On the Relation between Valence Weighting and Self-Regulation

THESIS

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Abstract

Valence weighting, a psychological process in which positive and negative signals are integrated through a weighting process to arrive at an initial appraisal of a stimulus, has previously been shown to affect judgments and behavior across a variety of domains, ranging from the interpretation of ambiguous situations to risk-taking. The current research examined the role of valence weighting in self-regulation, the processes through which individuals pursue goals. In Study 1, the focus lay on the relation between valence weighting tendencies and impulse control in the context of unhealthy eating. Based on previous research, it was predicted that those with a more positive valence weighting bias would appraise their impulses more positively than those with a more negative valence weighting bias, resulting in more impulsive behavior. First, valence weighting tendencies were assessed via an attitude formation and generalization task referred to as BeanFest. Then, participants reported whether they had attempted to avoid eating unhealthy food and the frequency with which they consumed a variety of unhealthy foods over the previous week, as well as the stress they experienced over the previous two weeks. Valence weighting tendencies predicted whether individuals accepted or rejected their impulses, as those with a more positive valence weighting bias consumed unhealthy food more frequently than those with a more negative valence weighting bias. This was particularly the case when individuals were actively trying to avoid eating unhealthy food and when they were under relatively high amounts of stress,
demonstrating the role of goals and motivation and/or opportunity to further deliberate on one’s initial appraisals in moderating this relation.

Study 2 focused on the relation between valence weighting and progress assessments in the context of a studying task in which individuals prepared for a test. When individuals are faced with a situation in which they must assess their readiness for a challenge (like the one created in this study) they must ask themselves, “Have I done enough? Am I ready for the challenge?” Because such appraisals should contain positive and negative features, it was predicted that those with a more negative valence weighting bias would reach judgments of readiness more slowly than those with a more positive valence weighting bias. Participants in this study first played BeanFest, after which they engaged in a studying task that was followed by an exam. Indeed, individuals with a more positive valence weighting bias tended to spend less time studying the material, which in turn led them to a tendency to score lower on the test. Furthermore, when faced with a decision as to whether they wanted to proceed to the test after having finished the passage, those with a more positive valence weighting bias took less time to deliberate. Thus, it appears that valence weighting shapes assessments of progress. Taken together, the work presented here demonstrates that valence weighting tendencies play a role in self-regulation, thereby determining the extent to which individuals succeed or fail in reaching their goals.
Dedication

Dedicated to my parents, Francisco Augusto Granados de Alba and Kattia Samayoa de Granados.
Acknowledgments

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Introduction

If a person were to spend enough time in fitness centers, they would notice a sharp spike in attendance in the month of January. This annual increase in attendance is the result of an influx of “New Year’s resolutioners,” people who use the beginning of new calendar year as an impetus for making positive changes in their life, seeking to improve their fitness. What drives these individuals to exercise is their adoption of a goal, a mental representation of a desired (i.e., positively valued) end-point (Fishbach & Ferguson, 2007). Once a resolutioner is inside the fitness center exercising, they have already engaged two processes that are crucial for goal achievement by developing a plan and putting it into action (Wilkowski & Ferguson, 2016). However, achieving a goal involves other processes as well. Individuals must assess their progress from time to time by comparing the difference between their current state and their desired state so as to detect and act on discrepancies (Carver & Scheier, 1982; Wilkowski & Ferguson, 2016). Furthermore, the path to goal achievement is not free of obstacles: there are often temptations that conflict with one’s goals, and one must control the impulses these temptations generate (Milyavskaya & Inzlicht, in press; Wilkowski & Ferguson, 2016). This collection of processes through which individuals pursue goals is referred to as self-regulation (Mann, de Ridder, & Fujita, 2013).
The current research provides evidence linking self-regulation to valence weighting, a fundamental psychological process in which positive and negative signals are integrated through a weighting process to arrive at an initial appraisal of a stimulus. The first study examines the association between valence weighting and impulse control in the context of unhealthy eating behavior over the course of one week, while the second study examines the association between valence weighting and goal progress assessments in the context of a studying task and test preparation. I begin by introducing the concepts of impulse control and progress assessment, and link each to goal achievement. I continue by reviewing the growing literature on valence weighting, after which I link each self-regulatory process to valence weighting.

Impulse Control and Goal Pursuit

In a world without immediately gratifying temptations that are inconsistent with our long-term goals, we would all walk around at our ideal weights and have plenty of money in our savings accounts. Unfortunately, we encounter tempting stimuli constantly, and when this occurs, they trigger desire-related impulses that seem to draw us toward them. When faced with such stimuli, a decision must be made as to whether one should act on the impulse or not. Acting on the impulse represents a setback to the pursuit of longer-term goals, while abstinence advances the pursuit of these longer-term goals. Thus, successful goal pursuit under the conditions described above (i.e., when directly faced with a temptation) depends largely on how impulses are construed and handled. To illustrate, imagine that an individual is unhappy with their current body weight and decides to start a diet that eliminates consumption of unhealthy food. When they attend
an office party one evening, they spot delicious fudge brownies. As they stand in front of the brownies, their positive attitude toward such treats may be automatically activated. An impulse to consume these unhealthy treats is experienced, yet at the same time, with just a bit of deliberation, they may feel uneasy about this impulse because doing so would conflict with their weight-loss goal. Whether they consume the brownies or pass on them will depend on how well the impulse can be controlled.

Behavioral research supports the intuitive idea that impulse management influences goal achievement. In one such demonstration, the impulse control ability of children was measured during the first decade of life using reports from various sources, including experimenter-observers, parents, teachers, and the children themselves, as part of a large longitudinal study. When the children became adults, their health, wealth, and criminality were assessed. The results revealed that children that could better control their impulses during childhood grew up to be healthier, wealthier, and less likely to commit crimes relative to those that were less able to control their impulses (Moffitt et al., 2011). Additionally, a meta-analysis revealed that self-reports of the ability to control impulsive reactions predicted academic and work success, eating and weight management, and interpersonal functioning, among others (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012). Thus, impulse control appears to influence the degree to which individuals are successful in achieving normatively-desired goals.

Impulse control also aids in the achievement of more immediate personal goals. In one study conducted by Crescioni and his colleagues (2011), individuals seeking to lose weight (i.e., those with a weight loss goal) enrolled in a 12-week weight loss program.
program designed to improve eating and exercising habits. During the group’s initial meeting session, participants reported on their ability to control impulses via a self-report scale. For the next twelve weeks, participants were weighed at weekly meetings and logged their dietary consumption and exercise via a web-based application. Presumably, during these twelve weeks individuals were faced with temptations at certain points and had to respond to them. At the end of the study, analyses revealed that impulse control ability predicted caloric consumption, calories burned through exercise, and weight loss such that those better able to control impulses consumed fewer calories, burned more calories through exercise, and ultimately lost more weight.

Putting these findings together, it is clear that impulse control facilitates the pursuit of long-term goals. When temptations that are inconsistent with such goals are encountered, successful goal pursuit requires that an individual inhibit their impulsive reactions in favor of acting in line with their goals.

Assessments of Goal Progress and Goal Pursuit

Controlling incongruent impulses, however, is only one of several self-regulatory processes. Much like travelers occasionally check how many miles they have covered during a long road trip, individuals pursuing goals assess their progress toward the goal from time to time. According to control theory (Carver and Scheier, 1982), this process involves comparing one’s current state to a reference or ideal state. When a discrepancy is detected between these states, actions are taken to reduce it. To illustrate, imagine an undergraduate student in the process of preparing for an upcoming exam. As they advance through the material, they must assess how well they are learning. If the student
perceives that they learned the material relatively well, they are likely to move on. On the other hand, if they perceive that they did not learn all that well, they are likely to keep studying that material.

Research suggests that such assessments of progress influence future goal-directed behavior. Female dieters who were made to feel that they had not made adequate progress toward their weight loss goal were more likely to choose a healthy snack as a parting gift, over an unhealthy one, relative to those made to feel that they had made more progress toward their goal (Study 1; Fishbach & Dhar, 2005). In a follow-up study, undergraduates that were made to feel that they were making relatively poor progress toward completing their academic tasks (as compared to a fictitious peer) expressed greater interest in engaging in academic activities than those that were made to feel they were making relatively good progress (Study 2; Fishbach & Dhar, 2005).

These assessments of progress should have several consequences. For example, it is easy to imagine that a student that reaches a premature positive assessment of their exam preparation will perform more poorly than a student that does not, as a result of having spent less total time studying. Thus, assessments of goal progress should impact goal achievement through their influence on goal-directed behavior.

Valence Weighting

The central argument of this paper is that valence weighting is linked to both impulse control and perceptions of goal progress. Before laying out the rationale for the link, it’s beneficial to gain a better understanding of valence weighting. To start, one can pose a seemingly simple question: when faced with an object, how do people decide
whether to approach or avoid it? Sometimes these decisions are guided by stored evaluations in memory that are activated by the attitude object. Objects that activate negative evaluations are avoided, and those that activate positive evaluations are approached. When individuals are faced with a novel object (i.e., one toward which there is no stored evaluation), however, they must consider and weight the positive and negative aspects of the novel object to arrive at an evaluation, a process referred to as valence weighting. Engagement of this valence weighting process represents an instance of attitude generalization, as the process requires that individuals weight the extent to which a novel stimulus resembles previously known stimuli toward which they hold positive attitudes versus known stimuli to which they hold negative attitudes. For this reason, valence weighting can be assessed via an attitude formation and generalization task called BeanFest. In BeanFest, participants first form positive and negative attitudes toward previously unfamiliar bean stimuli that differ in their shape and number of dots by interacting with them in the context of a game. Following this game phase, they are presented with novel bean stimuli (i.e., beans not encountered during the game phase) that bear a resemblance to the positive and negative game beans, and they are asked to indicate whether the bean would have been helpful or harmful during the game.

Of interest for the current paper is an individual’s pattern of attitude generalization during the test phase. When individuals evaluate a novel beans, do they weight resemblance to a known negative or a known positive more heavily? The extent to which participants classify novel beans as more positive or negative than would be expected based on their pattern of learning is referred to as their valence weighting bias.
Some individuals weight resemblance to a known negative more heavily than resemblance to a known positive, which means that their negative attitudes generalize more strongly. These individuals are said to have a negative valence weighting bias. In contrast, some individuals weight resemblance to a known positive more heavily than resemblance to a known negative, which means that their positive attitudes generalize more strongly. These individuals are said to have a positive valence weighting bias (Fazio, Pietri, Rocklage, & Shook, 2015).

Importantly, the attitude generalization tendencies captured by BeanFest are related to judgments across a variety of contexts. In an initial illustration, Pietri, Fazio, and Shook (2013) first assessed valence weighting tendencies via BeanFest. Then, to measure evaluations of novel situations, the researchers used the Rejection Sensitivity Questionnaire (Downey & Feldman, 1996). Here, participants were presented with rejection-related scenarios (e.g., asking a stranger out on a date), and had to indicate how much anxiety they would feel in that situation and how likely it was that the other person would accept their request. Such judgments regarding novel situations also represent attitude generalization, and thus, require the construction of an evaluative response on the basis of weighting the positive and negative signals associated with the target stimulus. The results revealed that those with a more positive valence weighting bias reported less sensitivity to rejection. In subsequent studies involving other hypothetical scenarios, those with a more positive valence weighting bias also showed less threatening interpretations of ambiguous events and more tolerance to risk (Pietri et al., 2013).
These attitude generalization tendencies also influence behavior. For example, the valence weighting bias was found to correlate with a laboratory-based measure of risk-taking such that those with a more positive valence weighting bias displayed riskier behavior (Pietri et al., 2013). In a particularly striking demonstration of the reach of valence weighting, researchers focused on friend-making during the first semester of college (Rocklage, Pietri, & Fazio, in preparation). College freshmen were recruited and invited to the lab for an initial session in which they played BeanFest and indicated the number of friends on campus that they had met prior to and since their arrival to campus. Two months later, these freshmen completed a survey in which they listed the number of friends made since the first lab session. Those with a more positive valence weighting bias reported making more friends in the intervening two-month period, even when controlling for the number of friends initially listed and trait extraversion. Apparently, those with more positive valence weighting tendencies were more open to overtures from the many strangers that they were meeting and arrived at more positive interpretations of their initial interactions, thus promoting their development of social relationships.

The wide range of judgments and behaviors with which valence weighting correlates suggests that it is a fundamental psychological process involved whenever the integration of positive and negative valence is required (Fazio et al., 2015). However, valence weighting exerts its greatest influence on judgment and behavior under certain conditions, namely when people lack the opportunity or motivation to override their initial evaluative appraisals. In a study that demonstrates the role of the opportunity factor, Rocklage and Fazio (2014) first brought participants into the lab to have their
valence weighting tendencies assessed via BeanFest. Upon completing BeanFest, participants played a similar game called DonutFest. Here, participants interacted with novel donuts that varied in color (ranging from yellow to orange in 10 steps) and the size of their hole (ranging from relatively small to relatively large in 10 steps), some of which carried positive value while others carried negative value. Of interest here was the sampling behavior displayed by participants. Given that information about the value of a donut was now contingent on approach behavior, participants had to consider the potential benefits and risks of approaching novel donuts, particularly at the start of the game when information about the value of each donut is absent. In this environment, approaching these unknown donuts more often reflects greater riskiness. Importantly, half of the participants made the approach/avoid decision in DonutFest under time pressure (i.e., with restricted opportunity to deliberate), while the other half had no such restriction (i.e., with unrestricted opportunity to deliberate). The results revealed that individuals who were under time pressure showed greater correspondence between their valence weighting tendencies and their approach behavior than those under no such pressure. Specifically, when under time pressure, those with a more positive valence weighting bias approached donuts more often, indicating riskier behavior, whereas no significant relation was present for those not under time pressure.

Another factor influencing the strength of the relation between valence weighting and behavior is the motivation to further deliberate on one’s initial evaluative appraisal. In a follow-up to the Rocklage and Fazio (2014) study described above, participants were once again brought into the lab to play the BeanFest game. To manipulate the motivation
to further deliberate on one’s initial evaluative appraisals, participants in this study either read an article on the benefits of overriding one’s intuition (i.e., providing high motivation to further deliberate) or on the benefits of acting on one’s intuition (i.e., providing low motivation to deliberate). After reading this article, participants proceeded to the Balloon Analogue Risk Task (Lejuez et al., 2002), a measure of risk-taking behavior. In this task, participants are presented with a balloon that can be pumped to increase its value on every trial. When participants decide to stop pumping, they can collect the points accrued to that point. Crucially, the balloon bursts after an unknown number of pumps, and if it bursts, participants receive no points for that trial. Thus, the benefit of accruing points must be weighed against the risk of losing it all. The results revealed that valence weighting predicted balloon pumping behavior: those with a more positive valence weighting bias pumped the balloon more often, demonstrating riskier behavior, but only when motivation to further deliberate was relatively low. This work suggests that valence weighting shapes initial appraisals that act as default responses to a target object when individuals lack the motivation or opportunity to further deliberate.

**Valence Weighting and Impulse Control**

With all of this in mind, impulse control can readily be construed as an issue of valence weighting. Returning to the case of the dieter with a sweet tooth, when this individual encounters the brownies, an impulse will be activated. Importantly, impulses are by their nature associated with positivity – they are, after all, urges to act so as to obtain a desired outcome, in this case, the consumption of brownies. A key determinant of whether the dieter will act on the impulse or control it is how accepting they are of the
positive signal inherent to the impulse. Do they accept the positive signal or question it? The more accepting an individual, the greater the likelihood that they will act on the impulse because other mental processes (such as control processes activated by a goal) have less of an opportunity to lead the individual to reject the impulse. The reasoning behind the link between valence weighting and impulse control is those with a more positive weighting bias may be more likely to accept the positively-valenced signal inherent to the impulse, whereas those with a negative bias may be more likely to question it. Thus, individuals with a more positive valence weighting bias should tend to show poorer impulse control relative to those with a more negative valence weighting bias.

This reasoning was tested in recent research by Zunick, Granados Samayoa, and Fazio (2017). In an initial study, participants first had their valence weighting tendencies assessed via BeanFest, after which they engaged in a persistence task that lasted three minutes. In the persistence task, participants were presented with an anagram (a collection of letters in scrambled order) and their task was to rearrange the letters so as to create a real English word. A single anagram appeared on the screen at a given time. Participants had the option of either providing a response or skipping to a different anagram. Importantly, some of the anagrams were unsolvable (i.e., their letters could not be rearranged to create English words). The researchers reasoned that encountering such unsolvable anagrams would create frustration, and that this frustration would trigger an impulse to quit by skipping to another anagram. After completing the anagram persistence task, participants responded to the Brief Self-Control Scale (Tangney et al.,
2004), a 13-item scale that assesses trait self-control ability. This last instrument was intended to serve as a proxy of motivation and/or opportunity to regulate initial impulses, as those that report high ability should be those that are the most motivated and have sufficient opportunity (e.g., mental resources) to override their initial impulses. The results revealed an interaction between valence weighting and trait self-control when predicting passing responses to the unsolvable anagrams. A more positive valence weighting bias was significantly associated with a greater number of skips on unsolvable anagrams, but only for those low in trait self-control. For those high in trait self-control, no significant association was found. Thus, among individuals who lacked the motivation and/or opportunity to override their impulses, valence weighting related to acceptance versus rejection of the impulse to quit in response to a frustrating anagram.

Although the above study supports the existence of a relation between valence weighting and impulse control, the evidence rests on the assumption that the unsolvable anagrams evoked an impulse to skip. To clarify the role of impulses in the observed relation, Zunick and colleagues (in press) conducted a second study. Participants once again played BeanFest and completed the Brief Self-Control Scale, but this time the Stroop task was selected as the dependent measure, as it is a task in which the provision of an impulse is much clearer. In the Stroop task, participants are shown names of colors (e.g., RED) in fonts of different colors (e.g., the color yellow), and their task is to name the color of the font. Importantly, saying the color name is a relatively automatic and dominant tendency, an impulse, whereas saying the font color is not. Thus, this is a straight-forward task on congruent trials when the color name and the font color match
(e.g., RED in red font). However, it becomes much more difficult on incongruent trials when the color name and font color do not match (e.g., RED in yellow font) because participants must inhibit the impulse to respond with the color name, and must instead name the color of the font. As a result, errors on incongruent trials represent impulse-control failures. Consistent with the results of the previous study, an interaction between valence weighting and trait self-control was evident when predicting Stroop performance. A more positive valence weighting bias was associated with a greater number of errors on incongruent trials, but this was particularly the case for those low in trait self-control. No significant relation between valence weighting and impulse control was found for those relatively high in trait self-control. Parallel results were discovered for the reaction time data such that a more positive valence weighting bias was associated with a larger difference between responses on congruent relative to incongruent trials, indicating poorer impulse control, and as before, this effect was all the more evident for those low in trait self-control. Thus, once again, valence weighting related to acceptance of the impulsive tendency, at least for those who lacked the motivation and/or opportunity to check their impulses.

Valence Weighting and Assessments of Goal Progress

Like impulse control, assessments of goal progress should also be related to valence weighting. To understand why, imagine once again that the student from the earlier example is assessing their progress in preparing for an exam. This assessment is essentially a simulation in which the student asks, “Have I done enough? Am I ready for the test?” There are likely to be both positive features of the simulation suggesting that
enough has been done, as well as negative features suggesting that enough has not been done. Thus, answering the question “have I done enough?” should be, at least partly, a matter of valence weighting. Individuals with a more positive valence weighting bias should give more weight to the positive features of the simulation, resulting in more positive assessments of their progress. Essentially, these individuals should be more likely to answer “yes” to the question “have I done enough?” On the contrary, individuals with a relatively more negative weighting bias should give relatively more weight to the negative features of the simulation, resulting in more negative assessments of their progress. These individuals should be more likely to answer “no” to the question “have I done enough?”

While existence of a link between valence weighting and assessments of goal progress makes sense given what is known about each process, no research has yet tested this conceptual reasoning.

**Current Research**

The aim of the current investigation is to examine the association between valence weighting and self-regulation. This is done through two studies, each of which examines the relation between valence weighting and one of the self-regulatory processes described above. Study 1 focuses on the relation between valence weighting and impulse control, and extends this line of research in several ways. First, it examines this relation in a real-world context by assessing frequency of unhealthy eating over a one week period. This stands in contrast to previous work which has examined this relation using laboratory-based impulse-control tasks. Second, instead of assessing dispositional motivation and/or
opportunity to regulate initial impulses (via a measure of trait self-control) as previous studies have done, Study 1 focuses on assessing stress, a situational variable that impairs motivation and/or opportunity to regulate initial impulses.

Study 2 expands on this program of research by examining the relation between valence weighting and a different self-regulatory process, goal progress assessment. Specifically, participants were immersed in a studying situation in which their goal was to prepare for a test by learning the material contained in a passage. Of particular interest was the influence of valence weighting on test performance through valence weighting’s effect on time spent studying, as well as its influence on time spent deliberating about one’s readiness. Valence weighting should shape the assessments that drive individuals to spend less time studying and less time deliberating.
Study 1

In Study 1, the idea that valence weighting tendencies would be related to impulse control in the domain of eating was put to the test. Participants were first brought into the lab to have their valence weighting tendencies assessed via BeanFest. Then, participants completed a questionnaire that assessed (a) dietary concern (i.e., whether individuals wanted to avoid eating unhealthy foods) over the past week, (b) the frequency of unhealthy eating over the past week, and (c) the amount of stress experienced over the past two weeks, as well as other measures not relevant to this investigation. First, it was predicted that dietary concern would predict frequency of unhealthy eating. Those concerned with avoiding unhealthy food should, on average, eat unhealthy food less frequently, as having a goal that is inconsistent with food-related impulses should lead individuals to reject their impulses on some occasions. Importantly, it was also predicted that the influence of valence weighting on frequency of unhealthy eating would depend on dietary concern. For those individuals that expressed dietary concern, having a more positive valence weighting bias was predicted to be associated with greater frequency of unhealthy eating because these individuals should be more accepting of their food-related impulses, leaving less opportunity for control processes to intervene. On the other hand, those with a more negative valence weighting bias should question their impulses to a greater degree, providing an opportunity for control processes to lead to a rejection of the
impulse. For those that did not express dietary concern, this association was expected to be relatively weaker because, even though those with a more negative valence weighting bias may question their impulses, they will not experience any countervailing force. They do not have a goal that is incongruent with the impulse.

The inclusion of the stress measure in this study provided an opportunity to examine the influence of this variable on frequency of unhealthy eating, as well as the role of valence weighting in moderating this effect. To start, increased stress was expected to be associated with greater frequency of unhealthy eating. Relatively high levels of stress should diminish one’s motivation and/or opportunity to make deliberative choices about food consumption, and hence, those experiencing higher levels of stress should engage in more frequent unhealthy eating. However, this effect was expected to depend on an individual’s valence weighting bias. Specifically, a more negative valence weighting bias may lead to more negative appraisals of these impulses, and hence, lessen the effect of stress on unhealthy food consumption. Conversely, a more positive valence weighting bias may lead individuals to weight more heavily any presumed stress-reducing and comforting benefits of tasty foods, thereby exacerbating the effect of stress on unhealthy food consumption.

Methods

Participants

One hundred and forty-six undergraduate students participated in the study as partial fulfillment of a course requirement. In total, 18 participants were excluded from the analyses: two participants were excluded for pressing a single response key during the
entire test phase of BeanFest (indicating a lack of effort), one participant was excluded for indicating that their responses were not truthful, six participants were excluded for failing an attention check, and nine participants were excluded for having participated in prior research employing BeanFest. The final sample consisted of 128 participants (52 men and 76 women).

**BeanFest**

The BeanFest procedure detailed here follows from that of previous valence weighting work (e.g., Pietri et al., 2013). The stimuli used in the game consist of previously unfamiliar beans. These bean stimuli vary in shape (circular to oblong) and number of dots (one to ten), forming a 10 x 10 matrix. Six beans from six different regions of the matrix are selected for presentation (36 beans in total), with each region being associated with either a positive or negative point value (see Figure 1). Before the game phase, participants were told that their objective in the game was to accumulate points. Their point total at the start of the game was 50 points. On each trial, a bean appeared on the screen, and participants had to decide whether to select it. If participants selected a positive bean, they were shown its value and 10 points were added to their total. If they selected a negative bean, they were shown its value and 10 points were deducted from their total. If participants avoided a bean or refrained from responding, the value associated with the bean was displayed on the screen, but their point value remained unchanged. Thus, participants learned about the valence of the beans and developed attitudes toward them through their interaction during the game. If a participant’s point total dropped to zero, they were informed that they had lost the game,
and the game restarted with 50 points to their credit. If a participant’s point total reached 100 points, they were informed that they had won, and the game restarted with 50 points to their credit. Importantly, the number of times that a participant won or lost had no bearing on the value of the beans or the number of beans they saw. All participants completed a practice block consisting of six trials, followed by three game blocks in which they saw 36 beans in each block.

Following the game phase, knowledge of the beans was tested. During the test phase, participants saw all 100 beans from the matrix, the 36 beans from the game phase plus 64 novel beans that varied in resemblance to the game beans. One at a time, participants saw a bean and indicated whether it would have been helpful or harmful during the game. However, they received no feedback about their choices. Thus, the test phase allowed for an assessment of the extent to which participants learned the valence associated with each game bean, and how these attitudes generalized to the novel beans that varied in resemblance to game beans.

The calculation of valence weighting bias focuses on the pattern of classification of novel beans. However, the categorization of novel beans is partly a function of learning of the positive and negative beans. Thus, to account for these differences in learning, valence weighting bias was calculated as the deviation between the actual average response to novel beans and the estimated response to novel beans based on the learning of game beans derived from a normative regression equation acquired from an aggregate sample of over 1894 Ohio State students who have participated in BeanFest.
In this way, valence weighting bias indexes the extent to which participants classify novel beans as more positive or negative than would be expected based on their pattern of learning. A more positive (negative) score indicates that participants classified more novel beans as positive (negative) than expected on the basis of their pattern of learning.

**Dietary Concern Measure**

Participants reported whether they were concerned about their dietary intake over the past week (“During the last week, I was trying to avoid eating unhealthy foods.”) on a dichotomous response scale (“Yes” or “No”). Seventy-one participants indicated being concerned with dietary intake, and 53 indicated not having such concern.

**Unhealthy Eating Scale**

To assess consumption of unhealthy food, participants completed an adapted five-item version of the Unhealthy Eating scale (Job, Walton, Bernecker, & Dweck, 2015). The scale items assess the frequency of consumption of various unhealthy, yet tempting foods (junk food, chocolates, salty snacks, sweets, and sugary beverages) over the previous week on a seven point scale (1 = Never, 2 = 1 time per week, 3 = 2 times per week, 4 = 3– 4 times per week, 5 = 5– 6 times per week, 6 = 1 time per day, 7 = two or more times per day). An average score indicating the frequency of unhealthy eating over a one-week period was calculated for all participants ($M = 3.15, SD = 0.97$). The scale

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1 The normative regression equation for calculating the expected pattern of novel bean classification on the basis of learning during the game phase is $Novel\ Beans = 0.59(Proportion\ of\ Positive\ Game\ Beans\ Correct) - 0.83(Proportion\ of\ Negative\ Game\ Bean\ Correct) + 0.08$. 

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showed reliability somewhat below recommended standards ($\alpha = 0.663$), but this was not deemed a pressing concern given that the intent was to assess a range of eating behaviors that make up the construct of unhealthy eating, and these different behaviors are not necessarily correlated with each other.

*The Inventory of College Students’ Recent Life Experiences*

To assess the stress faced by participants, they completed The Inventory of College Students’ Recent Life Experiences (Kohn, Lafreniere, & Gurevich, 1990). This instrument asked participants about the everyday stressors they dealt with over a two-week period. One at a time, participants were presented with forty-nine stressors faced by college students (e.g., “Conflict with professor(s)/instructor(s)”), and had to indicate (a) how frequently they experienced the stressor and (b) how stressful they found it to be on a four point scale ($1 = \text{Not at all}, 2 = \text{Only slightly}, 3 = \text{Distinctly}, 4 = \text{Very much}$). Both scales showed excellent reliability ($\alpha = 0.915$ for frequency judgments; $\alpha = 0.928$ for stressfulness judgments). Given that average ratings across the items ($M_{\text{frequency}} = 1.71$, $SD_{\text{frequency}} = 0.37$; $M_{\text{stressful}} = 1.69$, $SD_{\text{stressful}} = 0.44$) were highly correlated for these two judgments ($r = 0.918$), the two measures were standardized and then averaged to yield a composite measure of stress.

*Results*

First, an Ordinary Least Squares (OLS) regression analysis was conducted predicting average frequency of unhealthy eating over a one-week period from valence weighting bias, dietary concern, and their interaction term. This analysis revealed a significant main effect of dietary concern on frequency of unhealthy eating, $\beta = 0.376$
indicating that not being concerned with dietary intake significantly predicted greater frequency of unhealthy eating over a one-week period. Importantly, this analysis also revealed a significant interaction between valence weighting bias and dietary concern, $\beta = -0.171$ (95% CI: -0.338, -0.005), $t(124) = -2.04, p = 0.04$, such that a more positive valence weighting bias significantly predicted greater frequency of unhealthy eating for those that expressed dietary concern, $\beta = 0.244$ (95% CI: 0.032, 0.456), $t(124) = 2.28, p = 0.02$. In other words, given a concern with healthy eating, a more positive valence weighting bias was associated with greater impulse control failure. However, no such relation was evident for those that did not express dietary concern, $\beta = -0.099$ (95% CI: -0.356, 0.156), $t(124) = -0.77, p = 0.44$ (see Figure 2).

Next, the focus turned to the effect of stress on frequency of unhealthy eating. To shed light on the nature of this effect, the regression model described above was expanded by including stress and all two-way interaction terms, and then the three-way interaction term. As in the previous model, there was a significant main effect of dietary concern, $\beta = 0.385$ (95% CI: 0.231, 0.539), $t(121) = 4.93, p < 0.001$, meaning that not being concerned with dietary intake was significantly associated with more frequent unhealthy eating. Additionally, the interaction between valence weighting bias and dietary concern also reached statistical significance, $\beta = -0.177$ (95% CI: -0.333, -0.020), $t(121) = -2.23, p = 0.03$, and was substantively the same in terms of shape and

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2 All regression models were constructed by standardizing the outcomes and predictors (except those that were dichotomous) prior to computing the interaction term. Thus, standardized regression coefficients ($\beta$s) are reported for all analyses. These $\beta$s can be interpreted as effect sizes.
interpretation to that reported earlier, despite stress now being held constant.

Importantly, there was a significant main effect of stress, $\beta = 0.314$ (95% CI: 0.159, 0.469), $t(121) = 4.00, p < 0.001$, indicating that greater stress was significantly associated with more frequent unhealthy eating. It appears that greater stress does diminish the motivation and/or opportunity to make deliberative choices about food consumption.

However, there was also a marginally significant interaction between valence weighting bias and stress, $\beta = 0.125$ (95% CI: -0.016, 0.264), $t(121) = 1.75, p = 0.08$, such that, holding dietary concern constant, the effect of stress on frequency of unhealthy eating was stronger at a more positive valence weighting bias (1 SD above the mean), $\beta = 0.438$ (95% CI: 0.231, 0.644), $t(121) = 4.20, p < 0.001$, and reduced in magnitude at a relatively negative valence weighting bias, $\beta = 0.189$ (95% CI: -0.023, 0.401), $t(121) = 1.76, p = 0.08$ (see Figure 3). Though the inferential test revealed that the interaction term did not reach traditional levels of significance, the pattern appears to be quite clear: irrespective of dietary concern, the effect of stress on frequency of unhealthy eating depends on valence weighting bias. As valence weighting becomes more positive, the effect of stress on frequency of unhealthy eating becomes stronger.

Lastly, there was no significant three-way interaction between dietary concern, stress, and valence weighting bias, $\beta = 0.045$ (95% CI: -0.096, 0.186), $t(120) = 0.63, p = 0.53$.

**Study 1 Discussion**

The results of Study 1 supported the existence of a link between valence weighting and impulse control failure in a real-world context: valence weighting bias
significantly predicted average frequency of unhealthy eating over a one-week period for those that expressed dietary concern, such that a more positive valence weighting bias was associated with more frequent unhealthy eating. This provides further evidence that individuals with a more positive valence weighting bias are more accepting of their impulses than are those with a more negative valence weighting bias, and thus, are more likely to act on them. It appears that the questioning of the impulse engaged in by those with a more negative valence weighting bias allows for greater consideration of any incongruent goal the individual might hold, and consequently, better impulse control. Importantly, this represents the first evidence linking valence weighting bias and impulse control failure in a real-world context. Given the large number of impulses faced when pursuing a goal, this finding points to an important role for valence weighting in self-regulation.

For those that did not express dieting concern, consumption of unhealthy food did not appear to be a matter of valence weighting. Importantly, those that did not express dietary concern consistently reported consuming unhealthy food more frequently than those that did hold such a goal (see Figure 2). One explanation is that for these individuals, impulses are still appraised via valence weighting, but because no dietary concern exists, the impulse checking promoted by a more negative valence weighting bias does not yield a reason to control the impulse, and thus, it guided behavior.

Stress also played an important role in predicting frequency of unhealthy eating. First, the analyses revealed a significant main effect of stress on frequency of unhealthy eating: those experiencing greater stress reported eating unhealthy food more frequently.
This suggests that stress diminishes the motivation and/or opportunity to make dietary
decisions in a more deliberative manner. Under such conditions, individuals tended to act
on their impulses more frequently. Although stress impaired the motivation and/or
opportunity to make more deliberative dietary choices, holding dietary concern constant,
this effect depended on valence weighting bias. Greater stress led to more frequent
unhealthy eating, but this effect was particularly evident for those with a more positive
valence weighting bias. This finding suggests an important role for valence weighting in
the construal of impulse: when individuals have a more negative valence weighting bias,
they may appraise the impulse more negatively, thereby attenuating the link between
stress and consumption of unhealthy food. On the other hand, those with a more positive
valence weighting bias may appraise the impulse more positively, and when under
relatively high stress, perhaps the eliciting stimulus starts to look more like a comforting,
stress-reducing treat than it would under lower stress.

Lastly, the interaction between stress and valence weighting described above did
not differ as a function of dietary concern. The lack of a three-way interaction suggests
that the effect of stress on frequency of unhealthy eating became stronger as valence
weighting bias became more positive for both those that expressed dietary concern and
those that did not. For both types of individuals, an impulse in the context of stress seems
to be appraised all the more positively by those with a more positive weighting bias.
Study 2

In Study 2, the focus changed to examining the role of valence weighting on assessments of progress. To study such assessments, participants took part in a test preparation task in the lab. Assuming that participants adopted the goal of wanting to do well on the test, they had to assess their progress throughout the reading of the passage. Essentially, they had to ask themselves, “Have I learned this well enough? Am I ready for the test?” The answer to this question should partly be a function of an individual’s valence weighting tendencies as the simulation involved in answering this question should contain positive and negative features. To test this idea, participants were first brought into the lab to have their valence weighting tendencies measured via BeanFest. Then, participants were told that they would be completing a reading comprehension task. After reading a sample passage that acted as a practice run, participants were asked to read the target passage as if they were preparing for a test and were told that they would be tested on the material upon completion. At the conclusion of the passage, participants encountered an end screen that told them that they could either proceed to the test or return to the passage to continue studying. The time that participants spent on this end screen provided a measure of the degree to which they deliberated about the question.

3 This assumption seems valid given that, on average, participants performed reasonably well on the test ($M = 7.1$ out of a possible score of $10$, $SD = 1.80$).
“have I learned well enough?” Once they decided to proceed, participants took a short 10-item test that assessed knowledge of the material. Our primary interest concerned the effect of valence weighting on test score through valence weighting’s influence on time spent reading the passage. As participants read through the passage, they presumably assessed how well they were learning the material from time to time. Such assessment was encouraged by the fact that each of the four computer screens of text concluded with the presentation of directional arrows that enabled proceeding to the next screen or returning to the previous screen. If their assessments suggest that they are learning the material well, they should move through the passage more quickly. This reduced study time, however, should lead to less preparation, and consequently, lower test scores.

First, it was predicted that valence weighting would be related to test performance through its effect on study time. As participants assess their progress in learning the material, those with a more positive valence weighting bias should reach favorable assessments of their progress more quickly, leading them to reduce their studying efforts, as reflected in less study time, relative to those with a more negative valence weighting bias. In turn, individuals that spend relatively more time studying should perform better on the test. Thus, individuals with a more negative weighting bias should perform better on the test as a result of valence weighting’s effect on study time.

Additionally, it was predicted that individuals with a more positive valence weighting bias should deliberate less when faced with the end screen, i.e., when faced with the ultimate committing decision to proceed to the test, than those with a more negative valence weighting bias. A more negative valence weighting bias should promote
a more cautious approach and, hence, a more careful and time-consuming decision process.

Methods

Participants

Ninety-four undergraduate students participated in this study as partial fulfillment of course requirement. In total, seventeen participants were excluded. Three were excluded for performance-related reasons: one for not following instructions, and another two for not taking the reading task seriously as they spent less than 60 seconds reading the passage. Importantly, due to the reading-heavy nature of the task, 14 non-native English speakers were excluded from the analyses as well. The final sample consisted of 77 participants (36 males and 41 females).

BeanFest

The BeanFest procedure employed in this study is identical to that of Study 1.

Reading Passage

The reading passage was a 949-word encyclopedia entry on the topic of railways in Western Canada in the 19th century (“Railways, Canada,” n.d.). Before engaging in the target reading task, participants read a sample passage on the living, eating, and mating habits of blue jays meant to familiarize them with the nature of the task. Upon completion of the sample passage, participants encountered an instruction screen that told them that their task was to read and learn the material contained in the passage as they would be tested on their comprehension of the material. They were encouraged to treat this task as if they were preparing for a test in one of their courses, and were told that they could take
as much time as they wanted as they read the passage because their performance would be evaluated on the basis of their test score, rather than time spent reading. Finally, they read that, if they desired, they could navigate to an earlier page using an arrow button at the bottom of the screen. The passage itself was presented in sections on four separate pages on a computer screen. Participants navigated through the passage using directional arrows found at the bottom of the screen, and thus, could move forward and back through the passage as they desired. The total time participants spent reading the passage (in seconds) was used as the measure of study time ($M = 322.77$, $SD = 130.59$).

Once they completed the target passage, participants saw an end screen that informed them that they had a choice to make at that point: they could proceed to the test immediately or they could turn back and study more before proceeding to the test.

**Test**

Following the completion of the studying task, participants took a 10-item test created by the experimenter to test knowledge and comprehension of the target passage using True/False and multiple choice questions. The questions assessed memory for facts and comprehension of material distributed throughout the entirety of the passage. Scores on the test were reasonably high ($M = 7.10$, $SD = 1.80$), suggesting that participants did indeed take the task seriously.

**Results**

To determine whether valence weighting affected performance through its impact on effort, the first regression analysis focused on the relation between valence weighting bias and study time. Participants with a more positive valence weighting bias tended to
spend less time studying the passage, $a = -0.217$ (95% CI: -0.441, 0.008), $t(75) = -1.92, p = 0.06$. Next, test score was regressed on study time and valence weighting bias. Holding valence weighting bias constant, participants who spent more time studying the passage performed better on the test, $b = 0.465$ (95% CI: 0.253, 0.676), $t(74) = 4.38, p < 0.001$.

To quantify the indirect effect of valence weighting bias on test score through its effect on study time, a mediation model was constructed using the PROCESS macro for SPSS (see Figure 4; Hayes, 2013). A bias-corrected bootstrap confidence interval for the indirect effect constructed using 50,000 bootstrap samples did not include zero ($ab = -0.101$, 95% CI: -0.238, -0.010), which suggests that valence weighting influences goal achievement through its impact on assessments of goal progress. It appears that those with a more negative valence weighting bias took more time to answer affirmatively to the question “have I done enough?” which meant they spent more time studying the material, and as a result, performed better on a test of their knowledge.

Furthermore, the mediation analysis revealed no significant total effect of valence weighting on test score, $c = 0.015$ (95% CI: -0.215, 0.245), $t(75) = 0.13, p = 0.89$, and no significant direct effect of valence weighting on test score, $c' = 0.116$ (95% CI: -0.095, 0.327), $t(74) = 1.09, p = 0.27$.

Because the second analysis of interest focused on the amount of time taken to decide to proceed to the test (in seconds; $M = 7.35, SD = 3.57$), only the data for those who proceeded to the test after encountering the end screen for the first time were included (71 of the 77 participants). Here, time spent on the end screen was regressed on valence weighting bias. Valence weighting bias significantly predicted time spent on the
end screen, $\beta = -0.265$ (95% CI: -0.497, -0.032), $t(69) = -2.27$, $p = 0.03$, such that a more positive weighting bias was significantly associated with less time spent on the end screen. This result demonstrates that, when forced to commit to proceeding to the test, individuals with a more negative valence weighting bias took a more careful, time-consuming approach relative to those with a more positive valence weighting bias.

**Study 2 Discussion**

The findings of Study 2 suggest that valence weighting is associated with goal progress assessments, and that this association can have consequences for goal achievement. Individuals with a more positive valence weighting bias tended to perform more poorly on the test as a result of valence weighting’s effect on study time. This suggests that as participants asked themselves, “Have I learned this well enough?” those with a more positive valence weighting bias answered favorably quicker, leading them to study for less time, which then translated into lower test scores. On the other hand, those with a more negative valence weighting bias took longer to reach favorable assessments of their progress, leading to more study time, and ultimately, to better test scores. This study documents the important influence that valence weighting can exert on goal achievement when goal progress assessments are a part of goal pursuit.

Importantly, the design of the reading task forced participants to reflect on their level of preparedness for the upcoming test upon completing the passage. Supporting the idea that valence weighting influences assessments of progress, those with a more negative valence weighting bias tended to take longer to deliberate when they encountered the end screen. This reflects a more cautious approach to proceeding to the
test on the part of those with a more negative valence weighting bias, likely the result of less confident responses to the question, “Have I learned this well enough?”
General Discussion

A growing body of research suggests that valence weighting impacts judgments and behavior across a variety of domains, ranging from rejection sensitivity (Pietri et al., 2013) to friend-making (Rocklage et al., in preparation). Recent evidence suggests that impulse control is another domain in which valence weighting matters. Specifically, two studies have demonstrated that a more positive valence weighting bias is associated with poorer impulse control on laboratory tasks, particularly for those individuals with relatively low motivation and/or opportunity to override initial impulses (Zunick et al., 2017). Study 1 advances this program of research by demonstrating an association between valence weighting and impulse control using a measure of real-world unhealthy eating behavior. For those individuals that reported being concerned with dietary intake, a more positive valence weighting bias was associated with greater frequency of unhealthy eating, indicating poorer impulse control. Furthermore, valence weighting moderated the effect of stress on unhealthy eating: at more positive levels of valence weighting bias, greater stress was significantly associated with greater frequency of unhealthy eating, whereas this effect was attenuated at more negative levels of valence weighting bias. This suggests that valence weighting impacts how impulses are construed. When under stress, a more positive valence weighting bias seems to make impulses and their triggers appear all the more comforting or stress-reducing, leading people to act on them with greater
frequency. Taken together, it appears that valence weighting predicts whether individuals accept their impulses or reject them, particularly when the individual holds goals that are incongruent with their impulses and when the individual lacks the motivation and/or opportunity to make more deliberative decisions.

Study 2 focused on the relation between valence weighting and goal progress assessment, another important self-regulatory process, in the context of studying and test preparation. Two key findings emerged from this study. First, individuals with a more negative valence weighting bias tended to perform better on the test due to having spent more time studying the material. Additionally, a more negative valence weighting bias was associated with more time spent on the end screen, indicating greater deliberation when deciding to proceed to the test. These findings suggest that those with a more negative valence weighting bias adopted a more cautious strategy when proceeding with goal pursuit, likely influenced by their less favorable responses to questions such as, “Have I done enough?”, whereas the more favorable responses of those with a more positive valence weighting bias led them to proceed through their task in a less cautious fashion.

Taking a broader perspective, the studies presented above suggest that valence weighting matters for self-regulation. The two distinct self-regulatory processes that were the subject of investigation, impulse control and assessments of goal progress, proved to be sensitive to the impact of an individual’s valence weighting tendencies, and this influence had consequences for real-world eating behavior and test preparation. Thus, it appears that along with the other variables known to influence goal pursuit, such as
construal level (e.g., Fujita, Trope, Liberman, & Sagi, 2006; Park & Hedgcock, 2016), implicit theories of willpower (Job et al., 2015), and goal commitment (Fishbach & Dhar, 2005), valence weighting determines the extent to which individuals succeed or fail in pursuing their goals.

Given that the all evidence presented to this point demonstrates that a more positive valence weighting bias leads to less successful goal pursuit (via valence weighting’s influence on impulse control and goal progress assessments), it is fair to ask whether a more positive valence weighting bias will always lead to less successful self-regulation. Though there are no data that directly answer this question at this juncture, the answer is likely no.

The effect of valence weighting on self-regulation should depend on the specific situation in which it occurs and, more specifically, the specific matter that is being appraised. The results of both studies contained in this package can be analyzed from this perspective. For example, Study 1 focused on impulse control as it related to the consumption of tasty, yet unhealthy foods. A reasonable assumption made in this study was that encountering such foods would activate an impulse to consume the food in the mind of the individual. Under such circumstances, it is the impulse that is being appraised. The outcome of this appraisal led individuals to either be more or less accepting of the impulse, depending on the individual’s valence weighting bias. The degree to which this acceptance influenced behavior depended on whether individuals were concerned with their dietary intake and whether they had sufficient motivation
and/or opportunity to make more deliberative decisions. While this scenario represents a very common way that eating decisions are made, it is not the only one.

Indeed, decisions about future eating choices can be made ahead of time, before temptation-related impulses are triggered. For individuals concerned with dietary intake, such prospective control of impulses can be an effective way to act in line with their goals (Fujita et al., 2006). For example, an individual that is concerned with their dietary consumption may think about what to eat for lunch the following day and decide that they will pack a lunch instead of heading to a fast-food restaurant. Here, there is no active impulse that is subject to appraisal. Instead, the greater temporal distance should place the focus on the individual’s goals (Trope & Liberman, 2010), and given that goals are by definition positive, this salient positive signal should be subject to valence weighting. That is, under these circumstances, the goal (not the impulse) should be the object of appraisal. A reasonable prediction when individuals are engaged in such prospective decision-making is that those with a more positive valence weighting bias will appraise the goal more positively in their construction of the future situation, and this will lead to a greater likelihood of deciding to act in line with their goals at that moment. In turn, this should translate into more goal-consistent behavior, and consequently, less impulse control failures.

Thus, future research should systematically vary the conditions under which individuals make the dietary decisions by either presenting them with a tempting, yet unhealthy food stimulus and a much-less-tempting healthy alternative, and asking them to
make a decision in the moment (a situation akin to that in Study 1) or by asking them to think about these choices and having them make a related decision for their future.

The effect of valence weighting on assessments of goal progress should also be expected to vary by situation and the matter being appraised. In Study 2, a situation was created in which individuals asked themselves, “Have I done enough? Am I ready for the test?” as they assessed their progress both during the reading portion of the task, as well as when faced with the end screen. Because there are positive and negative features associated with these kinds of questions, those with a more negative valence weighting bias tended to place greater emphasis on the negative features, resulting in more study time, better grades, and more time spent deliberating on their readiness.

Having said that, previous research suggests that given the same input to the decision-making process, the framing of a question can lead to different outcomes. In a study by Hirt, Melton, McDonald, & Harackiewicz, (1996), participants first read a list of 40 statements that induced either a happy, neutral, or sad mood. After completing this task, participants moved on to a purportedly unrelated task in which they listed similarities and differences between pairs of television shows under the guise of examining how such shows were perceived. Participants in a control condition were told to list as many similarities or differences as they could. Importantly, the rest of the participants were given further instructions. Some of the participants were placed into a time-to-stop condition and told that as they were making the each list, they should ask themselves, “Do I think it is a good time to stop?” If the answer was yes, participants were told to stop, but if the answer was no, they were told to continue. The rest of the
participants were placed into an enjoyment condition, and told to ask themselves, “Do I feel like continuing this task?” Here, if the participants answered yes, they were told to continue, but if the answer was no, they were told to stop. The prediction was that mood would be used as input to the decision-making process, producing opposite patterns of persistence on the task, depending on the question provided to participants. In the control condition, those in a positive mood stopped sooner than those in sad or neutral moods. Likewise, those in the time-to-stop condition stopped sooner when they were in a happy rather than a neutral or sad mood. The happy mood state signaled an affirmative answer to the stop rule. Importantly, however, those in the enjoyment condition stopped sooner when in a sad or neutral mood relative to a happy mood. Here, the happy state signaled enjoyment and, hence, no need to stop. Thus, opposite patterns of persistence behavior were obtained by changing the framing of the question participants were to pose to themselves during the task.

This research suggests that the effects observed in Study 2 may be sensitive to change, provided that the question participants ask themselves can be manipulated. For example, if vague instructions regarding the nature of the task were provided (so as to avoid triggering the tendency to appraise one’s progress), and participants were instructed to ask themselves, “How much am I enjoying reading the passage?” as they progressed through the task and to stop when they no longer enjoyed it, individuals with a more negative valence weighting bias may reach unfavorable assessments of their enjoyment quicker, and thus, study the material for less time relative to those with a more positive
valence weighting bias. This decreased reading time should translate into worse performance on a test of their knowledge.

Future research should attempt to replicate the effect of valence weighting on studying and test performance presented here, while at the same time reversing this effect by manipulating the questions participants ask themselves during the task. For example, participants could be randomly assigned to either proceed through the task as described in Study 2 or to proceed through the task in the manner described in the above paragraph. This manipulation should lead to opposite effects of valence weighting on studying and test performance, demonstrating the situation-dependent nature of the effect of valence weighting.

In general, the effects of valence weighting in a given situation will likely depend on the dominance of the appraisal it promotes. For example, in a situation in which an impulse is evoked (e.g., when encountering tasty but unhealthy food), an appraisal of the impulse is the dominant tendency. In a situation that involves an immediate challenge (e.g., the studying and test preparation task like the one described in Study 2), the dominant tendency is to appraise one’s state of readiness. However, in situations in which no appraisal dominates, it may be possible to manipulate certain cues, such as stop rules, to encourage appraisals of different issues. Evidence supportive of the differential impact of valence weighting as a function of temporal distance and question framing would represent a significant contribution to the valence weighting literature by demonstrating its flexible effect on behavior.
Perhaps the most intriguing future direction involves expanding the scope of this work to include other self-regulatory processes. Goal pursuit does not only involve impulse control and goal progress assessments (though they are of great importance), but also the development of a plan to achieve a goal, as well as the implementation of that plan (Wilkowski & Ferguson, 2016). Given what is known about valence weighting, it is not difficult to imagine that these processes would be influenced by an individual’s valence weighting tendencies. For example, imagine a student that needs to prepare for a test and finds themselves with a great deal of not-so-fun studying to do. They may construct a plan to spend the night reviewing, but when it comes to implementing that plan, they engage in a simulation in which they ask themselves, “Do I want to start studying now?” Once again, this simulation should contain some features that are positive and others that are negative. At this point, an individual’s valence weighting bias should influence how these features are weighted in the construction of a response, and consequently, one’s response to the question. Thus, valence weighting should also relate to plan implementation during goal pursuit, and interestingly, under the circumstances described above, those with a more positive valence weighting bias should show better self-regulation than those with a more negative valence weighting bias, reversing the direction of the effects observed in this work, and demonstrating the flexible role of valence weighting in self-regulation. This example represents only one of the many exciting avenues of future research for this line of work.

Like all research, however, the studies presented here suffer from limitations. For instance, the measure of eating behavior employed in Study 1 relies on retrospective
reports which may be either randomly inaccurate or subject to systematic bias. Given that the measure asks participants to remember something rather concrete (i.e., the number of times participants ate various unhealthy foods during the past week), they should have an easier time relative to other memory-based measures. Furthermore, it also seems unlikely that participants’ valence weighting tendencies systematically biased their responses. If one were to advance a prediction regarding the effect of valence weighting on memory bias in Study 1, the most logical appears to be that when concerned with dietary intake, individuals with a more positive valence weighting bias would arrive at more favorable reconstructions of the past, and thus, would report relatively less frequent consumption of unhealthy food. The results, however, show the opposite pattern. Nonetheless, future research should monitor dietary choices more closely during a given period of time by, for example, using a food-logging cellphone application.

A final limitation in need of discussion is that the evidence presented does not permit the influence of valence weighting to be interpreted as causal in nature. Fortunately, BeanFest affords the opportunity to manipulate valence weighting tendencies during the test phase. In what is referred to as a recalibration procedure, participants who have undertaken the BeanFest game receive feedback during each trial of the test phase as to whether they are classifying the novel beans in an objectively correct manner. Thus, the recalibration procedure provides participants, in a way that everyday life does not, with feedback as to whether they are weighting resemblance to a known positive versus a known negative correctly.
This recalibration procedure has been shown to cause both immediate and sustained changes in judgment across a variety of domains. For example, Pietri and Fazio (2017) conducted an experiment in which they recruited individuals high in rejection sensitivity (as assessed by the Rejection Sensitivity Questionnaire) to take part in a laboratory session. This population was targeted because previous research has demonstrated that greater rejection sensitivity is associated with a more negative valence weighting bias (Pietri et al., 2013). Once inside the laboratory, participants were randomly assigned to play either the recalibration or control version of BeanFest, after which they completed the Rejection Sensitivity Questionnaire again. One week later, participants were invited to complete the Rejection Sensitivity Questionnaire once more. First, the results revealed that the effects of the recalibration procedure became evident during the test phase of BeanFest. Specifically, though there was no significant difference in the accuracy of novel bean classification between the recalibration and control groups during the early part of the test phase, by the end of the test phase, those in the recalibration condition were significantly more accurate in classifying novel beans than those in the control condition. As for the primary analyses, those in the recalibration condition reported lower rejection sensitivity than those in the control condition, and this effect was especially evident for those that started out relatively high on rejection sensitivity. A similar pattern of results for rejection sensitivity was obtained with the questionnaires completed one week later, with the only exception being that the effect of experimental condition was directionally consistent, but did not reach traditional levels of significance. Thus, individuals with an initially negative valence weighting bias were
recalibrated to weight positive and negative signals in a more balanced manner during attitude generalization. This recalibration of valence weighting tendencies translated into less anxiety regarding the possibility of rejection both immediately after the intervention, and one week following it.

Importantly, the recalibration procedure has also been shown to produce significant changes in real-world behavior. In an extension of the study on valence weighting and friend-making described earlier, recalibrating freshmen who scored high on rejection sensitivity led to a reduction along this dimension and an increase in the number of friends made over the following two weeks (Rocklage et al., in preparation). Future research should apply this recalibration technique in the context of tasks that involve impulse control or goal progress assessments to determine whether valence weighting does in fact exert a causal influence on these processes. For example, after undergoing recalibration, individuals with a more positive valence weighting bias should be more successful at rejecting their impulses. Such evidence may set the stage for the development of an intervention for those who struggle in a particular area of self-regulation.

The studies presented here represent the start of what promises to be an exciting program of research. Two studies demonstrate a link between valence weighting tendencies and self-regulatory processes. However, the effect of valence weighting on self-regulatory processes observed here may be malleable under certain circumstances, an interesting possibility that remains to be explored. Looking beyond the current studies, valence weighting may affect a variety of other self-regulatory processes, as many of
these may involve the construction of appraisals in which positive and negative signals must be weighted. Lastly, the use of the recalibration procedure in BeanFest promises to allow for more precise statements regarding the nature of the relation between valence weighting and self-regulation, as well as the possibility that interventions can be developed for those struggling in their pursuit of goals.
References


Appendix A: Figures

Figure 1. The full 10 x 10 matrix of bean stimuli used in the BeanFest task. For the purposes of illustration, beans with negative value have been colored red, while those with positive value have been colored green. In the actual game and test phases, all beans are white.
Figure 2. Conditional effect of valence weighting bias on average frequency of unhealthy eating over a one-week period as a function of dieting goals. Higher numbers on the vertical axis represent greater average frequency of unhealthy eating.
Figure 3. Conditional effect of stress on average frequency of unhealthy eating over a one-week period as a function of valence weighting bias, while holding dieting goals constant. Higher numbers on the vertical axis represent greater average frequency of unhealthy eating.
Study

Valence weighting

$\text{Test score}$

\[ a = -0.22^\dagger \]

\[ b = 0.46^* \]

\[ c' = 0.12, \text{n.s.} \]

\[ (c = 0.02, \text{n.s.}) \]

\[ ^\dagger p = 0.06, ^* p < 0.001 \]

Indirect effect: \[ ab = -0.10, 95\% \text{ CI: } -0.24, -0.01 \]

Figure 4. Mediation model depicting the indirect effect of valence weighting bias on test score through its effect on study time \((ab)\), the direct effect of valence weighting bias on test score when controlling for study time \((c')\), and the total effect of valence weighting on test score \((c)\). Paths represent standardized regression coefficients.