that individuals high in EBB do not believe internal, personal, expectations represent a bias. That is, individuals high in EBB might believe *externally* provided expectations represent an unwarranted bias on perception, but *personal* expectations do not (or, at least, the influence is perceived as legitimate and not a bias). This is an interesting possibility that can easily be explored in future research.

Future research could adapt the methodology of Carstens Namie and Handley (2015) to investigate the possibility that EBB interacts with internal and external expectations in a way that moderates expectation effect. More precisely, the experiment could add an internal expectation manipulation (prior exposure – no prior exposure) like that used by Geers and Lassiter (2005). For example, one could conduct an experiment in which participants are randomly assigned to view a small subset of positively rated paintings (internal expectation) or not, and randomly assigned to receive a negative expectation or no (external) expectation about the full set of paintings. Then, all the participants could view the full set of neutral paintings and complete the affect and EBB measures. It is possible that individuals high in EBB believe *externally* provided expectations represent an unwarranted and unwanted bias on perception and correct against the expectation as in Handley et al., (2009, 2013). But, perhaps individuals high in EBB perceive their *internal* expectations as legitimate and *not* a bias so they would not correct against the expectation. This is only one way that future research could examine that the possibility that internal and external expectations and EBB interact to moderate

expectation responding. The results of such research could help inform future placebo research by identifying specific mechanisms that are involved in moderating expectation responding.

Experimental Limitations & Future Directions

In general, the current results do little to help increase understanding about the influence of ambiguous versus concrete stimuli and expectation effects. It is possible that that potential effects of the ambiguous paintings were not ambiguous enough to *conceptually* simulate the ambiguity of the stimulus effects (of the placebo simulated alcohol and placebo analgesic cream) present in Handley and colleagues' (2009, 2013) research. Thus, the possible lack of comparable ambiguity of the effects among picture stimuli, placebo simulated alcohol, and placebo analgesic cream may represent a limitation to this study. Future research could use different stimuli with more ambiguous effects to better test the ideas presented in this thesis, such as a placebo 'medication' (e.g., sugar pill, syrup, topical cream, ointment, among others).

Another limitation of the current experiment is that the expectation manipulation might not have set a sufficiently negative expectation in the negative-expectation condition. Although the analysis of the expectation manipulation-check revealed a main effect of expectation (with more negative expectations in the negative expectation condition), the mean expectation of those in the negative condition was very near the midpoint of the 1 to 9 scale ($M = 4.55$, SD = 1.56), indicating that they were fairly neutral in their expectations. That is, participants in the negative expectation condition expected

fairly neutral affect, which may have influenced their subsequent affect. However, a single sample t-test found that the mean in the negative condition ($M = 4.55$, $SD = 1.55$) significantly differed from the midpoint of the scale (5), $t(170) = -3.83$, $p < .001$, $d = -0.29$, indicating that the participants in the negative condition did expect to experience negative affect in response to the paintings. Yet, when comparing the negative expectations of participants in the current experiment to those of participants in Carstens Namie and Handley (2015), the negative expectation does not seem as strong as in Carstens Namie and Handley (2015), $M = 3.45$, $SD = 1.78$, $t(92) = -8.42$, $p < .001$, $d = -.87$, as indicated by the effects sizes. In Carstens Namie and Hanley (2015) the Cohen's effect size was much larger, $d = -.87$, than the small effect size, $d = -0.29$, of the current experiment. The negative-expectation manipulation used in the current experiment was the same one used in the Carstens Namie and Handley (2015) experiment with one exception. In Carstens Namie and Handley (2015) participants answered an attention check question intended to eliminate fraudulent survey responses, in that there are illegitimate or fraudulent people who pose as M-Turk workers that use computer programs or other means to simply mark random answers instead of really taking the survey. Although unintentional, it is possible that the attention check question used, *"What was the highest rated mood (by percentage) reported by Amazon Mechanical Turk Workers after viewing this set of paintings?"* may have also strengthened the expectation of negative effects by making those effects more salient to participants who had to mark the mood/feeling. At the very least, this illuminates the possibility that the negative expectation in the current experiment was so weak that there were no real expectation

effects against which people higher in EBB could correct. Future research should look for ways to improve the negative expectation manipulation to make it stronger such as adding the attention check question used in Carstens Namie and Handley (2015). Perhaps the stronger negative expectation would produce the results predicted in the current thesis.

A third problem and major limitation of the current research is that a 2 (expectation) x 2 (picture type) ANOVA with EBB as the dependent variable revealed a significant main effect of expectation such that the control group was significantly higher in EBB than the negative expectation group. This could indicate a few possibilities. Perhaps receiving a negative expectation negatively influenced self-reported EBB. Consistent with this possibility, the EBB measure was completed immediately after the affect measure with no intermediate task or time for negative affect to subside which may have influenced responding on the EBB measure. This finding could also indicate a problem with random assignment to conditions in that, on average, people lower in EBB were assigned to the negative expectation condition. However, this is unlikely because there was no significant interaction between expectation and picture type in the ANOVA indicating that, overall, random assignment appears to have worked. Due to these possibilities, it would be prudent for future research to alter the administration of the EBB measure in one of three ways. First, researchers could counter-balance the experiment so that people are randomly assigned to respond to the EBB measure before or after receiving the expectation manipulation. This would counterbalance administration of the EBB measure thus reducing the likelihood of carry-over effects

influencing EBB reporting. Second, researchers could add a distractor task between reporting of affect and the EBB measure. This would give the participants' affect time to subside so that it does not influence self-reports of EBB. Third, researchers could administer the EBB measure in a pre-screening context well before the actual experiment. This is the best of the three options as it would eliminate the chance of carry-over effects or residual affect influencing self-reporting of EBB.

CONCLUSIONS

The current thesis sought to investigate conflicting findings of previous research into the moderating role of EBB on the expectation-bias. Specifically, the current experiment sought to conceptually replicate and extend previous research in order to identify why people higher in EBB experienced *less* expectation-bias compared to people lower in EBB in Handley et al. (2009, 2013), but experienced *more* expectation-bias compared to people lower in EBB in Carstens Namie and Handley (2015). This thesis hypothesized that differing levels of ambiguousness of the stimuli effects (concrete or ambiguous) could have resulted in the opposing findings. Unfortunately, the current experiment did not support the hypotheses. Yet, an expectation x EBB interaction indicates that when collapsing across picture type, the pattern of responding replicated Carstens Namie and Handley (2015). Specifically, there were more expectation effects at higher levels of EBB.

Importantly, limitations of the methodology may explain the lack of predicted effects. I proposed alternative explanations for the conflicting findings of Handley and colleagues (2009, 2013) and Carstens Namie and Handley (2015) and recommend avenues for future research to explore these ideas. The current results succeeded in raising more questions than were answered. However, the current results may have identified other interesting paths of investigation of expectation responding that could lead to identifying and clarifying specific mechanisms involved in the moderation of expectation effects.

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